UNIVERSIDAD COMPLUTENSE DE MADRID
FACULTAD DE PSICOLOGÍA

TESIS DOCTORAL

Flexibilidad atencional y factores motivacionales de auto-regulación: estudio de dinámicas de resiliencia al estrés y factores de protección contra la depresión y la ansiedad

Attention flexibility and self-regulation motivational factors : study of stress resilience dynamics and protective factors against depression and anxiety

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

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Director

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Madrid

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AGRADECIMIENTOS Y DEDICATORIAS

Ahora que estoy terminando esta etapa de mi vida, se vienen a mi mente muchas personas que han contribuido a todo este trabajo. Desde luego que, sin ellos, este trabajo sería muy distinto y probablemente estaría sin terminar a día de hoy.

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Blanco I.

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Resumen de la Tesis en Español

Flexibilidad atencional y factores motivacionales de auto-regulación: estudio de dinámicas de resiliencia al estrés y factores de protección contra la depresión y la ansiedad

La atención es conceptualizada como uno de los procesos cognitivos de mayor importancia a la hora de comprender el funcionamiento emocional en respuesta al estrés. La atención selectiva no sólo sirve como filtro de la información del entorno, sino que permite seleccionar aquella información relevante e ignorar la irrelevante. Por lo tanto, el entorno y la motivación tienen un rol indispensable para poder comprender cómo funciona la atención, realzando así el componente dinámico de la atención, frente a una conceptualización estable que ha sido imperante durante las últimas décadas. Esto plantea la posibilidad de que estos procesos motivacionales y contextuales modulen la atención hacia el cumplimiento de metas específicas. De hecho, desde esta Tesis se hipotetiza que la atención puede ser modulada por la activación predominante de distintos sistemas motivacionales de auto-regulación centrados en la búsqueda de resultados positivos y/o en la evitación de resultados negativos, modificando así los patrones atencionales dependiendo de metas específicas. Por lo tanto, todos estos procesos cumplirían roles específicos dentro de la regulación del estrés, dando lugar a que influencien el funcionamiento emocional de las personas. Además, el operativizar este proceso cognitivo de atención desde una perspectiva dinámica (e.g., flexibilidad atencional) implica que ésta puede entrenarse con el fin de generar beneficios en el funcionamiento psicológico.

En consecuencia, la realización de esta Tesis se centró en una serie de objetivos: evaluar la naturaleza flexible/dinámica de la atención ante cambios (a) intrasituacionales (e.g., cambios en el feedback emocional en una tarea de estrés momentáneo) e (b) intersituacionales (e.g., cambios entre contextos y metas emocionales en una tarea experimental) y establecer (c) cómo estos procesos pueden verse modulados por la activación preferente de ciertos sistemas motivacionales de auto-regulación. Asimismo, este objetivo se extendió a (c) evaluar cómo la habilidad para cambiar entre metas emocionales y entre contextos motivacionales predice el funcionamiento emocional en el día a día y finalmente (d) se estudió cómo la promoción de atención flexible a través de un entrenamiento cognitivo basado en refuerzos musicales contingentes con el fin de generar una mejora en atención flexible se veía también refleja en otros procesos psicológicos (e.g., atención flexible intrasituacional y recuperación del estrés).

Los resultados de los Estudios 1 y 2 mostraron que la atención puede entenderse más allá que como un proceso puramente estable, sino que se va ajustando ante los cambios intra a intersituacionales y puede verse modulada por la predominancia de distintos sistemas motivacionales de auto-regulación. En consecuencia, se puede concluir que existen diferencias individuales que pueden explicar en cierto grado la modulación del mecanismo de la atención flexible, dando lugar a poder predecir parte del funcionamiento emocional. Los resultados del Estudio 3 apoyan este hecho, ya que distintos índices de flexibilidad, ya sean afectivos o contextuales predijeron distintas emociones en el día a día. Por lo tanto, es necesario investigar que patrones generan verdaderamente un comportamiento adaptativo y cuales no, con el fin de promover aquellos que realmente sean beneficiosos. Debido a esto, como parte del último estudio 4

de la Tesis, se realizó una intervención cognitiva basada en refuerzos musicales contingentes con el fin de promover aquellos patrones atencionales favorables y castigar o no reforzar aquellos desfavorables. Los resultados mostraron que, aunque no hubo una mejora en los niveles de atención flexible intersituacional, sí que hubo beneficios durante un estresor momentáneo.

Para concluir, la Tesis presentada se centra en la valoración de la atención como un mecanismo dinámico y cambiante dependiendo del contexto y la meta que tengan las personas. Esto significa que la atención sirve como un mecanismo de regulación de la información ambiental, pero que, al mismo tiempo, puede ser modulada por distintos sistemas motivacionales. Esto, lleva a la idea que, dependiendo de cómo se procese la información emocional y contextual puede generar efectos en el funcionamiento emocional y adaptativo en el día a día. Todas estas dinámicas son imprescindibles a la hora de conocer cómo distintos procesos cognitivos influyen en el desarrollo y mantenimiento de problemáticas emocionales, ya que la promoción de un procesamiento flexible puede generar cambios subsiguientes en otros procesos psicológicos afectados.

English Summary of the Thesis

Attention flexibility and self-regulation motivational factors: study of stress resilience dynamics and protective factors against depression and anxiety

Attention is conceptualized as one of the most important cognitive processes when it comes to understanding emotional functioning in the face of stress. Selective attention does not only serve as a filter of environmental information, but it also allows selecting relevant information and ignoring irrelevant information. Therefore, the environment and motivation play an essential role to understand how selective attention works, highlighting a dynamic component of attention as a function of contextual and motivational features, in contrast to the stable conceptualization that has prevailed in recent decades. This raises the possibility that these motivational and contextual processes modulated attention towards the fulfillment of specific goals. Based on this proposal, in this Thesis it was studied whether attention can be modulated by the predominant activation of different motivational self-focuses focused on the search for positive results and/or on the avoidance of negative results, thus modifying attentional patterns depending of specifically active goals. These flexible attention processes would have a role in the regulation of stress, giving rise to the fact that they influence individuals' emotional functioning. Furthermore, operatizing this cognitive process of selective attention from a dynamic perspective (e.g., attentional flexibility) implies that it can be trained in order to generate benefits in psychological functioning.

Consequently, this Thesis focused on a series of objectives: to evaluate the flexible/dynamic nature of attention in the face of (a) intra-situational changes (e.g., changes in emotional feedback in a momentary stress task) and (b) inter-situational

changes (e.g., changes between contexts and emotional goals in an experimental task) and establishing (c) how these processes can be modulated by the preferential use of certain motivational self-focuses. Further, this goal was extended (c) to evaluate how this ability to change between emotional goals and between motivational contexts predicts emotional functioning on a daily basis and finally (d) to study how promoting flexible attention through cognitive training based on contingent musical reinforcements in order to generate an improvement in flexible attention can transfer to other psychological processes (e.g., intra-situational flexible attention and stress recovery).

The results from Studies 1 and 2 showed that selective attention can be understood as more than a purely stable process, but rather that it adjusts to intra- and inter-situational changes and can be modulated by the predominance of different motivational self-focuses. Consequently, individual differences in motivation can explain to some degree the modulation of the flexible attention mechanism, giving rise to being able to predict part of emotional functioning. The results of Study 3 supported this proposal, since different indices of flexibility, whether affective or contextual, predicted different emotions on a daily basis. This suggest that it is necessary to investigate which flexible patterns generate adaptive behaviors and which do not, in order to promote those ones that are more beneficial. Due to this, as part of the last study 4 of the Thesis, a cognitive intervention based on contingent musical reinforcements was carried out in order to promote those favorable attentional patterns and punish or not reinforce those unfavorable ones. The results showed that although there was no improvement in levels of inter-situational flexible attention, the training generated benefits in stress recovery during a laboratory stressor.

To conclude, the presented Thesis shows that attention is a dynamic and changing mechanism, depending on the context and the goal that individuals have. It also shows that flexible attention can serve as a regulatory mechanism of environmental information processing, but that, at the same time, that it can be modulated by different motivational systems. This leads to the idea that, depending on how individuals process this information, this can generate differences in emotional responses and adaptive functioning in daily life. All these dynamics are essential to understand how different cognitive processes influence the development and maintenance of emotional problems, since the promotion of flexible processing can generate changes in other affected psychological processes of stress regulation.

General Overview of the present work

Within the complex framework that encompasses today's society, mental health has a fundamental role in defining people's quality of life. Emotional disorders (e.g., depression and anxiety) currently represent societal problems, with a crucial impact across countries. The percentages of prevalence of depression are close to 13% (Lim et al., 2018) and more than 30% of the general population has suffered at some point in their lives from an anxiety disorder (Bandelow & Michaelis, 2015). Rather than solely focusing on studying the nature of the symptoms of these disorders, there is a need to investigate the factors, both risk and protective, that influence the processes of development, maintenance and relapse of emotional disorders. Only through that type of evidence, new prevention programs capable of reducing the probability of occurrence of these disorders can be generated (i.e., focused on enhancing variables that protect against these disorders). Further, advancing mechanistic research on the risk and protective factors involved in emotional disorders' maintenance, new intervention programs can be designed with the aim of minimizing and effectively resolving these problems when they are consolidated (aimed at influencing the maintenance and relapse phases). This is important, considering the current high rate of non-response to treatment and relapses that are present for these disorders. Although there are currently available effective treatments (e.g., Cognitive Behavioral Therapy) to treat these emotional problems (Driessen & Hollon, 2010), there is a high percentage of relapses (around 30%; e.g., Wojnarowski et al., 2019). If we focus on Europe, the percentages of prevalence associated with mental problems are around 38% of the total population, the most frequent being anxiety disorders (14%) and major depressive disorder (6.9%; Wittchen et al., 2011). These mental health problems generate

an estimated annual cost of 798 billion euros in Europe (anxiety disorders = 74.4 billion euros; major depressive disorder = 113.4 billion euros; Gustavsson et al., 2011). In order to reduce these associated costs and to find effective prevention programs and interventions, it is necessary to better understand how different processes and consequences associated with these problems interplay. Research on emotions and emotional disorders have been focused on the study of the interaction between different processes from different perspectives, such as cognitive processes (e.g., attention), emotion regulation and stress perception. From this view, these variables can be conceptualized as risk or protective factor depending on their effects in contributing to the onset and/or maintenance of these emotional problems. In fact, numerous studies suggest a key role of stress as a trigger of depression and anxiety (Hammen, 2005, 2015; McLaughlin & Hatzenbuehler, 2009) and for cognitive biases as causal mechanisms of emotion regulation dysfunctions (Gross & Thompson, 2007; Joormann & Vanderlind, 2014; Mehu & Scherer, 2015) that are present in emotional disorders (e.g., Aldao & Nolen-Hoeksema, 2012b). Specifically, selective attention has been conceptualized as one of the most important cognitive processes implicated in the regulation of emotions and stress, emphasizing its key role in the selective processing of information that facilitates adaptation to the demands of the environment (Gross & Thompson, 2007; Joormann & Vanderlind, 2014). Selective attention is defined as the individual's ability to select and focus their resources on a specific input while suppressing non-relevant information (McLeod, 2018) and is considered a key variable when it comes to understanding mechanisms of stress resilience and emotion regulation (Joormann & Vanderlind, 2014). For example, this cognitive function would be used when one wanted

to find a specific pair of shoes among all the ones in the closet. Therefore, it would allow the person to identify a specific relevant stimulus among a group of them, thus making him/her able to focus on the appropriate one and ignore the rest. However, when the target is affective information and the person has an emotional problem, this cognitive function would work differently. For example, a person with depression facing an assessment of their job skills in which he/she would receive both positive and negative feedback, would probably, once these negative aspects appeared, attend them and remain stuck on them, making him/her unable to stop paying attention to them and not taking into account the rest of alternative positive information. This would then bias the rest of the information processing and consequently generate maintained negative moods

Considering this, it is necessary to advance new insights on the specific mechanisms through which selective attention facilitates stress resilience and emotion regulation, as a mean to inform new interventions to effectively treat emotional disorders. With this idea, the present Dissertation was formulated to advance new forms of assessment and intervention in specific attentional mechanisms with relevance for the treatment of emotional disorders. In our conceptualization, we go beyond traditional models of selective attention and consider more recent cognitive flexibility models, from which affective attention flexibility has emerged as a specific mechanism with capacity to precisely explain the occurrence of stress difficulties in emotional disorders (Godara et al., 2020; Malooly et al., 2013; Stange et al., 2017). From this perspective, individuals with emotional disorders would have a deficit in managing their attention in a flexible way, not having into account the role that context plays in defining dynamic goals (i.e., new attentional targets) with relevance for adaptive stress and emotion regulation. This

means that the use of attention should be adapted to the characteristics of the context with the aim of preferentially processing information that maximize opportunities of attaining specific goals. However, individuals with emotional disorders would not be able to direct, maintain and disengage attention depending on contextual and motivational factors. In consequence, deficits in attention flexibility could be understood as a clear vulnerability marker to develop and maintain emotional disorders (Godara et al., 2020; Malooly et al., 2013; Stange et al., 2017).

Beyond the conceptual relevance of this new set of cognitive frameworks, scarce empirical research has currently been conducted to test their derived predictions, and many related research questions remain unsolved. It seems particularly necessary to advance new insights on what factors modulate individuals' ability to use attention flexibly to process different sources of emotional information. Among those ones, motivational components need to be considered, studying into detail what type of motivational factors can influence affective attention flexibility and its possible role in facilitating adaptive responses of stress regulation. Ultimately, once these interplays had been clarified, this knowledge should be used to inform new trainings in flexibility to test if it is possible to modify inflexible attentional patterns and generate more resource of flexibility in individuals suffering from emotional disorders. These were the main aims of the present Dissertation. The Thesis first present a series of conceptual chapters defining the specific processes that will be under study and their interplay: namely, Attention (Chapter 1), Motivation (Chapter 2), Stress (Chapter 3), and existing Interventions to train Attention Mechanisms and transfer to adaptive Stress Regulation (Chapter 4). From this thorough conceptual review, a series of objectives and a series of

specific hypothesis related to the role of affective attention flexibility in stress and emotion regulation will be tested (Chapters 5 to 8). Chapter 9 will finally provide a general discussion and conclusions of the full set of results of this work. Here, the new resulting knowledge will be discussed in terms of its conceptual and practical implications to advance the understanding of mechanisms of and effective interventions for emotional disorders. In general, results in these set of empirical studies supported the following main conclusions:

(a) Attention can be conceptualized and assessed using a more dynamic perspective, not only being associated to a predisposition to preferentially process positive or negative information, but to specific forms of flexibility in emotional processing;

(b) These processes can be modulated by individual differences in predominantly active motivational factors, known as promotion and prevention self-focuses, that influence the emergence of different attention patterns in distinct types of flexibility tasks (e.g., intra-situational and inter-situational changes requiring flexibility);

(c) Contextual and motivational factors are necessary to fully understand how attention is selectively enacted, because of the fact that it is a goal-dependent process, not only solely being modulated the saliency of the emotional features of available information;

(d) Affective attention flexibility has predictive capacity to account for emotional states when they are assessed through ecological methods during daily life functioning; and,

(e) Affective attention flexibility can be enhanced through trainings comprising contingent music reinforcement, which produce flexible attention patterns during the occurrence of stress and facilitate changes in psychophysiological variables associated to stress recovery in clinically emotionally disordered individuals.

In sum, the evidence collected in this Dissertation may be of high value to advance new specific frameworks of study and intervention of affective attention flexibility to promote mental health. This is only a first step in order to fully establish how flexibility can enhance stress and emotion regulation and protect against depression and anxiety. Yet, the results of this work can clearly inform new research strategies and interventions, which we consider have a clear potential to have an impact in reducing the individual suffering generated by emotional disorders and their associated societal and economic costs.

INTRODUCTION

(CONCEPTUAL CHAPTERS)

Chapter 1. Attention inflexibility as a cognitive-affective mechanism of risk for emotional disorders

1.1. Characteristics and implications of selective information processing for psychological functioning.

We live in complex and dynamically changing contexts that are flooded by large amounts of information from multiple sources, both internally (i.e., thoughts, bodily sensations...) and externally (i.e., smells, tastes, sounds...). All this information, which varies constantly and generates reactions in the individual, must be regulated and delimited (i.e., what is relevant and must be attended and processed at a given time), since otherwise adaptive functioning would be affected. This is the starting point of original information processing models (e.g., Simon & Newell, 1964), which aimed to define the mechanisms that are involved in this processing selectivity and has also been used to understand how this influence emotional functioning (Beck, 1967, 1976). These models have evolved across decades and clearly informed how cognitive mechanisms are in the basis of emotional functioning and mental health (e.g., Beck & Haigh, 2014). Although with their differences, certain models show similarities in central aspects, such as (a) the idea that the brain comprises a system of limited capacity, probably due to the difficulty associated with organizing the functioning of several cognitive and behavioral processes at the same time and the amount of information that is associated with specific tasks (more information implicates more difficulty; Hirst & Kalmar, 1987; Spelke et al., 1976). This leads to a second assumption, the fact that (b) the information processing capacity is also limited, requiring to only include (process) the information that is more central or relevant

to the activity that has to be carried out, while ignoring other irrelevant information (i.e., selective processing). This selective processing is not always conscious, since the brain can activate in parallel both conscious and unconscious processing operations. Models focused on parallel processing (Norman & Bobrow, 1975; Posner & McLeod, 1982), apart from identifying different mechanisms of selective processing (i.e., attention, interpretation, memory), also evaluate (c) the temporality of that information processing, more specifically how it works across these subsequent information processing stages. Several models are focused on linear or sequential processing (each processing stage is related to one specific function, generating one output that would be the input of next stage; e.g., attention → interpretation → memory; see, for instance, Everaert et al., 2012; Everaert & Koster, 2020; Leung et al., 2022). Other models suggest that (d) information can also be processed in parallel, in such a way that different cognitive mechanisms would process specific aspects of the information at the same time, in a more global way (Norman & Bobrow, 1975; Posner & McLeod, 1982).

In the case of sequential models based on bottom-up processes (Gibson, 1966), selectivity would operate at a low level of consciousness, based on the salience of the stimuli. In the case of parallel models based on top-down processes (e.g., Desimone & Duncan, 1995), executive functions of inhibition, updating and flexibility would be consciously enacted during the processing of information to regulate the processing of relevant information and influence behavior. However, initial selectivity of processing is thought to depend on general individual tendencies (i.e., preferences to attend and/or remember specific types of information; Beck, 1967, 1976). To explain these tendencies, models define the existence of cognitive schemes, which determine which specific

information will be more salient/relevant and will be more probably processed by the individual and influence his/her mental experience. In fact, purely cognitive models evolved to theories on the existence of depressive or anxious cognitive schemes to explain how specific selective processing tendencies characterize the risk to develop emotional disorders (Beck, 1967, 1976; see also Beck & Haigh, 2014; or the revision of the model by Vazquez et al., 2010). These models argue that the onset of emotional problems (e.g., depression) would depend on the activation of dysfunctional schemes (e.g., I am not worth anything) conformed as a consequence of early negative experiences, and activated when stressful situations appear. These schemes would generate biases (understood as a cognitive error pattern) in the processing of information (i.e., tendencies to selectively attend to negative information, interpret ambiguous information negatively, and preferentially generate negative memories).

Overall, these models have guided numerous research examining how cognitive processes guide selective processing of information and how this affects to emotional reactions (i.e., subjective experience, psychophysiological reactivity) and associated behaviors (for recent reviews, see, for instance, Disner et al., 2011; Koerner et al., 2020). In all these models, the way that information is selectively attended is considered a core feature that would influence (i.e., either sequentially or in parallel) other cognitive, emotional and behavioral responses. We thus start defining these attentional mechanisms and the methods that have been typically used to assess them.

1.2. Selective attention.

Attention is a primary cognitive process, which plays a leading modulatory role in selective information processing. Across decades, selective attention has been

conceptualized in several ways, depending on the role that it plays, but based on the assumption that is a cognitive process that filters sensorial and cognitive information, and can be delimited by both top-down and bottom-up processes (Broadbent, 1958; Kahneman, 1973; Kahneman & Treisman, 1984; Roselló, 1998). Yet, since the beginning of psychology, the operative definition of this construct has been complicated when it comes to understanding the specific nature of this phenomenon. One of the first definitions of attention was made by William James (1890), who defined it as follows "*It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others, and is a condition which has a real opposite in the confused, dazed, scatter brained state which in French is called distraction, and Zerstreutheit in German*" (p. 403-404). As James (1890) shows in his definition, attention is a high-degree function that depends on many factors, such as the attentional behavior evaluated or the temporality in which it occurs, implicating a necessity to generate specific definitions and categorizations of different forms of attention. According to this idea, Posner & Peterson (1990) generated a model based on the role of attention as a control mechanism. In this model, attention is divided depending on 3 functions: (a) alerting (focused on maintaining a specific state in order to process high-relevant context-stimulus), (b) target detection (focused on the idea of the existence of a system capable of detecting specific signals, which would produce an interference with other cognitive processes) and (c) orienting (which would focus on processes of disengagement of a specific stimulus, directing attention towards a new stimulus and maintaining on it; Posner et al., 1984; Posner &

Petersen, 1990). This last system could be termed as 'selective attention', which has been a key variable to understand emotional disorders from a cognitive perspective (Beck, 1967, 1976; Gross & Thompson, 2007; Joormann & Vanderlind, 2014). More specifically, selective attention can be understood as operation of directing cognitive resources towards relevant stimuli within the ongoing context while ignoring non-relevant ones, in order to only process context-dependent information that is congruent with current moods or goals of the individual (McLeod, 2018). From this view, this would require operations of disengagement from no-longer relevant information, change of attentional focus and attentional engagement with new relevant information (Posner et al., 1984; Posner & Petersen, 1990). Based on this, different methodologies have been designed to index selective attention processes while performing tasks that required any or all of these operations.

1.3. Tasks focused on measuring selective attention.

Through the last decades, the tasks developed to assess selective attention have been changing. While initial tasks were designed to index covert selective attention based on indirect methods (i.e., response times), other methodologies have emerged that allow to assess overt selective attention directly and objectively (i.e., through eye-tracking). This heterogeneous methodology has given rise to highly varied studies, leading to mixed results on the role of selective attention in emotional disorders (for a detailed review of these tasks, see, for instance, Keller et al., 2019; or Sanchez & Vazquez, 2012).

1.3.1. Emotional Stroop Task.

The Emotional Stroop is a reaction-time task derived from the original Stroop task (Stroop, 1935) in which participants have to name the color of certain words with different

emotional components (i.e., positive, negative or neutral). The dependent variable that is evaluated in this task is the interference of the emotional component when naming the color of the words, which would be associated with an attention bias in information processing. In general, results indicate that individuals with emotional problems (i.e., either clinical or subclinical levels of depression and/or anxiety) show slower times when naming the colors of negative words compared to control groups without problems (see for instance, the reviews of Epp et al., 2012; Peckham et al., 2010; Williams et al., 1996). In addition to this general negative effect, studies have also shown specific biases associated with the theme of the negative words that would exacerbate this negative bias. For example, individuals with high trait anxiety have been found to show greater interference towards threat-related words, whereas individuals with spider phobia have been found to show greater interference for phobia-related words (e.g., spider, cobweb; Williams et al., 1996). Similarly, metanalyses of studies using the emotional Stroop support this attention bias in depression, although the effect vary from highly robust (Epp et al., 2012) to small (Peckham et al., 2010) when using this task.

1.3.2. Dot Probe Task (MacLeod et al., 1986).

The Dot Probe Task (MacLeod et al., 1986) consists on a reaction-time based task designed to evaluate the modulating role of the emotional component of certain stimuli in attention, more specifically, in the speed with which a dot is detected. The typical design of this task comprises showing two stimuli (one with a negative emotional component and other one neutral) followed by a dot in the same location where one of these stimuli previously was. In this case, the participant simply has to indicate the location of the dot. The key idea in which the task is based is the assumption that those

individuals with an emotional problem (i.e., anxious or depressed) will have their attention biased towards the negative emotional component, which will facilitate a faster detection of the dot when it is located in the same position as the negative stimulus, compared to when the dot is located in the same position as the neutral stimulus. Results support this assumption, showing that clinically anxious participants shift attention toward threat stimuli, in such a way that latencies are smaller when the dot was in the same position as the threat word. In contrast, control participants typically show the opposite pattern, characterized by avoiding that negative emotional component (Bantin et al., 2016; MacLeod et al., 1986; Veerapa et al., 2020; Wilson & MacLeod, 2003). These results have been also found for depressed participants, showing an attention bias to negative information related to depression level (Joormann & Gotlib, 2007; Peckham et al., 2010). However, a metanalysis of studies using the dot-probe task did not find the expected bias pattern in individuals with clinical anxiety disorders (Kruijt et al., 2019) and multiple criticism has been made regarding the reliability of the attention bias metrics derived from this task (e.g., Schmukle, 2005; Waechter et al., 2014; Waechter & Stolz, 2015).

1.3.3. Exogenous Cue Task (Fox et al., 2001).

Beyond issues regarding their potential unreliability, although the tasks mentioned above have pointed out the existence of attention biases towards negative information in individuals with emotional problems (MacLeod et al., 1986; Peckham et al., 2010; Williams et al., 1996), there was still a debate about the attentional components that would be implicated in generating those biases. Taking into account models that divide attention into operations of disengagement, orientation/change, and engagement (Posner &

Petersen, 1990), other tasks with capacity to differentiate these engagement and disengagement components during negative processing have been designed. One of these tasks is the exogenous cueing task (Fox et al., 2001), in which the participants have to indicate in which location a target is located after the previous visualization of an emotional (positive or negative) or neutral stimulus. Depending on where both the emotional stimulus and the target are located, two series of items are generated: (a) valid cue trials, in which the emotional stimulus appears in the same side that the target will later appear, facilitating shorter detection latencies, and (b) invalid cue trials, in which the target appears on the opposite side of the emotional stimulus, leading to that the detection latencies are larger, allowing to measure the speed to disengage from emotional information. However, only one stimulus appears in each item in order to detect the target, not generating a competition between neutral vs emotional stimuli influence as it occurs in dot probe task. In the case of emotional disorders, results using this task support the assumption that they would be characterized by difficulties disengaging from negative material. For instance, high-anxious participants took longer detecting the target on invalid trials when the previous cue had a negative emotional component (i.e., threat cue), while this pattern was not found in low-anxious participants (Fox et al., 2001), indicating that anxiety is related to disengaging problem to negative emotional material. In the case of depression, studies have shown a similar attention bias when processing negative information (e.g., angry faces) by depressive participants. In fact, while individuals with depression were characterized by an attentional engagement and maintenance pattern on negative faces in valid trials, non-depressive individuals showed the opposite pattern, comprising a rapid disengagement from this information (Leyman et al., 2007).

1.3.4. Eye-tracking Free Viewing Tasks.

Whereas previous findings support a problem of attentional disengagement from negative information in individuals characterized by emotional problems, they have been based on covert measures of attention (i.e., indirectly assessed through reaction times in secondary tasks), which generates some possible interference in task performance. Due to difficulties associated with reaction-time measures (e.g., potential differences in speed of manual movements, conceptual issues interpreting reaction-times as direct assessments of attentional operations, low reliability of reaction-times index; Kappenman et al., 2014; Mogoaşe et al., 2014; Waechter et al., 2014; Waechter & Stolz, 2015), several studies emerged, in which overt attention is directly evaluated through estimations of eye-gaze position and movement, using eye-tracking technology (Blanco et al., 2019; Buckner et al., 2010; Chen et al., 2012; Lazarov et al., 2018). Eye-tracking refers to a technology that allow to monitor eye-movements and gaze positions in real time and extract precise metrics on specific attentional operations of engagement, maintenance and disengagement of the gaze on the presented stimuli. This technology has been widely used through free viewing tasks, where several stimuli with different emotional contents are presented and participants receive the instructions to freely watch (i.e., attend) the stimuli (i.e., words, faces, images) during a determined period of time. This type of task allows to evaluate natural patterns of attention of competing emotional and neutral stimuli, not depending on other external cues o rules. Using this technique, different indices of attention can be computed: initial orientation biases, defined as the tendency to have a facilitated detection of a type of emotional material (measured through eye-tracking indices such as “time to first fixation” or “first fixation location”) and maintenance biases,

defined as the tendency to sustain attention toward specific emotional material once it has been visually fixated (measured through eye-tracking indices such as “total dwell/fixation time” or “total fixation count”; for a detailed explanation, see Lazarov et al., 2019).

Using these techniques and designs, multiple studies have supported the existence of attention biases in emotional problems (see, for instance, the meta-analysis of Armstrong & Olatunji, 2012). As for anxiety problems, although the effects are small, meta-analytic evidence supports a relation between anxiety levels and several forms of attention biases to threat. These biases are characterized not only by an initial preferential orientation toward threat, but also by a sustained maintenance of attention on it (Clauss et al., 2022). Regarding depression, the results also support the existence of an attention bias, both in clinical (Lazarov et al., 2018) and subclinical samples (Blanco et al., 2019; Caseras et al., 2007), characterized by sustained attentional processing of negative material. Similarly, there is evidence in favor of a lack of attention bias towards positive information in depressed compared to non-depressed individuals (Blanco et al., 2019). However, the assessment of the different stages of the attention process (i.e., differentiating between engagement and disengagement processes) is complicated in free viewing paradigms and further eye-tracking designs have been developed to directly index these operations.

1.3.5. Engagement-Disengagement Task (Sanchez et al., 2013).

In order to differentiate between the different phases of attention, Sanchez et al. (2013) established a new paradigm focused on conditions of attentional engagement toward and attentional disengagement away from emotional information (i.e., positive and negative faces). In addition to establishing a control condition based on the free

viewing of emotional vs. neutral faces, this paradigm also delimits (a) an engagement condition (which is evaluated through the time to fixate on a target in an emotional face after having attended a neutral one) and (b) a disengagement condition (which is evaluated through the time to fixate on a target in a neutral face after having attended an emotional one). Thus, in the first of these two conditions, the time that participants need to direct their attention toward an emotional face is assessed, while, in the second one, the contrary process based on stop attending and disengaging from an emotional face is assessed. Results support the existence of a disengagement deficit from negative stimuli in depressed individuals compared with controls, suggesting that the actual problem of attention characterizing depression is not the attentional orientation (i.e., engagement) toward negative information, but a maintained focus on it once it is attended, that cannot be inhibited (Sanchez et al., 2013; Sanchez, Romero, et al., 2017). In this same line, difficulties inhibiting the processing of threatening material has also been documented for anxious individuals when using related procedures of mixed anti-saccade tasks (i.e., low anxiety individuals benefited from the switch in anti-saccade latencies, while those high anxiety did not show this improvement; Ansari et al., 2008).

1.4. Attention biases and its importance for information processing.

Overall, initial research supports a presence of attention biases toward negative information in depression and anxiety. These biases have been conceptualized as one of the key mechanisms of the onset, maintenance and recurrence in emotional disorders, in line with predictions of Beck's model (Beck, 1967, 1976; Beck & Haigh, 2014). Yet, in daily life, individuals have to process and switch between multiple forms of positive and negative emotional information, which points out the necessity of also studying the

presence or lack of biases towards other types of information. In fact, in addition to supporting attention biases towards negative information in both depression (Armstrong & Olatunji, 2012; Caseras et al., 2007; Lazarov et al., 2018; Sanchez et al., 2013; Sears et al., 2010) and anxiety (Armstrong & Olatunji, 2012; Buckner et al., 2010; Clauss et al., 2022; Gamble & Rapee, 2010; MacLeod et al., 1986), there are other studies where a lack of attention bias on positive information in depression has also been found (Armstrong & Olatunji, 2012; Blanco et al., 2019; Chen et al., 2012; Sears et al., 2010, 2011), in contrast with non-depressed individuals, who show such attention bias to positive information. In some studies, both type of biases has been found, characterizing emotionally disordered individuals by a reduction of fixation time on positive stimuli and by a longer time on negative ones compared to healthy controls (Duque & Vázquez, 2015). All these differences among studies may be due to multiple factors, both methodological (i.e., type of tasks used, specific combinations of stimuli, type of emotional stimuli used, exposure times) and personal factors (i.e., sample characteristics, difference between clinical and subclinical samples).

In consequence, within different emotional disorders, although there are some similarities in processing (i.e., attention biases towards negative information), there are also highly diverse information processing patterns capable of differentially biasing how environmental information is attended to and, therefore, how it is interpreted, which causes that other higher-order cognitive processes are also affected. The fact that attention is biased produces a filtering of environmental information in a determined way (for example, biases toward negative and away from positive information in emotional disorders), which gives rise to all subsequent processes of interpretation and memory to

be biased in similar directions (see for instance, Everaert et al., 2013, 2014; Sanchez, Duque, et al., 2017). This implies that individual differences in selective attention might not only influence emotional information processing itself but also the regulation of resulting emotions, as postulated by multiple models (Gross & Thompson, 2007; Joormann & Vanderlind, 2014). Regarding information processing, literature suggests that there is a relation between different cognitive biases, in such a way that attention biases influence other operations of interpretation and memory. These studies show that the more attention is biased towards negative or positive information, the more individuals preferentially interpret ambiguous information (Everaert et al., 2013, 2014) and remember information in those similar ways (Everaert et al., 2013, 2014; Koster et al., 2010). Following the same example of the assessment of job skills, the individual with emotional problems would only focus his/her attention on the negative aspects of their work, such as possible mistakes, feelings of lack of effort, etc. without taking into account that he/she probably did his/her job correctly. If one morning his/her boss asked him/her to have a meeting in two hours (ambiguous situation) he/she would probably focus even more on those aspects and interpret that his/her boss is calling him/her to fire him/her. In fact, every time similar events occurred, he/she would remember this previous event as a negative result. As for related emotion regulation processes, selective attention has a main role in the use of different forms of emotion regulation strategies. In this case, selective attention to negative information affects the use of putatively maladaptive emotion regulation strategies such as rumination (repetitively thinking about one's own feelings and its possible causes; Nolen-Hoeksema, 1991), in such a way that an attentional tendency towards negative information is related to a greater use of rumination

(Donaldson et al., 2007; Duque et al., 2014; Holas et al., 2019; Hur et al., 2019; Kaiser et al., 2018). Also, attention could not only be influencing the use of different emotion regulation strategies in a direct way, but also in an indirect way, through its effects on interpretation. In this line, it has been shown that a higher selective attention toward negative information predicts higher negative interpretation biases that in turn predict lower use of putatively adaptive emotion regulation strategies (i.e., reappraisal, viewing stress or emotional events from a different perspective with the aim to change the emotional effects of it; Gross & John, 2003) and higher use of putatively maladaptive emotion regulation strategies (i.e., rumination; Everaert et al., 2017). Further, the role of attention biases has also been demonstrated in stress regulation, using momentary stress induction procedures (i.e., speech task) with the aim to assess how different attentional components towards negative or positive information (i.e., engagement or disengagement) can predict individual differences in stress recovery. In this case, the relation between higher depressive symptom levels and lower levels of stress recovery after this type of inductions have been found to be mediated by attention difficulties characterizing emotional disorders (i.e., longer fixations and slower times disengaging from negative stimuli; Sanchez et al., 2013; Sanchez, Romero, et al., 2017). The latter study (Sanchez, Romero, et al., 2017) is one of the first experiments addressing how such forms of negative attention biases can vary as a function of the variation of the negative information that is available in the context, a component that must be considered in contemporary frameworks to adequately study attention and emotion regulation in an ecological manner.

1.5. Importance of context to understand the nature of attention biases and their role in emotion regulation.

Evidence from multiple studies postulates the existence of attention difficulties in the processing of emotional material in emotional disorders (Armstrong & Olatunji, 2012; Clauss et al., 2022; Peckham et al., 2010). Yet, as commented above, these studies often show some incongruencies (i.e., evidence for a negative bias, lack of positive bias, both types of biases or no evidence for neither bias) which has been discussed in terms of limitations of some of the tasks, and the heterogeneity of the methods and populations studied. However, another issue that may account for lack of consistent findings on the nature of attention problems in emotional disorders is the fact that attention, as typically assessed, is assumed to be a context-independent factor that is stable across time and situations. This way of defining and assessing selective attention contradicts the own original conceptualization of selective attention as a cognitive process that permit filtering environmental information (Broadbent, 1958), in a way such that efficient use of attention should thus be characterized by an ability to change its focus depending on the needs and characteristics of the context itself (Godara et al., 2020; Godara, Sanchez-Lopez, Baeken, et al., 2021). The importance of adequately attending and responding as a function of changing contextual factors is central for psychological functioning, and it has been highlighted by many researchers in the field of emotion regulation (Aldao, 2013; Aldao & Nolen-Hoeksema, 2012a; Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Sanchez-Lopez, 2021). In contrast with classical models that postulate the existence of (mal)adaptive emotion regulation strategies (adaptive = reappraisal, plan refocusing; maladaptive = rumination, dampening, focusing on decreasing positive emotions and

states; Wood et al., 2003), new emotion regulation frameworks postulate that the functional value of each emotion regulation strategy depends on the specific characteristic and demands of each context and how/what variables modulate these relations, implicating a flexible use of emotion regulation strategies (Aldao et al., 2015; Aldao & Nolen-Hoeksema, 2012a). One of the context variables that modulates this association is stress perception, in such a way that the perception of the situation in terms of its intensity and controllability can predict the preferential use of some emotion regulation strategies (Haines et al., 2016; Socastro et al., 2022; Troy et al., 2013). For instance, Socastro et al. (2022) have shown that rumination, a purportedly maladaptive strategy, is less used when there is a high perception of control of highly intense situations (i.e., your car breaks down the day you have an important meeting but you have the option of taking a taxi soon or you have another spare car), but more used when there is a high perception of control of situations of low intensity (i.e., a small change of plans arises that you can solve quickly but it changes the organization of your day). In the same way, a higher use of reappraisal is predicted by lower levels of perceived controllability, in such a way that this specific pattern is related to lower depression and anxiety levels (Haines et al., 2016), while reappraisal may turn maladaptive when it is used during high control situations (Troy et al., 2013). These results implicate that the degree of use of a given emotion regulation strategy is not enough to understand its associated benefits/drawbacks, but that it is necessary to understand contextual factors influencing its temporary dynamic use, which would ultimately determine its effectiveness.

The effect of the perception of stress has not only been shown with respect to the differential use of emotion regulation strategies, but also with respect to the emergence

of different affects (i.e., less negative affect during high control situations; Jones et al., 2017) or changes in psychophysiological variables (i.e., positive and negative relations between perceived stress and heart rate and high frequency heart rate variability, HF-HRV; Vaessen et al., 2021). In the same way, contextual factors do not only affect the differential use of emotion regulation strategies but also have functional relationships with brain regions implicated in affective processing (i.e., differences in the activation of the amygdala to ambiguous images of surprise when positive or negative contexts are added; Kim et al., 2004) and resulting cognitions (Godara et al., 2020). Consequently, context can influence psychological functioning at multiple levels. Therefore, contrary to a stable conceptualization of cognitive-affective processes (i.e., negative attention bias vs. positive attention bias; maladaptive vs. adaptive emotion regulation strategies), current evidence highlights how a dynamic conceptualization of these different psychological mechanisms can provide more valuable insights on how specific issues in selective attention and related affect experiences account for the emergence and maintenance of emotional disorders.

Rottenberg (2007) proposed the Emotion Context Insensibility (ECI) theory, that although focused on depression, could explain the appearance of emotional symptomatology in general, as a function of a diminished ability to process changes in the environment, which would lead to deficient emotion regulation and attenuated emotion reactivity (for an extensive discussion of this topic, see Rottenberg & Hindash, 2015). “For example, an individual with emotional problems may display symptoms such as high levels of sadness or anhedonia. According to this theory, when one person would be facing a negative situation such as a debt notification that he/she cannot pay, there

would be no increase in his/her symptoms, just as they would not decrease when a positive situation occurs such as a birthday celebration, and there would be no change in his/her emotional reactivity". In order to evaluate this prediction, several studies assessing reactivity to emotional material have been conducted. In the typical procedure, depressed vs control participants must rate the extent to which certain videos (i.e., positive, negative, and neutral videos) made them feel, at the same time that psychophysiological measures were collected (i.e., heart rate). In general, results indicate that the depressed group showed less reactivity to emotions such as sadness or happiness during all the conditions, with no emotional adjustment between the changes in emotional material presented in the videos. In contrast, non-depressed individuals showed these differences in emotional reactivity when seeing different emotional content, being able of emotionally adjusting to changes in the context (Rottenberg et al., 2002, 2005). Furthermore, the levels of reactivity based on psychophysiological variables during the visualization of the videos predicted clinical status 6 months later, associating lower heart rate reactivity with a maintenance of depressive clinical status, while those participants who recovered 6 months later, showed higher reactivity (Rottenberg et al., 2002). Therefore, these differences would support several conclusions, such as (a) the importance of the context (dynamic conceptualization of emotional processing), (b) that the individual's ability to emotionally adjust to these environmental changes is a key variable in the understanding of emotion regulation and (c) how these relations are affected at higher levels of emotional symptoms (Rottenberg & Hindash, 2015).

The importance of context, although it has mainly been applied to study emotional reactivity and regulation (Aldao, 2013; Aldao & Nolen-Hoeksema, 2012a; Bonanno &

Burton, 2013; Kashdan & Rottenberg, 2010; Sanchez-Lopez, 2021), can also be applied to study cognitive mechanisms (i.e., selective attention) that supports the processing that facilitates these adequate emotional responses. From a typical static view, the maximization of preferential processing of positive or negative information has traditionally been associated with a preferential use of strategies of reappraisal (Sanchez et al., 2016) and rumination (Duque et al., 2014), respectively, already proving the connection between selective attentional processing and specific forms of emotion regulation. Nonetheless, when considering specific contextual demands, selective attentional processing of negative vs. positive information may not necessarily be inherently mal/adaptive but depend on the specific characteristics of the context and how contextual demands change across time. For example, while an individual is in a party where everyone is having fun, the most adaptive selectivity would be to maintain attention toward positive information (i.e., happy music, happy faces of friends…) in order to continue maintaining associated positive affects. However, when the context changes and the individual must go back home at night crossing a dark corridor, the most adaptive selectivity might comprise preferentially looking at those most negative components of the environment (i.e., possible threats) so he/she arrives home safely. In fact, although there are studies supporting the existence of a general preferential attention bias towards positive information in healthy individuals (Blanco et al., 2019; Duque & Vázquez, 2015), there is also literature that supports a facilitated attention in healthy individuals to efficiently detect threatening stimuli, both animals (i.e., spiders or snakes: Öhman, Flykt, et al., 2001) or faces (Öhman, Lundqvist, et al., 2001), when the situation demands it. This effect is magnified by high anxiety levels but still exists in the general population

(Öhman, Flykt, et al., 2001). In consequence, what the current models suggest is that the direction of attention to preferentially process positive or negative information would not be fixed but depend on the characteristics of the specific contextual demands and the goals associated with those demands (Mancini, 2015).

Thus, the most optimal behaviors in each context would be defined through the adjustment between the current context demand, the goal associated with the context demand, and the consequent attentional pattern guiding selective processing of information that is congruent with that context and demand (Godara et al., 2020; Kashdan & Rottenberg, 2010). In contrast to a static conceptualization of attention, current models thus aim to operatize attentional processes as dynamic, arising across contexts and goals, thus generating the term 'affective attention flexibility', which would be derived from models of cognitive flexibility (for a detailed explanation see; Stange et al., 2017). To fully operatively define and study such components of affective attention flexibility, we must thus first establish the modulating role of motivational goals in selective attention processing, as discussed in the next section.

1.6. The implication of goals-directed processes in selective attention

There are several processes that can guide our attention to work in a dynamically changing selective manner. Literature proposes two main specific processes, as already introduced at the beginning of this chapter: a bottom-up, stimulus-driven way process, and a top-down, goal-directed process. The first one would imply that attention is captured by specific characteristics of the stimulus that has a higher salience (e.g., appearance of a threat; Desimone & Duncan, 1995). The second one would imply that specific selective processing of given stimulus is favored in an intentional manner as this

selectivity facilitates achieving a specific goal (e.g., search for an email message associated with a specific topic in order to answer a question; Corbetta & Shulman, 2002). Across decades, both types of processes have been studied independently, in such a way that they have come to be understood as separate entities. However, on a daily basis, both processes work together in such a way that they would be constantly influencing selective attention (Corbetta & Shulman, 2002). This means that during our daily functioning, attention is captured by stimuli based both on specific stimuli salient features and on individual specific goals. For example, if we aim to meet someone in a crowded area, our attention will be stimulus-driven directed towards characteristics (bottom-up process) that are associated with the person we want to find, but guided by the aim of finding to that person within the crowd (top-down process), in such a way that those top-down process would influence bottom-up process, increasing the salience of certain stimulus, with the aim to fulfill that goal.

Experimental studies have supported the influence of goal-directed processes in attention towards goal-relevant stimuli (Mazzietti et al., 2014; Vogt et al., 2011). These studies show that goal-relevant stimulus generated different information processing patterns (i.e., goal-relevant stimulus generated larger cue validity effects; Vogt et al., 2011) depending on experimental groups (i.e., thirsty individuals compared to control ones lasted more time responding about the length of screen frames when water bottles appeared in the screen; Mazzietti et al., 2014). Based on this type of evidence, it can be argued that if selective attention is influenced (i.e., directed) by ongoing goals, in the event of a change of environment or a change of goal within the ongoing context, attention should be modified and directed towards new stimuli that promote new forms of goal-

congruent processing, highlighting the importance of motivation in the modulation of selective attention. For example, at a party, the main motivational goal could be based on a social approach and enjoyment of the party, which should derive in a preferential selective direction of attention towards those stimuli that reinforce that goal (i.e., happy faces). However, if the context changes (e.g., one realizes that his/her friends are looking very annoyed and having an argument between them) the main goal might be to solve the argument occurring among those friends, so the attention should be modified according to the new goal, giving rise to a preferential attention toward other types of stimuli that are relevant to the new goal (i.e., disgusted faces). Consequently, in order to fully understand how different contextual and motivational processes modulate attention from a dynamic perspective, it is necessary to establish an operative framework to study how context-related goals associated with top-down processes modify the salience of stimuli captured by bottom-up processes to guide selective attention in a flexible manner.

1.7. Definition of cognitive flexibility and affective attention flexibility

The concept of 'affective attention flexibility' used in this Dissertation is derived from more general original frameworks in the study of cognitive flexibility (Scott, 1962). From those original models, cognitive flexibility is understood as the ability to switch between mental schemes according to context-dependent goals, as a hallmark of mental health. This concept has derived into numerous ways of understanding psychological flexibility, generating new perspectives focused on specific psychological processes of flexibility, such as 'emotion regulation flexibility' (Aldao et al., 2015; Sanchez-Lopez, 2021), 'psychophysiological flexibility: cardiac vagal control' (Rottenberg, 2007; Thayer et al., 2009), and 'affective attention flexibility' (Godara et al., 2020; Wen et al., 2019;

Wen & Yoon, 2019), among others. As for the last one, affective attention flexibility could be understood as the ability of an individual to process emotional information associated with an event with the aim to efficiently regulate the generated emotions and/or influence the most adaptive behaviors to respond to the demands of the ongoing event. Given this, individual differences in levels of affective attention flexibility can be crucial to facilitate adaptive emotion regulation and behavior. As a first way to evaluate affective attention flexibility, indirect tasks indexing working memory updating or inhibition of emotional material through the disengagement task (Sanchez et al., 2013; Sanchez, Romero, et al., 2017) have been used. Using these approaches, results have related inflexibility (i.e., sustained processing of negative material) with a greater use of maladaptive emotion regulation strategies such as rumination, both in the laboratory (De Lissnyder et al., 2010) and as measured during daily life with Experience Sampling Methods (i.e., ESM; Pe, Raes, Koval, et al., 2013; Pe, Raes, & Kuppens, 2013), greater negative affect and less positive affect on a daily basis (Yaroslavsky et al., 2019), and lower levels of satisfaction (Pe, Koval, et al., 2013). Other widely used task to measure attentional flexibility is the affective switching task (AST; Genet et al., 2013; Malooly et al., 2013), a computerized task requiring shifting attention between affective and non-affective rule-dependent information. For example, Grol & De Raedt (2020) or Malooly et al., (2013) used an AST where participants had to switch between different rules based on an affective components (identify the valence of an image) and a non-affective components of the stimuli (identify the number of people in an image), focusing on switching between rules but not including a contextual component. Using this methodology, it is possible to present trials requiring switching away and towards

affective and non-affective information, which allows evaluating the efficiency of participants to inhibit irrelevant information at the same time that they shift to relevant information depending on a determined rule. Affective attention inflexibility, as indexed with the AST, has been related to lower levels of trait resilience (Genet & Siemer, 2011), lower levels of habitual use of reappraisal (Malooly et al., 2013) or higher levels of emotional symptoms (i.e., both anxiety and depression; Wen et al., 2019; Wen & Yoon, 2019). However, although these results are in line with current conceptual frameworks stating that flexibility would be associated with a component of adaptation to the environment and that inflexibility would imply the opposite (Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Malooly et al., 2013), this association is not always evident. In fact, some studies have shown that inflexibility to preferentially process positive information is related to lower levels of habitual use of rumination (Genet et al., 2013). Other studies have related flexibility to negative outcomes, such as lower levels of resting-state HRV, which implicates a low activation of parasympathetic system (Grol & De Raedt, 2020). Given this mixed findings, it is necessary to not inherently attribute an adaptative nature to multiple forms of attention flexibility, since they may not always contribute to adaptive emotional consequences (e.g., Aldao et al., 2015; Genet et al., 2013).

Due to the importance of considering contextual factors and motivational goals in the definition of adaptive forms of selective attentional processing of affective information, Godara et al., (2020) developed a new affective flexibility task based on the evaluation of participants' efficiency to selectively attend to different types of affective stimuli when it came to repeat or switch selective attention patterns as a function of

different contexts and emotional goals. Participants learned different combinations of contexts (e.g., party with friends, presentation at the university) and specific associated emotional goals (e.g., enjoy the party vs. resolve conflicts), which were associated with an adaptive emotional component, either positive or negative. For example, the combination of "party with friends" and the specific goal of "enjoying the party" was associated with a selective attention toward positive information, while in the same context (party with friends) the specific goal of "solving a conflict with friends" was associated with a selective attention toward negative information. Thus, in this novel task, depending on the combination of context and goal features, participants have to direct their attention to the appropriate emotional component as quickly as possible, while eye-tracking is used to assess the speed to fixate attention in appropriate stimuli. Consequently, the different succession of trials generates a repetition or change between emotional goals and specific contexts. In this way, the task allows to evaluate the individual's efficiency of attention flexibility when making changes or iterating between emotional goals and contexts (Figure 1).

Figure 1. Affective Flexibility Task design made by Godara et al. (2020).

The results of Godara et al. (2020) showed the existence of a maximization of the attentional pattern towards negative information in individuals with higher symptoms of depression, while the opposite pattern towards positive information was observed in individuals with lower depression levels. In this way, through the development of this type of new procedures, attentional processing of emotional information in specific contexts can be evaluated, thus giving importance to the modulatory role of selective attention by context and goal features. Consequently, it is necessary to know how attentional processes, understood from a dynamic perspective, are modulated by contextual and motivational factors, giving rise to variations in the attentional display due to the succession of context-dependent goals. The studies presented in this Dissertation thus aimed to implement this type of novel designs to further advance knowledge on the nature of adaptive affective attention flexibility processes that relate to efficient emotional

reactivity and regulation and that can be intervened to promote these characteristics in individuals suffering from emotional disorders.

1.7. Summary

Attention has been one of the most studied cognitive processes in emotional disorders and extensive research supports a main role of selective attention in the characteristics of psychological functioning of the individuals, as it involves the first stage of affective information processing that affect to other types of cognitive processes (e.g., interpretation) and is associated with different forms of emotion (dys)regulation. Since initial formulations from classical attention models, selective attention was conceptualized as a static process, giving rise to research focused on general attention biases. This body of research has found that a greater selective attention towards negative information and a lack of preferential attention toward positive information may both be characteristic in emotional disorders. These biases have been associated with the onset, maintenance, and recurrence of emotional disorders. However, multiple psychological mechanisms such as cognition, emotion regulation or even brain functioning processes can be modulated by contextual factors, leading to elaborate new frameworks to study selective attention and related processes from a more dynamic perspective. The dynamic conceptualization of selective attention can be defined as affective attention flexibility, which refers to the individual's ability to process affective information depending on ongoing context demands and associated goals. Initial studies on affective attention inflexibility have related it to emotional symptoms and deficient use of emotion regulation strategies. Consequently, the study of affective attention flexibility processing requires three principles of assessment and analysis to fully understand this process and

its contributions to mental health: (a) the inclusion of context and (b) motivational goals, in order to understand how attention can be influenced by the activation of different goals in specific contexts, and (c) not inherently attributing an adaptative nature to flexibility processes, since it is necessary to evaluate different flexibility patterns and establish how they can be related to psychological outcomes. This Thesis builds on this perspective, aiming to clarify how such components of affective attentional flexibility may depend on ongoing demands and motivational characteristics of the situations, but also how individual differences in motivation might account for the emergence of inflexible forms of affective attention. With that aim, in the next Chapter we introduce a framework to study motivational factors and their modulating role in these processes of affective attention flexibility.

Chapter 2. Motivational Factors Potentially Modulating Affective Attention Flexibility: Promotion and Prevention Self-Focuses

As highlighted in the previous Chapter, the concept of affective attention flexibility is rather new and requires considering individual variables that could modulate their manifestation. A clear prediction, given the nature of the process (i.e., flexible selectivity of emotional material as a function of specific contextual demands and goals), is that individuals with specific preferences to activate different types of motivational goals will tend to show different forms of attention flexibility. From this point of view, in the present Thesis, the study of motivational self-focuses will be introduced to test how different motivational profiles account for different patterns of selective flexible affective attentional processing. Such motivational factors have been derived from a series of existing theories on self-perception and motivation that are explained into detail below. An important corollary of these frameworks' predictions is that different predominant motivational profiles may account for different vulnerabilities to develop emotional disorders, such as depression and anxiety (Klenk et al., 2011). Thus, introducing the study of affective attention flexibility, as it is modulated by these motivational systems, might shed light on specific mechanisms that lead to the emergence of different forms of emotional problems.

2.1 Self-discrepancies theory

Motivational frameworks to study cognitive processing were initially based on theories of self-perception. From these initial models on self-perception, the individual

own self-perception and especially, the discrepancy between perceived current states and the ones that a person would like to achieve has been considered a key factor characterizing the development, maintenance and relapse of several emotional problems, such as depression and anxiety. Specifically, the Self-Discrepancy Theory (SDT: Higgins et al., 1985) was formulated to define different forms of self-discrepancies that guide the emergence of emotional dysfunctions and risk for emotional disorders. Based in this assumption, the SDT includes the concept of "self-domains", which is understood as the different self-perspectives from which individuals can define or evaluate themselves. More concretely, the SDT (Higgins, 1987; Higgins et al., 1985, 1986) identified three self-domains:

(1) the "Actual Self" (equivalent as self-concept), which would include those attributes that the individual consider he/she actually possesses,

(2) the "Ideal Self", which would include those attributes that the individual would like to ideally have,

(3) the "Ought Self", which would include attributes that the individual considers he/she should have, based on obligations or rules.

This theory postulates that self-discrepancies generate different forms of emotional discomfort. Specifically, the "intensity" and "quality" of the emotional discomforts generated by a self-discrepancy would depend on the specific discrepancy between the current self-concept and different types of self-domains (Higgins, 1987). Each of these domains would allow the individual to generate different personal representations based on specifics mental schemas ('who I am', 'who I would like to be',

'who I ought to be'). Taking into these mental representations, the model identifies two possible sources of discrepancy depending on the domain of the self that is discrepant with the actual self that have been investigated in multiple studies since the 1980s (Hardin & Lakin, 2009; Ozgul et al., 2003; Strauman & Higgins, 1988). Actual-Ideal self-discrepancies would relate to emotions referred to dejection (e.g., sadness, dissatisfaction), that, when maintained, would confer risk to further increase depressive symptom levels. In contrast, Actual-Ought self-discrepancies would relate to emotions of agitation (e.g., nervous, afraid), that, when maintained, would confer risk to further increase anxious symptomatology levels. Based on the predictions of this model, a broad line of empirical research has emerged to study the causal role of these discrepancies in emotional problems, the specificity of these discrepancies to account for different forms of emotional disturbances (i.e., depression, anxiety) and to test how these relationships can be mediated by the preferential use of different types of emotion regulation strategies linked to each type of self-discrepancy (Caselli et al., 2014; Dickson et al., 2019; Mason et al., 2019; Roelofs et al., 2007).

In line with this, several studies have demonstrated that only actual-ideal discrepancies are related to dejection emotions (Stevens et al., 2014) and only actual-ought discrepancies are associated with agitation emotion, supporting the emotional specificity hypothesized by SDT. This results have been established either in correlational (Higgins, 1987; Higgins et al., 1985; Strauman & Higgins, 1988), and experimental studies (Hardin & Lakin, 2009; Johns & Peters, 2012; Scott & O'Hara, 1993), including experiments using inductions and priming conditions to manipulate self-discrepancies and test their effects (i.e., priming conditions based on increasing the accessibility of

participants' self-discrepancies through the description and explanation of personal ideal goals in the ideal priming condition and personal oughts goals in the ought priming condition and if they have been achieving those goals over the years; Higgins et al., 1986). However, other studies have not found this emotional specificity (Dickson et al., 2019; Ozgul et al., 2003; Stevens et al., 2015), but general associations between one or both types of self-discrepancy indices and one or both types of emotional symptoms (i.e., depression and anxiety). For example, some studies have found multiple relations between both self-discrepancies with both emotional problems (Ozgul et al., 2003). Other studies have only found relations between actual-ideal self-discrepancies and both depressive and anxiety symptoms (Dickson et al., 2019). Finally, some studies have found that both self-discrepancies were related only with depressive but not with anxious symptoms (Stevens et al., 2015). Overall, the latter set of results suggest that there might only be one general transdiagnostic mechanism of self-discrepancies accounting for multiple forms of emotional disturbances, contrary to what the SDT predict. In fact, the traditional emotional specificity predicted by the SDT model is not supported by a recent meta-analysis of extant studies considering the relations between self-discrepancies and multiple forms of emotional psychopathology (Mason et al., 2019). This meta-analysis showed that both self-discrepancies were related with several psychological measures such as negative emotions, rumination, self-esteem and both forms of emotional symptoms (i.e., depression, anxiety). Overall, current evidence does not invalidate the effects of self-discrepancies to affect emotional functioning but highlights that their role might not be as specific as initially expected. To further clarify specific mechanisms that might lead to that specificity between self-perception issues and emotional impacts, a

further model was formulated that add the consideration of different types of motivational self-focuses guiding cognitive processing and resulting affective states, as defined below.

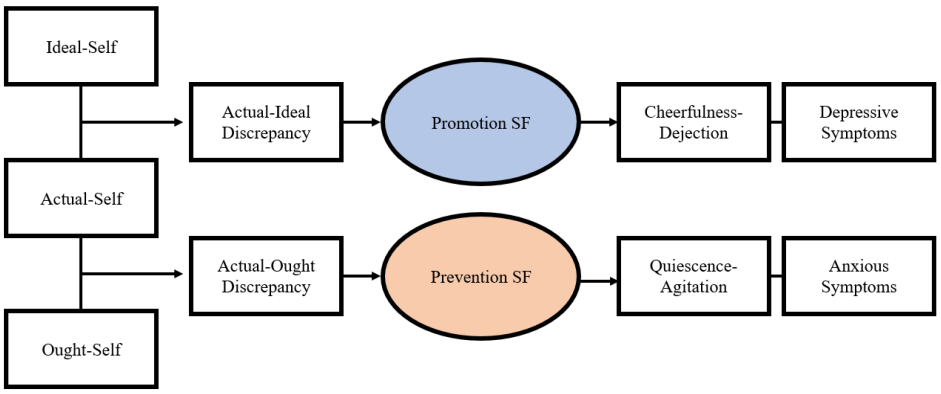
2.2. Regulatory Self-Focus Theory

The defined self-discrepancies, either with a general effect in negative affect or specific forms of depression- and anxiety-related emotions (Mason et al., 2019), can either way motivate the individual to resolve them, giving rise to the activation of different regulatory systems depending on the type of self-discrepancy. Contrary to a purely hedonic model (i.e., defining general goals of solving negative discomfort), the regulation of specific self-incongruencies referred to strong ideals or strong oughts should involve different types of specific regulatory goals, implicating different coping strategies and different emotional consequences. With the aim to implement self-discrepancies into a motivational approach accounting for different system of motivation and regulation, the Regulatory Self-Focus Theory (Higgins, 1997, 1998) was formulated. This model defines a series of motivational dimensions that help to regulate specific goals in daily life. Specifically, they can refer to a promotion focus (i.e., fulfill aspirations or accomplishments, in line with observed incongruences between the current state and the ideal desired state) or to a prevention focus (i.e., fulfill responsibilities or safety, in line with observed incongruences between the current state and the ought desired state). This framework postulates that the coordination of psychological processes guiding context-based behaviors depends on the differential activation of promotion and prevention motivational self-focuses (i.e., SF) and their corresponding associated affective goals (i.e., to feel happy/not sad, to feel calm/not nervous; Higgins, 1997). Therefore, the activation of a given motivational SF would implicate a different type of self-regulation, which

would influence the way that contextual demands are perceived and the activation of specific situational goals, thus guiding different forms of selective attention to affective information in the environment.

A promotion SF would be activated through the perception of actual-ideal states' discrepancies, guiding the preferential processing of emotional information that promotes affective states in a cheerfulness-dejection emotional continuum related to achieving certain possible positive outcomes, rewards or aspirations (i.e., feeling happy, not feeling sad; Higgins, 1997, 1998). In contrast, a prevention SF would be activated through the perception of actual-ought states' discrepancies, guiding the preferential processing of emotional information that supports affective states in a quiescence-agitation emotional continuum, related to goals of protection, security and avoidance or termination of possible negative outcomes or punishments (i.e., feeling calmed, not feeling nervous; Higgins, 1997, 1998, 2012). In consequence, specific negative states would be associated to the activation of a promotion SF, when not attaining the desired positive results, whereas other specific negative states would be associated to the activation of a prevention SF, when not been able to avoid the feared negative results. For a schematic explanation between models and its emotional consequences, see Figure 2.

Figure 2. Explanatory scheme of Higgins models.



This model provides a series of predictions that can be tested through experimental studies. Initial evidence from Shah & Higgins (2001) supports some of these predictions. Through different studies, participants had to do specific tasks (e.g., rate their past and current emotions, rate the emotional components of words) and solve, after a motivational induction of specific promotion and prevention SFs, an anagram task comprising a stress induction. Results from these experiments showed that individuals with higher levels of promotion were faster when appraising information within cheerfulness-dejection categories, whereas individuals with higher levels of prevention were faster when appraising information within quiescence-agitation categories. Therefore, it was concluded that the speed at which certain emotions are processed is facilitated by the perception of certain ideals or oughts, specifically as promotion and prevention SFs are associated with each different type of cognitive scheme.

This type of effects might then cause that the activation of different motivational SFs influence information processing, in such a way that it can guide attention towards a series of stimuli (i.e., attention towards positive information after the activation of promotion SF and towards the negative information after the activation of prevention SF).

However, although there is a tendency to preferentially activate a given type motivational system across situations (i.e., there are individuals with higher tendencies to activate promotion SFs vs. individuals with higher tendencies to activate prevention SFs across contexts; Higgins, 1997), the specific demands of momentary contexts can further influence the temporal activation of different motivational systems (i.e., and resulting momentary goals) in order to flexibly adjust selective attention to the needs of the context and its interpretation. This idea has been highlighted in this theory (Higgins, 1997) and in some related studies that evaluate changes in the activation of motivational SFs in different contexts. In a recent study, LaCroix et al. (2023) analyzed momentary motivational SF activation depending on specific contexts (e.g., work place vs. personal life). A gender effect was supported showing that, in contexts referred to their personal lives, men were more promotion-focused but became more prevention-focused in work environments, while women were more balanced in their personal lives and became more promotion-focused in their work environment (LaCroix et al., 2023). Overall, these results provide some initial evidence on that flexible changes between motivational SFs can occur in different contexts within individuals. These changes could promote the use of specific mechanisms capable of adjusting the functioning of the individual to the goals to fulfill them in a flexible manner.

Contrasting with the former assumption, according to which flexible activations of goals and associated behaviors (i.e., selective attention) may be adaptive, a chronic inflexible activation of specific motivational SFs would be associated with the appearance of specific emotional symptoms (Klenk et al., 2011). Specifically, chronic failures to attain goals in individuals with a predominant promotion SF are thought to eventually

produce a lower engagement with pursuit on possible promotion goals, as it generates the perception that the non-attainability of goals will not change. If this pattern persist, individuals would tend to reduce the activation of the promotion SF, no longer looking for possible positive results, and consequently maintaining a permanent attentional focus in negative information and resulting depression-related dejection emotions. This cycle would produce dysphoric moods, low motivation, negative self-evaluation and eventually depression onset (Klenk et al., 2011). Therefore, the chronic reduction of the activation of the promotion SF (hypoactivation) is thought to be associated with depression. Further, the hyperactivation of the prevention system is thought to cause high levels of hypervigilance towards threats and avoidance of possible negative results (avoidance from prevention failure). This motivational-orientation, contrary to improving the achievement of prevention goals, when chronically activated, would cause a worsening of agitation states. Therefore, the hyperactivation of chronic prevention SFs, as a result of failure fulfill goals of safety and problems' solving would in turn cause higher levels of worry, irritability and fatigue, symptoms associated with generalized anxiety (Klenk et al., 2011).

In consequence, the comorbidity between depression and anxiety can be understood from this framework as an initial reduction of promotion SF and a posterior hyperactivation of prevention SF. The hypoactivation of a promotion SF might in turn produce a predominant activation of the prevention SF, that would become chronic, producing the deactivation of the promotion SF. The cycle would become stronger, hypoactivating the promotion SF, increasing feelings of promotion failure and depressive symptoms, while, at the same time, the hyperactivation of prevention SF would continue,

increasing the hypervigilance process and increasing anxiety symptoms (Klenk et al., 2011). In addition to the numerous studies that show specific relationships between promotion and prevention SFs, measured through self-discrepancies levels, and depression and anxiety (Hardin & Lakin, 2009; Johns & Peters, 2012), Klenk et al. (2011) carried out a study that justify the theoretical framework, relating only promotion failures with depressive symptoms and only prevention failures with anxious symptoms after controlling for the opposite motivational SF and emotional symptom levels.

Overall, initial evidence points out the utility of these motivational framework to define different mechanisms and risk factors to develop emotional disorders. Importantly, the mechanisms through which such vulnerabilities occur can be studied in relation to how different motivational SFs and specifically active goals guide the flexible use of selective attention to process situational information and to influence the enactment of different forms of emotion regulation and behaviors, as considered below.

2.3. A new framework to study motivational SF and its influence in attention flexibility

Daily life involves behaving in different contextual environments (e.g., going to work/class in the morning, having a meal with colleagues or friends at the cafeteria, going back to work/class after lunch), which may have different associated demands and goals to fulfill (e.g., to deal efficiently with a complex work assignment - to feel calmed -, to disconnect and have a relaxed time with others - to feel happy -, to anticipate new potentially problematic work demands and elaborate a plan to address them in advance - to avoid feeling nervous -, respectively). The ability to flexibly shift cognitions and behaviors between these changing contexts as a function of the associated motivational

SFs and resulting affective goals is thus crucial to develop adaptive responses to life stressors (Fresco et al., 2006). Specifically, adaptive functioning is thought to rely on an optimal balance between focusing on current mental-sets (cognitive stability) and shifting and updating mental-sets when the contextual demands change (cognitive flexibility; see Goschke & Bolte, 2014). Therefore, understanding the mechanisms supporting cognitive flexibility for efficient contextual goal maintenance or shifting is of high relevance to promote efficient context adaptation and stress regulation (e.g., Bonanno & Burton, 2013).

Previous findings support a preferential focus and efficient processing of motivationally congruent information for each type of SF (Shah & Higgins, 2001). The preferential activation of promotion or prevention SFs could therefore influence affective attention flexibility, modulating the way that goal-relevant information is selectively attended and efficiently processed (Klenk et al., 2011). However, to date, it remains to be tested whether (a) such specific facilitations of processing are supported by a higher affective attention flexibility for specific motivationally-relevant information that is congruent with each specific SF (i.e., higher promotion SF relating to higher flexibility in contexts activating proximal goals within the cheerfulness-dejection continuum; higher prevention SF relating to higher flexibility in contexts activating proximal goals within the quiescence-agitation continuum) and (b) how there may be mechanisms that favor the regulation of different emotions or stressors. Overall, the present Thesis thus aimed to introduce the study of motivational SFs to test their potential modulation of individual differences in affective attention flexibility, considering how those processes ultimately affect to the capacity to regulate stress and reduce risk for specific forms of emotional disorders (Klenk et al., 2011).

2.4. Summary

The revised literature in this Chapter can be used to define specific predictions regarding the modulatory influence of motivational factors in affective attention flexibility and its potential effects in stress regulation. In order to regulate the discrepancies between the self-states of individuals (i.e., current, ideal and ought), initial evidence points out that there may be different motivational SFs that direct the individual's attention to specific sources of information and influence the use of a series of regulatory strategies and consequent specific emotions. The preferential activation of a promotion SF has been linked to selective attention toward possible positive results associated with the desire of fulfillment of goals. The preferential activation of a prevention SF has been associated to selective attention toward possible negative results in order to guide strategies aimed to fulfill the goals of avoiding them (Shah & Higgins, 2001). The flexible switching between different motivational SF (i.e., and resulting momentary goals and related attentional preferences) depending on the specific demands of context has been related to correct psychological functioning (while chronic activation of given SFs has been related to impaired emotional functioning; Higgins, 1997, 1998, 2012; Klenk et al., 2011).

Therefore, it is necessary to empirically test how these motivational SF can modulate the direction of attention selectively towards different forms of affective information processing. The present Thesis tested the hypothesis that motivational SFs modulate affective attention flexibility: i.e., that promotion SF maximize attention selectivity of positive information and higher processing of cheerfulness-dejection emotions, while prevention SF maximize attention selectivity of negative information and

higher processing of quiescence-agitation emotions. Motivational SFs are thus seen as potential factors modulating flexibility of affective attentional processing in specific directions. This might have important effects in the ability to regulate emotions in the face of stressors that ultimately confer risk to the development of emotional disorders. In the next Chapter is thus introduced the importance of stress dysregulation as a central mechanism in the basis of depression and anxiety onset and maintenance that might be modulated by mechanisms of affective attentional flexibility, as this operates as a function of motivational SFs guiding the activation of different forms of contextual goals.

Chapter 3. Stress Regulation as a Result of Attention and Motivational Factors

In order to study the role of affective attentional flexibility in mental health, and how motivational SFs modulate it to lead to differences in stress regulation and emotional disorders' risk, conceptual models of stress, its assessment and preliminary evidence on its relation to attention mechanisms must be considered. Specifically, in the present work, heart rate variability (i.e., HRV) was included as an objective marker of stress reactivity and recovery, and specific models considering this measure and its relation to affective attention flexibility and emotional functioning are defined and considered in the present Chapter.

3.1. Stress Theories

3.1.1. Allostatic Thought (Sterling, 1988)

During daily life, there are multiple situations promoting needs and demands that have to be regulated both cognitively and emotionally. To achieve this, individuals have a series of mechanisms (i.e., emotional, cognitive, physiological) that allow adjustment with the environment demands in order to achieve some needs. These mechanisms would make possible to start enacting specific behaviors and resources that favor the individual's adaptability to a certain situation. For example, the heart, through the increase of the heart rate (HR) (i.e., pumping of more oxygenated blood to the organs and muscles of the body), would allow a greater adaptation to dangerous situations or those ones that require a physical effort (Voorhees & Han, 2015). Therefore, the changes in the variability of the HR (increasing during a stress situation and coming back to its baseline level when the

stress situation is finished) can provide information on the adjustment of individuals to possible stress situations, in the same way as an emotion regulation mechanism. This idea, associated with the importance of generating adaptive changes, can be derived from the allostatic model (Sterling, 1988), which, contrary to a classical homeostatic model (i.e., the organism tends to stability through the maintenance of different physical parameters; Cannon, 1932), focuses on "maintaining stability through change" (Sterling, 1988).

Different formulations of allostatic models emphasize the importance of flexible adaptation processes in the face of changing environments and situations perceived as stressful, giving rise to mechanisms favoring variability (against homeostatic models, which emphasize the importance of reducing variability; Logan & Barksdale, 2008; McEwen, 2003). One of the key points of allostatic models is the study of brain functions allowing variability and adaptability, since the brain is the central organ that initiates the perception of an event as stressful, triggering a stress response and the consequence bodily changes (i.e., increased HR, release of hormones, functional changes in brain regions, activation of the sympathetic system) that, consequently, generate adjusted responses. However, when stress-related responses become chronic (i.e., lengthening over time) they would cause allostatic load, which would be understood as the "cost" associated with the change (Logan & Barksdale, 2008; McEwen, 2003). The specific brain and psychophysiological mechanisms accounting for these different forms of stress (dys)regulation have been defined, based on such initial allostatic models, through theories such as the Polyvagal Perspective and the Neurovisceral Model, presented below.

3.1.2. Polyvagal Perspective (Porges, 1995, 2007)

The polyvagal theory (Porges, 1995, 2007) suggests that the evolution of mammals promoted a very close relationship between the autonomous system and emotional processes, in such a way that emotional experiences, affective states or even prosocial behaviors would have a neuroanatomical substrate associated with the vagus nerve. Therefore, different physiological states would promote a series of certain behaviors. For example, the withdrawal of vagal control promotes mobilization, fight or flight, while the increase in vagal control increases prosocial behaviors (Porges, 1995, 2007). Based on this, each state would be associated with the activation of different autonomous subsystems, that would be dynamic depending on the characteristics of the event. The Social Engagement System would be associated with the myelinated vagus nerve, the Immobilization System with the vegetative vagus nerve and finally, the Mobilization System with the sympathetic system, promoting fight or flight behaviors. Therefore, when the environment is perceived as safe, the body state would be regulated towards health promotion goals (i.e., tissue restoration, continuation of digestive processes, increase of the immune system) and prosocial behaviors, caused by the activation of the myelinated vagus nerve. However, when there is a perception of threat, the myelinated vagus nerve would be inhibited, causing the disinhibition of the sympathetic system and the vegetative vagus nerve, activating the im/mobilization systems. At this point, three options, depending on the specific perception of context, could occur: (a) the activation of the Immobilization system (which would be one of the oldest at the phylogenetic level) or (b) the activation of the Mobilization system, characterized by either flight or fight behaviors that could be activated, differentiating the

appearance of one or the other depending on the individual's motivation (fight --> approach motivation; flight --> avoidance motivation; Beauchaine et al., 2007). An adaptive daily functioning would be characterized by the dynamic activation of the different systems depending on the characteristics of environment. To do this adaptively, it would be necessary to a) adequately assess the risk of a situation and b) be able to exchange between systems. For this purpose, the central nervous system needs to adequately identify when a situation is threatening. This is known through a neural process called "neuroception", which, located in the temporal cortex, would serve to identify contextual characteristics, finally being able to determine if a situation is safe or threatening. Consequently, different emotional problems would be related to an ineffective ability to switch between systems due to incorrect identification of environmental characteristics (i.e., incorrect functioning of neuroception processes). From a psychopathological perspective, part of the emotion regulation process is controlled by the myelinated vagus nerve, since it dampens the activation of mobilization responses. Therefore, dysfunctions in the vagus nerve would cause emotional lability and emotional psychopathology. The method that the myelinated vagus nerve has to modify this is through the "vagal brake", which acts on the sino-atrial node of the heart, accelerating or slowing down the blood level and consequently, promoting one behavior or another.

3.1.3. Neurovisceral Model (Thayer et al., 2009; Thayer & Lane, 2000)

Building from initial proposals of the polyvagal perspective, the Neurovisceral Model has defined specific physiological indicators for self-regulation, namely cardiac vagal activity. According to the model, the autonomous system is made up of two

subsystems, each of them associated with specific functions. The sympathetic system is involved in the mobilization of resources, while the parasympathetic system is involved in the restoration of resources. Both subsystems would be in a constant balance, until environmental deviations would produce changes in the activation of one.

From the neurovisceral model (Thayer et al., 2009; Thayer & Lane, 2000), the system that would control these changes would be the central nervous system, more specifically an internal regulation system called the "central autonomic network" (CAN), which allows the regulation of different functions (i.e., endocrine, autonomic and behavioral). CAN include areas of the entire brain such as the anterior cingulate, the insula, the prefrontal cortex, the amygdala, the ambiguous nucleus (vagus nerve) or the nucleus of the solitary tract, among others (Thayer et al., 2012). All these areas would be related and the processed information by these regions would be transmitted in a bidirectional way. This flow of information would end up reaching the neurons that innervate the heart, mainly through the vagus nerve, so the final output of the CAN is the different variations in the variability of the HR. That is, the different interactions between the outputs associated with the autonomic system (both sympathetically and parasympathetically) of the CAN in the sino-atrial node is what produces the variability in HR levels. Therefore, in healthy individuals, the prefrontal cortex would produce a constant inhibition of limbic regions such as the amygdala in non-threatening situations. However, when faced with contextual changes, the amygdala would be activated (disinhibition), thus increasing the HR and decreasing its variability through three different pathways (for a full explanation, see Thayer et al., 2009) and releasing a series of mechanisms that would produce a greater fit with the environmental demands.

Consequently, decreases in HRV in threatening situations is considered an adaptive adjustment mechanism (i.e., a marker of adequate stress reactivity when required by the ongoing environmental demands), as also is the return to basal levels at the end of its regulation (i.e., a marker of stress recovery when the environmental demands have been solved). These phasic changes would produce changes, not only at the psychophysiological level, but would be associated with cognitive processes (i.e., attention) and with the regulation of emotions, which thus have a central key role in this model.

3.1.4. An integrative perspective

Although with their differences, the models presented (Sterling, 1988; Porges, 1995; Thayer et al., 2009) have a series of shared ideas to highlight. First, the use of HR and its variability goes beyond an objective stress index but would be the ultimate output of a long series of regulatory processes both at the autonomous (direct marker of the balance between the sympathetic and parasympathetic systems) and the neural level (indirect marker of functional relationships of inhibition between frontal regions and the amygdala). Thus, the use of HRV allows a simple and reliable evaluation of very complex regulatory processes, while inferring conclusions at different levels of explanation. This allows HRV to be conceptualized as an index of emotion regulation. In the same way, the models emphasize the importance of contextual factors as inductors of psychophysiological changes compared to other more traditional models focused on static perspectives (Cannon, 1932), in such a way that what is adaptive would be the fact that the mechanisms favor the adjustment of individuals to the contextual change (i.e., decrease of HRV in stressful situations and return to basal HRV levels as part of recovery).

In contrast, a maladaptive functioning is conceptualized as maintaining the same mechanisms in the same situations (i.e., blunted HRV reactivity), not allowing the correct functioning in response to dynamically changing contextual demands (i.e., lack of neuroception from the polyvagal model or lack of cognitive-emotional adjustment from the neurovisceral model). HRV has been thus defined as a central variable for the study of affective attention flexibility and motivational modulatory factors in the study of stress regulation in the present Dissertation.

3.3. Definition, baseline and phasic changes of HRV

HRV is one of the most studied mechanisms in stress research, and it is based on changes in HR, conceptualized as Heart Rate Variability (HRV) (Porges, 1995, 2007; Thayer et al., 2009). The HRV is understood as an indirect indicator of the inhibitory balance between prefrontal regions and the amygdala. It is defined as beat-to-beat variability within specific HR ranges, produced by changes in vagal dominance and consequently in the para/sympathetic balance (Thayer et al., 2009; Thayer & Lane, 2000). One of the central points of the models presented is how the context can generate changes in the mechanisms associated with HRV, focusing on its changes as an important variable for the adjustment of the individual to the environment. The vagus nerve would maintain this inhibition of vagal tone in the heart through the parasympathetic system in non-threatening environments (Beauchaine et al., 2007). However, when there is a perception of threat, the inhibition of the vagus nerve disappears, disinhibiting the sympathetic system, increasing HR and decreasing its variability (Beauchaine et al., 2007; Thayer et al., 2009; Thayer & Lane, 2000). In this case, a significant decrease in HRV in the face of a threat is considered an adaptive mechanism of the individual (Kim et al., 2018).

Nevertheless, those individuals suffering from or at risk to develop emotional disorders are characterized by low levels of HRV at baseline and maintain these same levels during stressors, not generating a context-dependent response and therefore maintaining the activation of the sympathetic system. This lack of response in HRV is usually called "blunted reactivity" and would express an inadequacy of those mechanisms focused on the regulation of stressful situations (Hamilton & Alloy, 2016; Weber et al., 2010). This mechanism is not specific to any disorder, but is considered a transdiagnostic variable (Beauchaine & Thayer, 2015), with this phenomenon of blunted HRV appearing both in depressive (Hamilton & Alloy, 2016; Kemp et al., 2010; Rottenberg, 2007) and anxious individuals (Chalmers et al., 2014; Friedman, 2007), among others.

In order to measure HRV, numerous indices have been used for it (i.e., RMSSD, HF band, NN50, pNN50, LF/HF ratio). Each one has specific characteristics, being divided most of them into time-domain and time-frequency measurements of HRV. Regarding time-domain measures, one of the most important indices is the RMSSD (i.e., root mean square of successive differences), being used in most of the studies (Kemp et al., 2012; Wang et al., 2013; Weber et al., 2010; Zandara et al., 2018). Regarding time-frequency measurements, the HF band would be the most used index, which would reflect the activation of the parasympathetic system (Kemp et al., 2010, 2014), and is highly correlated with RMSSD levels. In contrast, the LF band has also been widely used (Chalmers et al., 2014; Kemp et al., 2010), but it is not clear to what extent it would reflect the activation of the sympathetic system (for a review see; Shaffer & Ginsberg, 2017).

3.4. HRV in affective disorders

Based on the predictions of the models presented above, some studies have focused on evaluating baseline differences in HRV between people with and without emotional disorders. Regarding anxiety disorders, it has been shown that individuals with anxiety disorders (i.e., Generalized Anxiety Disorder (GAD), Social Anxiety Disorder (SAD), Posttraumatic Stress Disorder (PTSD) and Panic Disorder (PD)) have lower levels of resting-state HRV, either by indices of time domain (i.e., RMSSD) or time frequency (i.e., HF HRV; Chalmers et al., 2014; Friedman, 2007). This has been interpreted as a presence of deficits of prefrontal areas (i.e., mPFC) to inhibit limbic regions (i.e., amygdala) in anxiety, giving rise to a para/sympathetic imbalance and, consequently, deviations from the correct vagus nerve function. These same results with respect to association between GAD and low resting-state HRV have been further replicated in other exhaustive studies, where different effects of potential confounders, such as medication, tobacco use, exercise levels, BMI, among others, were controlled (Kemp et al., 2014). Regarding depression, multiple studies have also shown the presence of lower levels of HRV in baseline levels of depressed individuals with respect to controls (Kemp et al., 2010, 2012). However, other authors suggest an effect of antidepressant medications in reducing HRV levels, suggesting that perhaps it is not the depressive disorder itself that generates dysfunctions in vagal control, but rather the medication to treat depression (Kemp et al., 2014; Rottenberg, 2007). Although there are different reviews and meta-analyses that conclude on the existence of different patterns at rest and in reaction to stress in people with depression (Hamilton & Alloy, 2016; Kemp et al., 2010), the results regarding depression and low HRV levels are not fully conclusive (Rottenberg, 2007).

For example, a meta-analysis found results supporting a lower level of HRV in depressed compared to non-depressed individuals (all without cardiovascular diseases), at the same time that it was found that, for example, SSRI treatment did not affect, for better or worse, the HRV levels (Kemp et al., 2010). Yet, although this study shows these differences in HRV in depression, and there is literature that postulate no effects of SSRI on HRV (Kemp et al., 2010), it is not possible to know if the cause of this reduction is the use of drugs or the clinical status of the depressed. Similarly, other studies show the importance of anxiety comorbidity in HRV patterns in depression. Kemp et al., (2012) found that although individuals with depression showed lower levels of HRV, when participants with depression were divided according to another comorbid disorder, the only group that showed those lower HRV levels compared to control participants was the group showing comorbid depression and GAD. In sum, although it is true that a stronger relationship between lower baseline HRV levels and anxiety disorders has been found in the literature (Chalmers et al., 2014; Friedman, 2007), this relationship has also been found to some extent in depressive disorders (Kemp et al., 2010; Sgoifo et al., 2015), although it might be moderated by other associated conditions.

At the neural level, it is plausible that both types of emotional problems are characterized by lower levels of HRV at rest. In general, the frontal regions maintain close relationships with limbic areas, in such a way that, when required, they would favor the inhibition of the limbic areas for proper functioning. Nevertheless, during a stressful event or when there is a perception of threat, this balance disappears, giving rise to a greater activation of limbic areas (i.e., amygdala), inhibiting the activation of frontal regions. This would favor the activation of a series of mechanisms that would be adaptive while

the threat lasts. However, both disorders, although with their differences, would be characterized by difficulties in fronto-limbic relationships (continued disinhibition of limbic areas), in such a way that they would be characterized by processes of hypo-frontality and hyperactivation of the amygdala, not allowing an adjustment between the functioning of the individual and the context. These neural processes would give rise to difficulties in cognitive control and consequently, to the emergence and maintenance of emotional symptoms (for depression: Beevers et al., 2010; De Raedt & Koster, 2010; for anxiety: Bishop, 2007, 2008; Carlson & Fang, 2022; Dolcos et al., 2020). Consequently, the maintenance of these maladaptive neural relationships would produce a continuous stress response, giving rise to the activation of all those mechanisms associated with stress, including the increase in HR and the decrease in variability. Furthermore, other authors emphasize the relation between HRV and the use of different emotion regulation strategies. For example, lower resting HRV levels have been associated with greater use of perseverative cognitions, such as rumination, worry or hypervigilance, probably associated with a heightened alert state made by overthinking (Ottaviani, 2018; Ottaviani et al., 2016), while higher levels have been associated with a higher use of reappraisal (Volokhov & Demaree, 2010).

Although resting HRV levels is thus a variable to take into account when understanding the functioning of the individual, if we consider flexibility and regulation from a context-dependent perspective, the study of resting HRV must be extended to evaluate how the mechanisms (i.e., HRV) allow the individual's adjustment to new or perceived stressful situations through their changes. To study this, different types of methodologies have been used to assess context-based dynamic changes: experimental

methodologies using simulated/real situations to induce responses to contextual demands, and experience sampling methodologies (ESM) to ecologically monitor these changes as they naturally occur in response to daily life contextual demands. The first approach focuses on using a specific situation (having higher levels of experimental control but less ecological validity) in order to see the change in these mechanisms in response to a controlled stressor, such as giving a speech (Sanchez et al., 2013), having a job interview (Zandara et al., 2018), completing difficult mental arithmetic tasks (Weber et al., 2010) or giving a lecture (Filaire et al., 2010). The second approach focuses on the evaluation of different parameters (e.g., perception of stress, emotions, motivation, etc.) different times per day (with lower levels of experimental control but more ecological validity; Armey et al., 2015; Csikszentmihalyi, 2014; Socastro et al., 2022).

In laboratory experimental conditions, an initial normative effect of reactivity has been observed, in such a way that there is a decrease in HRV when facing a stressful situation (i.e., arithmetic task, lecturing, job interview; Filaire et al., 2010; Weber et al., 2010; Zandara et al., 2018). Similarly, at the end of the experimental stressors, a normative response in healthy individuals has been established, comprising that the HRV increases back to baseline levels (Weber et al., 2010) or even higher (Zandara et al., 2018). However, if two groups are generated based on their baseline HRV levels, it is observed how the pattern of HRV-based reactivity and recovery during and after confronting the experimental stressor is different for those with low basal HRV levels, who show no change in their reactivity or recovery (i.e., blunted reactivity; Weber et al., 2010). This blunted HRV pattern in response to stress has been extensively documented in depressed individuals (for a review; Hamilton & Alloy, 2016).

Regarding the use of ESM methodology to monitor changes in HRV, the vast majority of studies have been based on ambulatory designs (single-day designs), which generate continuous HR recordings for an entire day (for review; Vaessen et al., 2021) while in turn the participants have to respond to surveys regarding their emotional and stress experiences at the moment that HR is evaluated. From this perspective, there are different variables that have been used as a predictor of changes at the psychophysiological level, such as the perception of stress or ongoing affective states. As for the confluence between objective markers of HRV and subjective self-reports of affective states, positive affect (PA) have been associated to HRV, in such a way that the greater is the momentary positive affect experience, the greater HRV is at those occasions (Määttänen et al., 2021). This relationship seems to be moderated by the type of emotions that conform positive affect, since an highly activated PA (formed by emotions based on activation/high arousal) was negatively related to HRV, whereas a deactivated PA (formed by emotions of calm or tranquility) was particularly positively related to HRV, generating differentiated patterns (Schwerdtfeger & Gerteis, 2014). Another variable that has been used to predict changes in HRV during daily life functioning is the perception of momentary daily stressors. For example, it has been shown that the intensity of the occurring stressor in interaction with post-traumatic symptoms is capable of predicting changes in HRV, in such a way that those high in PTSD showed decreases in HRV in situations of high stress, while healthy individuals with no PTSD symptoms did not show those decreases (Dennis et al., 2016). However, the expected effect associated between HRV and perceived stress is not still clear in the ESM literature. In fact, in a systematic review it was observed that out of 12 studies that evaluated HRV, not even half of them

supported an association between perceived stress (either measured through perceived stress or affect) and changes at the cardiovascular level during daily life functioning (Vaessen et al., 2021).

Overall, extant evidence primarily points to the relevance of using HRV in experimental controlled conditions to study mechanisms accounting for different stress regulation patterns that are markers of risk and presence of emotional disorders. In that vein, some initial studies have considered the relation between HRV and cognitive processes related to affective attention flexibility, as described below.

3.5. Association between HRV and cognition

As a consequence of the assumptions derived from the neurovisceral model of stress regulation, the relationship between HRV and different processes of attentional control and emotion regulation has been studied (Thayer et al., 2009). Part of these studies have focused on evaluating how higher levels of HRV can predict greater performance in attentional or executive tasks. For example, higher resting HRV levels, measured by RMSSD and HF scores, negatively correlate with lower switch-costs index (higher flexibility) in a task-switching paradigm with the aim to assess cognitive flexibility (Colzato et al., 2018). In this task, participants had to switch between rules in order to identify whether certain letters were vowels or consonants or whether certain numbers were odd or even. However, although in general, higher levels of HRV were associated with better performance, under specific circumstances, different HRV profiles are not always necessarily related to poor functioning. For example, in another study, Hansen et al., (2009) divided a sample based on their resting HRV levels (high vs low HRV) while also randomly assigning them to undergo a shock-threatening condition or not. In order

to evaluate related attentional processes, different tasks were used, which could vary from identification tasks to more complex including working memory (i.e., continuous performance tasks, CPT). In the non-threat condition, participants with high HRV levels performed better than those low in HRV. However, individuals with low HRV levels were faster and improved their performance in these tasks in the threat condition, implicating that when there was a fit between the situation and HRV levels, attentional performance improved.

There is not yet direct evidence on the role of specific forms of affective attention flexibility in predicting adaptive HRV changes in response to stressors. An initial study of Sanchez, Romero, et al. (2017), implemented a task that allow to index forms of attention inflexibility to changes in emotional information during a stressor (i.e., giving a speech) and to test its relation with HRV changes to the stressor. In this study, inflexible sustained attention to negative feedback during the speech, irrespectively of changes in the sources of negative information, were related to self-reported lower recovery from stress after giving the speech. A similar relation was not supported when considering indices of HRV change following the end of the stressor. Nonetheless, this initial task was not fully designed to index full forms of attention flexibility to both positive and negative information. Thus, new methodological advances in the assessment and intervention of affective attention flexibility and its role in modulating HRV in response to stress were examined in the present Dissertation.

3.6. Summary

From a contextual perspective, the current literature suggests that HRV would not only serve as an objective indicator of reactivity and recovery from stress but would also

serve as a context-dependent index of emotion regulation. In this case, the fact that an individual reduces their HRV levels in the face of a stressor or a contextual change should be conceptualized as an adaptation mechanism, since it activates a series of functions (i.e., at attentional and emotional level) that favor resolution in those contexts. Therefore, the key point that new designs, as the ones defined for this Dissertation, should consider is studying the fit between the context and the mechanisms that are activated. In contrast, individuals with emotional disorders, are characterized by an imbalance in the functional relationships between the frontal and limbic regions and are thus not able to adjust their psychophysiological responses to contextual changes, generally showing blunted low levels of HRV. From a theoretical point of view, as revised so far, this would reflect a maladaptive functioning of causal affective attention flexibility and related emotion regulation processes, as shown in some studies where lower levels of HRV were associated with worse performance in attention flexibility tasks (Colzato et al., 2018; Hansen et al., 2009).

Ultimately, this opens the venue that designing new interventions to target these attention mechanisms might generate benefits for emotionally-disordered individuals, facilitating more adaptive HRV changes in response to occurring stressors. This was the final aim of this Dissertation and, to give the required background on how to effectively intervene attention processes, a final conceptual Chapter is presented, highlighting the main types of existing interventions and considering the specific therapeutic targets that should be integrated into new forms of training in affective attention flexibility.

Chapter 4. Promotion of Affective Attention Flexibility to Facilitate Stress Regulation through Cognitive Interventions

4.1. Attention Bias Modification (ABM)

As discussed in the previous chapters, information processing in emotional disorders is biased in such a way that they would be characterized by different alterations in attention (i.e., longer fixations on negative information and shorter fixations on positive; Armstrong & Olatunji, 2012; Clauss et al., 2022; Lazarov et al., 2018; deficient inhibition of the processing of negative information; Sanchez et al., 2013; Sanchez, Romero, et al., 2017; and unflexible attention selectivity toward negative information; Godara et al., 2020). This forms of attentional problems would further influence different subsequent processes such as interpretation (i.e., negative interpretation of ambiguous situations; Everaert et al., 2013, 2014), memory (i.e., higher recall of negative information; Koster et al., 2010) or emotion regulation (Duque et al., 2014; Holas et al., 2019). With the purpose of correcting these maladaptive cognitive patterns, numerous studies have aimed to modify them in individuals with emotional disorders through cognitive bias modification (CBM) programs (for a detailed overview see, for instance, Koster et al., 2009), to evaluate the transfer effects of these biases modification to improve other related psychological functions (e.g., stress regulation) and, ultimately, to reduce emotional symptoms. Given that attention is conceptualized as one of the first stages in information processing and that it has been demonstrated its influence in other subsequent processes (i.e., interpretation, memory; Everaert et al., 2013, 2014; Koster et al., 2010),

much of the research on cognitive bias modification programs has been focused on targeting and modifying attention.

For this, Attention Bias Modification (ABM) trainings have been developed, which aim to help the individual to redirect attention from a negative component to a neutral or positive one and thus generate changes in affective information processing. The most widely used task to modify attention biases is the modification of the dot probe task (for a review of this task, see point 1.3.2; MacLeod et al., 1986). In this dot-probe training format, in the control group the percentage of times that the dot substitutes one of the neutral or emotional components is maintained (i.e., 50%-50%), but in the active training group this percentage is modified in such a way that the number of times that the dot replaces the neutral or positive stimulus is greater (i.e., varying between 80% to 92% of the trials, depending on the study, e.g., Beevers et al., 2015; Britton et al., 2015; Duque & Vazquez, 2018; Månsson et al., 2013). With this procedure, through repetitive associations of targets with non-negative stimuli, the aim is to favor a redirection the attentional processing of information away from negative information. Although different meta-analyses have reported the effectiveness of this ABM training to change attentional biases and decrease emotional symptoms, the effect sizes of these effects varies between small to medium (Hakamata et al., 2010; Mogoaşe et al., 2014). Further, there are several limitations and critics regarding this training concerning (a) their clinical utility, (b) issues with the task used to measure attention bias change, (c) unclear mechanisms involved, (d) issues of treatment engagement or (e) unclear neural components implicated (Clarke et al., 2014; Mogoaşe et al., 2014). Each of these issues is considered below.

First, several authors suggest that the clinical utility associated with ABM is uncertain, since the changes in symptoms, when they occur, are not mediated by the change in attentional bias, so it is not really known whether symptoms' improvement is due to a change in the central attentional mechanisms implicated in the ABM procedure or not (Mogoaşe et al., 2014). Second, the task used to measure pre-post treatment change in most of these studies (i.e., the original dot-probe task) has issues of reliability (Schmukle, 2005; Waechter et al., 2014; Waechter & Stolz, 2015). In fact, there is a debate around which component of attention is actually being modified. Some authors suggest that the disengagement component would be trained (Beevers et al., 2015), while others argue that remains unclear if this dot-probe based ABM procedure modifies top-down or bottom-up processes (Britton et al., 2015). Third, another issue is that this typical ABM training programs tend to be repetitive and long (i.e., high number of trials and sessions to be effective), causing a lack of adherence to the treatment (Mogoaşe et al., 2014). Low compliance can thus affect the results of the intervention.

Moreover, the results associated with the neural changes produced by the ABM programs, to date, show certain inconsistencies, as different studies find support for different areas and functions involved, with a clear heterogeneity of findings and poor clarity on the specific neural mechanism involved. Regardless of the effectiveness of the program in reducing emotional symptoms, the use of ABM has been associated with changes at a structural level, such as a reduction in the grey matter size of the amygdala and the Anterior Cingulate Cortex (i.e., ACC; Aday & Carlson, 2017), or changes at the functional level, such as an improvement of the association between the ACC and the fronto-medial gyrus (Beevers et al., 2015). Another study found an increased activation

of the right and left amygdala in the ABM group and a decrease of activation in both areas in the control group (Britton et al., 2015). Other studies show a greater activation of the left amygdala compared to a Cognitive Behavioral Therapy program (Månsson et al., 2013), but also reduction in the amygdala and insula bilaterally as in subgenual ACC (i.e., sgACC), along with an activation of the ventromedial Prefontal Cortex (i.e., vmPFC) and the connection between the vmPFC and Orbilateral Prefrontal Cortex (Taylor et al., 2014). Consequently, it can be observed how there is some support for models that suggest connections between prefrontal and limbic regions in the regulation of selective attention and emotional information processing. However, in certain cases, the expected relationships are not consistent (Britton et al., 2015; Taylor et al., 2014), there is a wide diversity in the areas that influence these processes, or there are difficulties in determining the laterality of these effects.

Finally, the main limitation of the use of dot-probe based ABM programs is the own conceptualization of attention (and thus, its way of evaluation and modification) as a static process. The training merely focuses on redirecting attention away from negative component, without taking into account the characteristics of the context in which the attentional process occurs. As previously mentioned, attention to negative information does not have to be inherently maladaptive, but in certain circumstances, it can activate certain mechanisms that facilitate adaptive functioning (Öhman, Flykt, et al., 2001). Therefore, when designing new interventions of training attention, as in this Dissertation, it should not be enough to modify the negative attentional bias, but do it in a dynamic and flexible way that also facilitates negative information processing when required (see Godara, Sanchez-Lopez, Baeken, et al., 2021). This idea implies going beyond original

trainings based on mere repetition and associative learning, such as the dot-probe based ABM, and including training components that favor top-down cognitive control facilitation flexibility in attentional processing. In the next section, other previous cognitive control interventions designed to train these components for emotional disorders and the main findings of their effects are presented.

4.2. Cognitive Control Interventions

Due to the mentioned problems of traditional ABM programs to reliably assess and change attentional biases and their limited results in transfer in reducing symptom levels, another series of training programs were developed in parallel to target cognitive issues associated to emotional problems. Some authors have focused on the modification of cognitive control processes, which have been postulated as important key variables in the etiology of emotional disorders (Joormann & Vanderlind, 2014). For instance, Hoorelbeke et al., (2016, 2023) applied a cognitive control training (CCT) using a new version of the Paced Auditory Serial Addition Task (PASAT; Gronwall, 1977) in which participants had to add serially presented numbers (1–9), responding to the sum of the last two presented stimuli (2–18). The aim of this training is to generate an increase in cognitive control abilities with the aim to improve emotion regulation (e.g., increase of positive reappraisal of an autobiographical memory and increase the effectiveness of positive reappraisal in daily life in contrast of rumination). The control group simply had to press keys to indicate the number that appeared on the screen. The results indicated that the training compared to the control condition, in addition to increasing levels of cognitive control (e.g., transference effect evaluated with an n back task), reduced the risk of participants to use rumination when experiencing low levels of positive affect. These

effects have been found both in undergraduates (Hoorelbeke et al., 2016) and in a remitted depressed sample (Hoorelbeke et al., 2023), among others. Consequently, although there seems to be an effect of cognitive control training to reduce rumination, this seems to be only partial (in situations with low positive valence), and this transfer effect was not observed in the use of other emotion regulation strategies such as reappraisal. These results may be due to the use of non-emotional material when training cognitive control or to the use of implicit instructions.

In contrast to traditional ABM (Duque & Vazquez, 2018; Månsson et al., 2013) or general cognitive control programs (Hoorelbeke et al., 2016, 2023) in which instructions are implicit, explicit trainings are proposed as a way to make participants aware of their own mental processes (i.e., intentionally direct their attention towards positive information in order to make positive interpretations; Blanco et al., 2023; Sanchez et al., 2016). Sanchez et al., (2016) adapted the scramble sentence task (i.e., SST; Wenzlaff & Bates, 1998) to explicitly train attentional control and transfer to biases using emotional material (i.e., competing positive and negative words). The original SST is a widely used task to measure the tendency to interpret ambiguous information in a more positive or negative way. In a first phase (reading phase), six words appear out of order and the participant has to mentally generate a grammatically correct sentence using only 5 of the 6 words that appear on the screen. In the second phase (response phase), the participant has to generate that sentence by putting in order each number associated with each word. In consequence, individuals have to create a sentence with a positive or a negative meaning, leading to certain stablish the degree of interpretation bias. In training studies (Blanco et al., 2023), the control group completed this standard SST task and did

not receive any kind of feedback or any specific instructions (i.e., elaborate the first sentence that come to your mind). In contrast, the active group was asked to maximize their attention to engage and sustain attention in the positive word to efficiently generate positive interpretations during the unscrambled sentences task, while inhibiting the processing of the negative word. In addition, the active participants received various types of attention-based feedbacks: (a) positive words were shown in a green frame and negative words in a red one during the visualization of the words and (b) at the end of each block their attentional performance (i.e., attention bias score) were shown in order to give the trainee a reference of their attentional performance and ability to change initial negative biases. The aim of the explicit instructions and the individualized feedback provided was to help the trainees to be aware of their cognitive processes to maximize their ability to focus attention in specific affective components, delimit specific interpretations and track their performance in order to motivate them to improve it. The initial results showed that the this type of training, compared to the control condition, was effective in reducing the attention bias towards negative information, as assessed in a dot-probe task, and showed that the effectiveness to modify the attention bias transferred to improve the use of reappraisal in a negative mood induction task and to generate lower negative emotional reactions to the induction (Sanchez et al., 2016). These effects have been replicated and extended through the use of other tasks to assess transfer to attention and emotion regulation (Sanchez-Lopez, De Raedt, et al., 2019; Sanchez-Lopez, Everaert, et al., 2019). These studies showed that the active training facilitated attentional disengagement from negative information (using the eye-tracking disengagement task, Sanchez et al., 2013) and not only improved reappraisal ability but reduced state

rumination. Furthermore, this training has proven to be particularly effective in at-risk individuals from the general population characterized by low resilience levels and to maximize its effects to improve emotion regulation when combined with neuromodulation of neural areas implicated in attention and emotion regulation (Sanchez-Lopez et al., 2021) . Ultimately, the training has been adapted into an online multisession webapp system that can be used by trainees during their daily life functioning, as real-life stressors occur. The results using this version show that, across two studies, those participants in the active group showed greater attention to positive words and a greater number of positive interpretations in the SST, as well as a reduction in general levels of habitual use of rumination and anxiety symptoms (Blanco et al., 2023). Therefore, it seems that the trainings presented favor an improvement in emotion regulation of the participants in the active conditions and facilitate reductions of emotional symptoms. However, as with original ABM trainings, context processing is not considered in order to generate a more flexible and adaptive attention to its characteristics. It must be then considered how new alternatives, integrating some of the active training ingredients highlighted by Sanchez et al. (2016; i.e., training attention through gaze-contingent feedback), can be formulated to maximize training affective attention flexibility.

4.3. Flexibility as a mechanism of intervention

Affective inflexible processing has been related to higher levels of trait rumination (De Lissnyder et al., 2010; Genet et al., 2013; Pe, Raes, Koval, et al., 2013), lower levels of reappraisal in the lab (Malooly et al., 2013) and in daily life (Pe, Raes, Koval, et al., 2013), lower levels of resilience at trait level (Genet & Siemer, 2011) and lower positive affect and higher negative affect (Yaroslavsky et al., 2019). In consequence, individual

differences in levels of affective flexible processing are associated with different mechanisms that favor an adaptive functioning.

One initial study aimed to directly modify the flexibility of affective processing through the use of a modified version of the AST in a healthy sample (Malooly, 2016). Using this approach, no results in favor of an improvement in aspects related to emotion regulation or emotional symptoms were supported (Malooly, 2016). In order to more specifically modulate attention, some author have used music (Godara et al., 2019; Godara, Sanchez-Lopez, & De Raedt, 2021; Godara, Sanchez-Lopez, Baeken, et al., 2021; Lazarov et al., 2017) and monetary rewards (Godara et al., 2019; Godara, Sanchez-Lopez, & De Raedt, 2021). For example, Godara and colleagues introduced a goal-inducer task, in which some trials (i.e., neutral-goal trials and neutral-action trials) were associated with an explicit goal (i.e., press the space button as fast as participants can), while for others trials categories (i.e., negative trials or standard neutral) there was no associated goal. Participants received music and money (Godara et al., 2019) or avoided white noise and lose money (Godara, Sanchez-Lopez, & De Raedt, 2021), when they were able to swiftly respond to a neutral goal trial in comparison to negative trials where participants had no explicit goal associated. With this method, introducing explicit goals (i.e., as in current ABM trainings; Sanchez et al., 2016) attention was manipulated and individuals with high levels of depression were able to match the performance of controls when subsequently disengaging attention from negative stimuli when using reward-manipulations (Godara et al., 2019) or even both groups were able to improve their disengagement from negative stimuli when using avoid-punishment-manipulations (Godara, Sanchez-Lopez, & De Raedt, 2021). Several conclusions can be drawn from

these studies: (a) attentional control (i.e., disengagement from negative information) can be manipulated through musical or monetary reinforcers, which could serve as a key aspect to maximize the effects of attention training, (b) individuals with emotional problems indicated that music was more motivating than the money (Godara et al., 2019; Godara, Sanchez-Lopez, & De Raedt, 2021) and (c) although the methodology used was useful (musical reinforcement at the end of each correctly performed trial), contingent musical reinforcers on attentional functioning (i.e., reinforcers applied at the time that the individual is performing the adequate trained attention patterns) could generate greater effects.

In line with these aspects, Lazarov et al. (2017) developed an attentional training with contingent musical reinforcement in individuals with social anxiety aimed to train them to redirect their sustained attention from negative to neutral information. To do this, they established two groups: an active one, which listened to music that played contingently on their attentional display (i.e., when attending to neutral but not when attending to negative stimuli), and a control group, which listened to music regardless of their attentional performance. The results showed a decrease in anxiety symptoms in both groups, although the change was greater in the active group. In fact, the difference between groups in their decrease in symptoms was mediated by the time they looked at the negative stimuli (i.e., lower times attending to negative information as result of the training accounting for its effects to reduce anxiety symptoms). Consequently, it is suggested that contingent musical reinforcement of attention can serve as a useful tool to promote consistent attention changes and transfer to emotional functioning. In order to continue evaluating the benefits of this training based on contingent music, the

methodology used by Lazarov et al. (2017) was carried out in a sample of children between 7 and 10 years. The training comprised the same sessions (8 sessions in each condition, active and control) and as in the previous protocol, the participants listened to the selected music only when they directed their attention towards neutral information. Results indicated that, although there was not a significant change on anxiety levels, as self-reported by the children (probably due to already existing baseline low anxiety levels), clinicians and parents reported a significant reduction on children's anxiety symptoms (Linetzky et al., 2020). In fact, an evaluation of benefits on neural functional connectivity of music contingent trainings on social anxiety individuals have also been tested (Zhu et al., 2022). The results, in addition to showing a reduction in the symptoms of social anxiety and depression following this training, trainees further showed a decrease in the connectivity between the executive control network (ECN) and salience network (SN), an increase in the ECN network itself and between ECN and default mode network (DMN). These changes in connectivity were associated with changes in levels of social anxiety and depressive symptoms at the end of the protocol (Zhu et al., 2022). This protocol has not only been applied with participants with social anxiety (both adults: Lazarov et al., 2017; Zhu et al., 2022; and children: Linetzky et al., 2020), but also with depressed individuals, in order to assess whether the effect found is also useful for individuals with specific depression problems. However, although the participants in the training group showed a shorter fixation time towards negative faces, this was not reflected in changes in symptom levels (e.g., both groups decreased their levels in the same way, Shamai-Leshem et al., 2021).

While the latter approach is highly relevant, however, neither contextual nor motivational aspects were yet integrated into the evaluation or the training of attention. Therefore, with the aim of modulating attention as a dynamic process, it is necessary to consider attention trainings using contexts where different goals can be generated, favoring flexibility when directing and maintaining attention towards the emotional information that is more appropriate to the achieve each specific goal. This would thus generate an adjustment between the context, the goal and the attentional deployment (Godara et al., 2020; Godara, Sanchez-Lopez, Baeken, et al., 2021). Following all these ideas, Godara, Sanchez-Lopez, Baeken, et al., (2021) carried out a contingent musical reinforcement training in dysphoric participants in which contextual and motivational aspects were taken into account. They adapted the previously mentioned affective attention flexibility task (Godara et al., 2020). In this task different context associated to specific goals are presented, and it is assessed how fast are individuals in engaging attention with the most appropriate emotional information (i.e., positive or negative) for each context-goal combination in each trial. Following this, Godara, Sanchez-Lopez, Baeken, et al., (2021) introduced manipulations that maximized that flexibility in matching attention with each corresponding context-goal combination. To do this, two groups were created. A control group received music or white noise regardless of where they directed their attention in the appropriate manner. In contrast, in the active training group, when facing goals that required focusing on the positive information, participants received music when they focused on the positive stimuli and the music stopped when fixated on the negative stimuli. For goals that required fixating on the negative information, participants avoided listening to white noise when fixating on the negative

stimuli and listened to it when fixating on the positive stimuli. Therefore, using this design: (a) attention was contingently reinforced and (b) receiving musical reinforcements (i.e., reward-manipulation) or avoiding white noise (i.e., avoid-punishment-manipulation) depended on the fit between the type of context and goal combination. In order to measure transfer effects between groups, an affective attentional flexibility task (Godara et al., 2020) similar to the training was carried out, and a speech task (Sanchez, Romero, et al., 2017) in which the participants received predefined positive and negative feedback based on emotional faces that represent a false-jury. While receiving this feedback, participants had different goals, which changed from "feeling confident during the speech" (greater fixation towards the positive) to "resolve concerns of the jury" (greater fixation on the negative). Results showed a transfer effect in both tasks. In the affective attentional flexibility task, the active group showed an increase in attention flexibility when repeating and switching towards positive goals, while the control group did not. In the same way, in the speech task, the results showed that the participants in the active training showed an attentional processing of the positive and negative in a flexible manner, depending on the goal, maximizing the processing of specific emotional information depending on the established goal (i.e., greater time fixating on positive feedback when the goal was positive and greater time fixating on negative feedback when the goal was negative).

Consequently, in order to develop a correct processing of information, it is necessary to favor a flexible attention directed by specific goals and contexts. Until now, only the study of Godara, Sanchez-Lopez, Baeken, et al., (2021) has managed to evaluate and train all these aspects at the same time, giving rise to very promising results and the

need for further research in this subject. The final aim of the present Dissertation was thus to advance and test a new format of this promising training intervention, with the design being informed by collected knowledge in the previous conducted studies of the Dissertation on affective attentional flexibility, its modulation by motivational factors and its contribution to stress and emotion regulation.

4.4. Summary

In order to effectively reduce the characteristic symptoms of emotional disorders, many researchers have aimed to manipulate attention, due to its key role in information processing (i.e., filter stimulation) and subsequent emotional and behavioral processes. For this, initial ABM programs have been used, which are designed to train individuals to redirect attention from negative information to a neutral or positive information through the modification of the probability of appearance of targets (i.e., dots) and emotional information (Duque & Vazquez, 2018; Hakamata et al., 2010; Mogoaşe et al., 2014). However, in addition to having small effect sizes, multiple limitations have been identified for initial ABM trainings, such as unclarity on the modified mechanisms and low treatment engagement (Mogoaşe et al., 2014). As an alternative, other programs have integrated knowledge from cognitive control trainings (Hoorelbeke et al., 2016, 2023), attentional control trainings (Sanchez-Lopez, De Raedt, et al., 2019; Sanchez-Lopez, Everaert, et al., 2019; Sanchez et al., 2016) and ABM trainings using music as contingent reinforcers (Lazarov et al., 2017; Zhu et al., 2022). Ultimately, new forms of affective attention flexibility trainings have emerged (Godara, Sanchez-Lopez, Baeken, et al., 2021) that modulate attention with contingent musical reinforcers, manipulating directly the affective attention flexibility mechanism itself. These training programs, although still

scarce, have proven to generate benefits, increasing the levels of attention flexibility towards positive and negative information. Consequently, attention manipulation with a dynamic component appears to be an important mechanism with potential to generate benefits for individuals with emotional disorders. This was the last aim of the present Dissertation, whose main objectives and structure of empirical studies to address them are presented below.

PRESENTATION OF THE STUDIES CONDUCTED IN THIS DISSERTATION (EMPIRICAL CHAPTERS)

Overview of objectives of the present Dissertation and structure of empirical studies conducted to address them

Based on the extant evidence reviewed in the theoretical chapters, it is necessary to continue advancing on the understanding of the functioning of affective attention flexibility, its motivational modulation and its potential adaptiveness and contribution to stress regulation. In order to fulfill these aims, 4 experimental studies were carried out, each one evaluating specific aspects of affective attention flexibility in relation to aspects of cognitive, emotional and psychophysiological functioning. The first focus was on evaluating attention from a dynamic perspective in order to evaluate goal-dependent processes under intra-situational changes. In this case, participants with different levels of predominant motivational SF were exposed to a momentary stress induction task based on giving a talk to an audience while receiving emotionally changing feedback (Study 1). With this design, the specific objectives were: (a) to evaluate the relation between predominant motivational SF and different psychological functioning (emotional symptoms, reward and punishment sensitivity, emotion regulation), (b) to assess if the stress task was effective as a stress inducer, both at a subjective and psychophysiological level, (c) to establish different patterns of affective attention flexibility depending on the predominant motivational SF, (d) to establish how goal-dependent processes guide attention through intra-situational changes (feedback changes), showing a flexible component of attention and (e) to evaluate how predominant motivational SF modulate the attention pattern depending on specific goals associated to get possible positive results or to avoid possible negative ones.

As a next step, it is not only important to understand how attention fluctuates (i.e., flexibly adapt) when faced with intra-situational changes, but also when faced with inter-situational changes. Therefore, in the following study (Study 2) we tested how affective attention flexibility worked through different goals (associated with different adaptive emotional components) when switching across different motivational contexts. The specific objectives were: (a) to evaluate the capacity of the task to assess inter-situational affective attention flexibility and (b) to establish how predominant motivational SF levels modulate affective attention flexibility within and across motivational contexts and affective goals. In this case, it was expected that specific predominant motivational SFs would modulate attention toward a specific motivational context, indicating that each participant is more flexible in its predominant motivational context.

After learning how goal-dependent processes can modulate attention both intra- and inter-situationally, it is necessary not only to focus on the precise measurement of the affective attention flexibility process itself and on the individual differences in motivational variables that could modulate it, but also on its predictive role in emotional functioning (Study 3). For this, a new design was implemented in which different forms of contextual and affective attention flexibility were tested as predictors emotional functioning in daily life. With this, the objectives of this Study were: (a) to evaluate how affective and contextual attention flexibility could predict emotional functioning in daily life, (b) disentangling which patterns can be related to an adaptive emotional functioning and which ones are not.

As for the last empirical part of the Dissertation, and informed by the results obtained in the previous studies, we aimed to promote those adaptive patterns found in

Study 3 through a new cognitive training in affective attention flexibility (Study 4) in individuals with emotional disorders, which have shown problems in these mechanisms. For this, a modification of the attentional flexibility task (Godara et al., 2020; Godara, Sanchez-Lopez, Baeken, et al., 2021) was carried out and contingent music was used as a reinforcer of certain adaptive attentional patterns. The specific objectives of this final study were: (a) to establish the capacity of the training to modify affective attention flexibility through contingent music-based cognitive training, (b) to test their close transfer effects in inter-situational affective attention flexibility (i.e., increase flexibility toward positive or negative information as function of specific contextual goals, as assessed in the task validated in Study 2) and (c) to test their far transfer effects during a stress induction, with the aim to generate adaptive changes in intra-situational affective attention flexibility, self-reported emotional changes and psychophysiological indicators of stress regulation (i.e., generate better reactivity and recovery patterns as assessed through HRV, as assessed in the task validated in Study 1). Table 1 shows a summary where each one of the experimental studies is shown together with the specific objectives of each one.

Table 1. Summary table with specific objectives of each experimental study.

	Specific objectives of each study
Study 1: Modulatory effects of motivational self-focus in attention flexibility and psychophysiological stress recovery: An eye-tracking study.	- Evaluate the effectiveness of the speech task to induce stress. - Evaluate the association of predominant motivational SF and psychological functioning (HRV, self-reported emotions). - Stablish affective attention flexibility patterns depending on levels of motivational SF. - Stablish the flexible component of attention through intra-situational changes, evaluating whether goal-dependent processes can guide attention.
Study 2: Individual differences in motivational self-focus modulate context-based affective attention flexibility toward goal-relevant information: an eye-tracking study.	- Evaluation of inter-situational affective attention flexibility. - Stablish the flexible component of attention, not only through intra-situational changes but also between the switch between different emotional goals in specific motivational contexts.
Study 3: Is flexibility always optimal? Role of Contextual and Affective Attention Flexibility as a predictor of emotional functioning in daily life. An ESM study.	- Evaluate how attention flexibility patterns, both emotional or contextual, can predict emotional functioning on daily life. - Stablish which type of flexibility patterns are associated with adaptive emotional functioning.
Study 4: Affective Attention Flexibility Training in contextual-goal approach facilitate stress recovery in individuals with clinical levels of emotional disorders.	- Evaluate if music contingent training can modify affective attention flexibility through a close transfer (affective attention flexibility task) and far transfer task (speech task).

Chapter 5: Study 1 – Modulatory effects of motivational self-focus in attention flexibility and psychophysiological stress recovery: An eye-tracking study

Overview:

Affective attention flexibility (AAF), the ability to selectively switch attention towards positive and negative information depending on ongoing situational demands, it is thought to be modulated by individual differences in motivational self-focus (i.e., SFs). To test this prediction, in the series of studies presented in this Chapter we created a novel procedure to evaluate attentional focus toward dynamically changing positive or negative feedback during social stress and tested the modulatory role of promotion and prevention motivational SF on AAF. The procedure was first validated in a pilot study (n=32 participants). The main study comprised one hundred and two participants, with varying promotion and prevention motivational SF levels. Participants confronted the social stressor (i.e., giving a speech) while they received pre-programmed changing balanced, positive and negative social feedback on their performance. Eye-tracking was used to monitor individuals' shifts in attentional focus toward balanced, positive and negative social feedback across contexts. Psychophysiological and self-reported indicators of stress were further collected before, during and after the speech. Overall results showed that participants with higher promotion levels showed higher fixation times to positive information when contexts switched toward positive social feedback, whereas participants with higher prevention levels displayed higher fixation times to negative information when contexts switched toward negative social feedback. These findings

suggest that individual differences in motivational SFs might account for different stress vulnerabilities. Our results inform ways to promote resilience through their influence in (mal)adjusting AAF processes that can be implicated in stress regulation.

5.1. Introduction

As reviewed in the conceptual section of this Dissertation, attentional control and flexibility are thought to play an important role in individuals' ability to adapt to continuously changing environments. The ability to shift and update the processing of information when contextual demands change facilitates goal-directed behaviors (Goschke & Bolte, 2014) and is thought to be implicated in efficient stress regulation (Pruessner et al., 2020; Southwick & Charney, 2012). Although there is a paucity with empirical research directly investigating contextual effects in affective attention during stressful experiences, previous studies indicate that adaptive selective attention toward relevant positive and negative features in the environment is dynamic in nature and may (sub)serve effective regulation of negative moods. For instance, using different mood manipulations, Sanchez et al. (2014) found that healthy individuals increased their attention towards positive stimuli specifically when experiencing transient increases in negative mood, with such attention change serving to regulate the induced negative moods. In contrast, depressed and anxious individuals are typically characterized by sustained attention to negative information (Armstrong & Olatunji, 2012) and by inflexible attention toward negative stimuli when prompted to disengage from them, which has been found to predict impaired recovery from transient stress responses (Sanchez et al., 2013).

Overall, these studies highlight the functionality of temporally adjusting attention to maximize the processing of positive information as a means to favor efficient stress adaption. Nonetheless, the processing of both positive and negative information can be considered adaptive to the extent that it is adjusted to contextual demands and allows for adaptive coping (Bonanno et al., 2007; Coifman & Bonanno, 2010). Previous research has supported that adaptive attention reflects a dynamic processing of both negative and positive information rather than static attention biases within a given direction (Zvielli et al., 2014). Further, recent studies have developed new procedures to directly assess affective attention flexibility (i.e., AAF) based on contextual changes occurring during stress. Sanchez, Romero, et al. (2017) adapted a well-validated stress induction procedure (i.e., giving an impromptu speech in front of a confederate audience providing emotional feedback; Lin et al., 2016; Lowe et al., 2012) to test attention to socio-evaluative feedback in dynamic change. In that study, participants with different levels of depression gave the speech while viewing pictures representing a false feedback audience varying in the type of feedback depicted across the speech (e.g., from moments representing balanced positive-negative feedback to moments representing clearly rejecting negative feedback). Using eye-tracking to monitor gaze towards social feedback, AAF differences emerged as a function of depression levels. Non-dysphoric individuals were characterized by a balanced processing of positive and negative pictures across the speech but showed longer fixation durations to negative pictures when they received clearly rejecting feedback. In contrast, dysphoric individuals showed inflexible larger fixation durations to negative pictures across the whole speech, irrespectively of social contextual changes. Further, and

in line with the proposal that AAF contributes to stress resilience, higher AAF during the task predicted higher emotional recovery from stress after giving the speech.

Whereas these initial findings are already informative on the relevance of AAF during context-changing stressors to promote stress recovery, they are incomplete as contextual changes in this experiment only considered a way of emotional relevance (i.e., variations in contextual negative feedback). In the current series of studies, we developed an advanced eye-tracking procedure to test whether selective attention dynamically change (i.e., flexibly adjust) within a socially stressful situation varying in both positive and negative relevance (i.e., varying from and toward both contexts of positive and negative social feedback). Ultimately, we aimed to identify individual differences that might account for different forms of attention (in)flexibility. To achieve this last aim, we investigated how AAF is modulated by individual differences in motivational SFs, as they have been proposed to be implicated in specific forms of AAF and stress vulnerabilities.

Self-regulation (the coordinated set of psychological processes guiding context-based behaviors) is thought to depend on the activation of promotion and prevention motivational SFs (Higgins, 1997, 1998, 2012). According to Higgins' framework, self-regulation guided by a promotion SF involves a preferential activation of positive-outcome-focused motivational states that makes the individual to be particularly reactive to potential gains and rewards. In contrast, self-regulation guided by a prevention SF involves a preferential activation of negative-outcome-focused motivational states that makes the individual to be particularly reactive to potential losses and punishments (Klenk et al., 2011). The activation of specific motivational regulatory SFs is thought to be self-sustaining, leading to individuals to have preferentially accessible SF relevant

goals (i.e., promotion or prevention goals) that bias the way that situations (e.g., a socially stressor) are appraised and thus attended to and experienced. Based on this assumption, individuals with a habitual activation of a promotion SF would get cognitive schemes related to possible positive results (gains) more accessible, leading to preferentially attend and process positive social information in the environment. In contrast, individuals with an habitual activation of a prevention SF would get schemes related to possible negative outcomes (losses) more accessible, leading to preferentially attend and process negative social information in the environment (Higgins, 1997, 1998; Shah & Higgins, 2001). A prediction derived from this framework is thus that, although individuals may be responsive (flexibly adapt their attention) to emotional contextual changes in general, individual differences in the habitual activation of motivational SFs will be related to a higher responsiveness to specific emotional components based on contextual changes (i.e., higher flexible attention toward positive changes at high promotion, higher flexible attention toward negative changes at high prevention levels).

Based on the reviewed literature and to advance the understanding of AAF processes and their modulation by individual differences in motivational SFs, we aimed to study intra-individual AAF dynamics under controlled laboratory conditions of dynamically changing social stressors (i.e., transient contexts of both negative and positive social feedback). This Chapter comprises two experiments. A first pilot experiment (n = 32) was conducted to validate the effectiveness of the new procedure to induce transient processes of stress reactivity to and recovery from a social stressor and to test normative processes of AAF across dynamically changing social feedback. The main experiment (n = 102) was conducted to further validate these effects in AAF and

stress reactivity and recovery and to test the modulation of AAF as a function of individual differences in motivational SF.

It was hypothesized that individuals high in promotion SF levels would show preferential attention to positive information when receiving clearly positive feedback and lower attentional shifting toward negative feedback when context varied from positive to balanced feedback (Higgins, 1997; Shah & Higgins, 2001). In contrast, we hypothesized that individuals high in prevention SF levels would show preferential attention to negative information when receiving clearly negative feedback and lower attentional shifting toward positive feedback when context varied from negative to balanced feedback (Higgins, 1997; Shah & Higgins, 2001). In order to establish the validity of the procedure to index AAF under valid conditions of transient stress, the effectiveness of the procedure to induce patterns of stress reactivity and recovery was also evaluated. To test this, we not only monitored self-reported emotional changes in response to stress (nervousness, tension) but also used objective psychophysiological indicators of change (i.e., heart rate variability, HRV) across the different sections of the stress procedure (baseline-anticipation-confrontation-recovery, see below). Previous eye-tracking research suggests that maladaptive rigid attention biases are involved in inefficient regulation of transient stress responses (Sanchez et al., 2013; Sanchez, Romero, et al., 2017), characterized by withdrawal of cardiac vagal control and the activation of the defensive systems (Park et al., 2014; Thayer et al., 1996). Stressor-induced suppression of cardiac parasympathetic activity (Gianaros et al., 2005) has been documented in a growing number of studies using HRV as an indirect measure of parasympathetic (vagal) control over time-related variations in heart rate (e.g., Berntson

et al., 1997). It has been proposed that the pattern of change in HRV parallels the amount of inflexibility that characterizes a complex behavior (Friedman & Thayer, 1998; Ottaviani, 2018). Therefore, HRV was used as a physiological measure of parasympathetic activity of stress regulation, during the speech task as well as during a recovery period afterwards, whereas mood scales were additionally used to assess self-reported emotional stress reactivity and recovery across the speech procedure.

5.2. Pilot experiment

5.2.1. Method

5.2.1.1. Sample

In a first pilot experiment (n=32; 30 female, mean age= 21.6 years old), we aimed to validate the new variant of the eye-tracking speech task used by Sanchez, Romero, et al. (2017). The new variant included not only transitions toward and from balanced to negative social feedback, but also toward and from balanced to positive social feedback. The task comprised the following sequence: Balanced-Positive-Balanced-Negative-Balanced Feedback, which allowed to model AAF to both positive and negative changing social contexts during stress. HRV and self-reported moods were monitored before, during, and after completing the eye-tracking social stress task. Sample size was determined based on previous studies testing the effectiveness of similar laboratory stress inductions (i.e., speech-task) to induce significant self-reported and HRV-based stress reactivity and recovery changes (see Sanchez, Romero, et al., 2017). Only one participant decided to abandon the experiment due to the stress produced by the task.

5.2.1.2. Questionnaires

The day before taking part in the experimental session, participants filled out an online survey including a series of self-report measures. The questionnaire package included self-reports of depressive (Center for Epidemiologic Studies – Depression Scale 8 item version; CES-D 8; Radloff, 1977) and generalized anxiety symptoms (General Anxiety Disorder scale; GAD-7; Spitzer et al., 2006), and motivational SF (Promotion / Prevention Scale; Lockwood et al., 2002), as variables of interest for this study. A full report of all the baseline measures collected, their descriptives and internal consistencies can be seen into detail in the Supplement of this Chapter.

5.2.1.3. Self-reported mood

To rate mood across the different sections of the experimental session, two visual analogue scales (VAS) providing measures of nervous and relaxed mood were used. VASs were completed at baseline (pre-stress), immediately after completing the stress induction (during-stress) and following a subsequent recovery period (post-stress). Participants were asked to indicate the extent to which they experienced each mood (i.e., "nervous", "relaxed") at that given moment, with labels ranging from 0 "not at all" to 9 "very much".

5.2.1.4. Heart rate variability

A Polar V800 and a Polar H7 sensor attached to a chest strap were used to register HRV. This system allows for a detection of R-R intervals with a resolution equivalent to 1 ms (i.e., sampling rate: 1000 Hz) and has proven feasible to record psychophysiological changes linked to emotional activation (see Giles et al., 2016). HRV was indexed through the Root mean square of successive differences (RMSSD) of interbeat intervals (in

milliseconds) at each period (from now on, the term HRV will be used to specifically refer to RMSSD). The RMSSD has been shown to be a reliable index of cardiac parasympathetic activity (Thayer & Lane, 2007), reflecting decreases as an effect of stress (Delaney & Brodie, 2000) and increases as an indicator of successful emotion regulation, following social stress manipulations (Sanchez, Romero, et al., 2017; see full details of the procedure in the Supplement).

5.2.1.5. Self-Attribute Task

This task comprised the presentation of a list of 20 positive adjectives to the participants, who rated the extent to which they felt identified with each one. The 5 adjectives with the highest ratings made by each participant were selected to be used in his/her speech task (impromptu speech, see below) with the aim that the participants could talk about their self-identified own personal qualities (full details in the Supplement).

5.2.1.6. Vanilla Baseline Period

Resting baseline HRV was recorded during the performance of a Vanilla baseline procedure (Jennings et al., 1992), which required subjects to perform a trivial counting task, involving sustained attention but with minimal cognitive load (see full details in the Supplement). Previous research has largely shown good performance of this task to index reliable stable baseline HRV levels (Jennings et al., 1992).

5.2.1.7. Speech paradigm

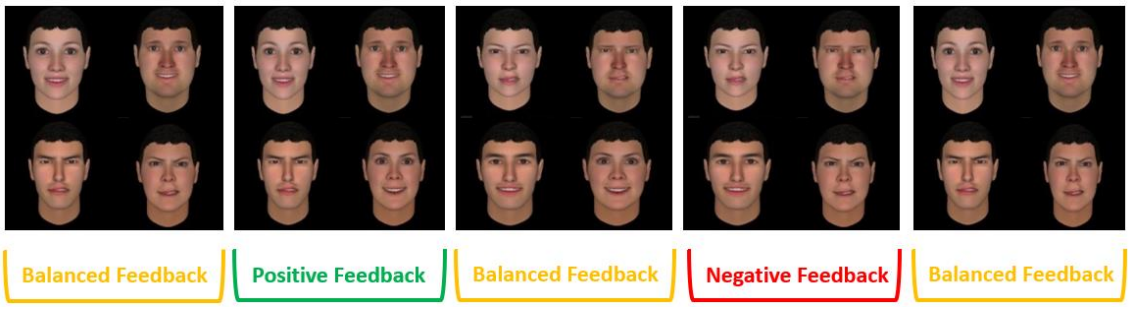
In the main task, completed after the self-attribute and vanilla tasks, participants were asked to give a speech while they received false feedback in form of dynamically changing positive and negative avatars on the computer screen. AAF toward positive and

negative feedback was recorded via a Tobii Tx-120 infrared eye- tracker at a frequency of 120 Hz (see full details in the Supplement).

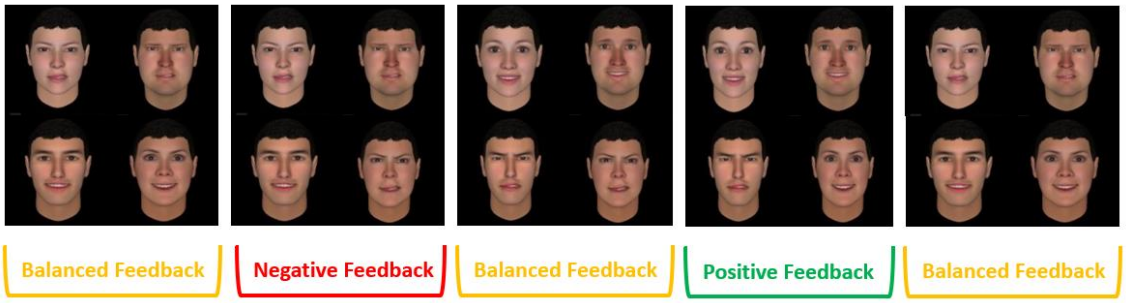
False feedback comprised a total of 4 faces, positive (smiling) and negative (disgusted), with 2 male and 2 female avatars, created with FaceGen Modeller software (Singular Inversions, Toronto, ON, Canada). The false feedback was presented in a pre-determined manner, going from Balanced (50% positive and 50% negative) to Positive (25% negative and 75% positive) and Negative (25% positive and 75% negative) Feedback. The false feedback slides were presented in the following order: Balanced – Positive – Balanced – Negative – Balanced (see Figure 3A), with each slide been presented for 30 seconds. Participants were made to believe that they were being video recorded during the task and that the appearing feedback avatars were uploaded by real evaluators connected in a contiguous room (see full details of the procedure in the Supplement).

Figure 3. Schematic of the speech task sequences.

3A) Balanced-Positive-Balanced-Negative-Balanced sequence (employed in Pilot Experiment and for half of participants in the Main Experiment).



3B) Balanced-Negative-Balanced-Positive-Balanced sequence (employed in half of participants in the Main Experiment).

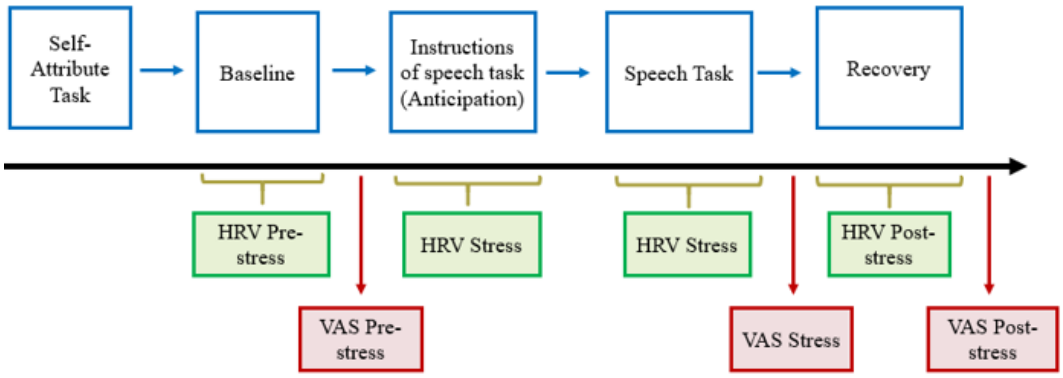


Participants' eye movements were recorded via eye-tracking across the whole speech procedure. To obtain measures of preferential attention to emotional feedback, we used the "total fixation time" (the sum of the durations across fixations) for each type of feedback (positive, negative) at each speech-slide. Attention to emotional feedback at each slide was indexed through the proportion of total fixation time on positive over the total fixation time on negative faces across the 30-sec feedback presentations. This parameter is a commonly reported index of attention bias that is sensitive to individual differences, and it has been used in previous impromptu speech eye-tracking paradigms (Lin et al., 2016; Sanchez, Romero, et al., 2017).

5.2.2. Design Overview

Figure 4 provides with a schematic of the whole procedure of the study.

Figure 4. Schematic of the tasks sequence during the experimental sessions.



After providing written informed consent, participants put on the Polar equipment and started completing the "Self-Attribute Task". Once they finished this task and after confirming that the Polar device was recording heart rate properly, participants performed the Vanilla Baseline procedure, which lasted 5 minutes (pre-stress baseline HRV), and then completed the first VASs (pre-stress mood). After that, they received the instructions for the speech task (stress anticipation phase), comprising preparing 5 impromptu speeches on why they considered they possessed the previously selected 5 self-attributes. HRV was recorded for this period (stress-anticipation HRV), which lasted for approximately another 5 minutes. Participants then completed the speech task, where eye movements toward feedback at each speech-slide and HRV were continuously recorded (AAF indices and during-stress HRV, respectively). Immediately after finishing the speech task, participants rated again their current mood state in the second VASs (post-stress mood). Participants then rested for another 5 minutes (post-stress HRV), and after this recovery period, they rated again their current mood state in the final VASs (post-recovery period). At the end of the procedure participants were fully debriefed on the real purposes of the study and completed a brief questionnaire to test the level of

suspiciousness on the real aims of the stress induction procedure (namely, whether they believed they were being video-recorded, and whether they believed real jury members were online connected, in a Yes-No format). The ratio of suspiciousness for each of these issues was 10/31 and 15/31, respectively[1]. Finally, they received a brief positive mood induction aimed to reduce remaining negative mood levels (Sanchez, Romero, et al., 2017) and were thanked for their participation. The experimental session lasted approximately 75 min.

5.2.3. Analytic approach

The main analyses comprised testing stress reactivity and recovery effects in self-reported moods and HRV across the experiment, and flexibility-based attention changes as a function contextual feedback changes across the speech. Repeated-measures analyses of variance (ANOVA) were applied considering the effect of Time for each given outcome (self-reports: pre-during-post stress; HRV: pre-anticipation-during-post stress, attention: balance-positive-balanced-negative-balanced). For cases not meeting the assumption of sphericity, Greenhouse-Geisser correction was applied.

5.2.4. Results

5.2.4.1. Effects on self-reported mood (VAS) and physiological variables (RMSSD)

Mean and standard deviations for each VAS and HRV levels at each time point in the pilot study are fully reported in the Supplement. As for Nervousness, the effect of Time was significant, $F(2,29) = 31.98$, $p < .001$, $\eta_p^2 = .69$. Post-hoc comparison supported a significant increase in Nervousness from Time 1 (pre-stress) to Time 2 (during-stress),

[1] All main analyses in the pilot and the main experiments were further contrasted while controlling these two Suspiciousness variables as covariates. Neither of the main results changed as a function of these variables. The full set of these analyses is reported in the Supplement.

and decreases from Time 2 to Time 3 (post-stress), both *p's*< .001. The same Time effect was found for Relaxation, $F(2,29) = 19.54$, $p < .001$, $\eta_p^2 = .57$. Participants had a significant decrease in relaxation when they had to face the task (i.e., from pre- to during-stress), but then returned to baseline levels, showing a significant increase from during- to post-stress, both *p's*< .001. As for HRV, a significant Time effect was found, $F(3,25) = 3.88$; $p = .02$; $\eta_p^2 = .32$, indicating a change of RMSSD across phases. Post hoc comparison revealed decreases in HRV from the baseline to the phase of stress anticipation ($p = .005$) and a return to baseline level (increases from during- to post-stress) during the recovery ($p = .004$).

5.2.4.2. Affective Attention Flexibility (AAF)

A repeated-measure ANOVA with Time (Time 1: balanced feedback; Time 2; positive feedback; Time 3: balanced feedback; Time 4: negative feedback; Time 5: balanced feedback) as within-subject factor was performed with the attention index as dependent variable. The analysis supported a significant effect of Time, $F(4,25) = 29.63$; $p < .001$, $\eta_p^2 = .83$, indicating that participants were flexible, as they attended to positive vs. negative feedback depending on the amount of emotional feedback of each type of emotion in each slide. Therefore, participants increased the time attending to positive information when there were transitions to more positive feedback (i.e., Time 1-balanced to Time 2-positive; Time 4-negative to Time 5-balanced) and increased the time attending to negative information when there were transitions to more negative feedback (i.e., Time 2-positive to Time 3-balanced; Time 3-balanced to Time 4-negative; all differences across the slides $p < .01$, in the expected directions; see a full visual depiction of these findings in the Supplement)

5.2.5. Interim Discussion

Results confirmed that the experimental procedure was effective as a social stress induction. Participants showed significant increases in their levels of self-reported nervousness and decreases in their levels of self-reported relaxation and RMSSD (i.e., a decrease of the parasympathetic activation) during the performance of the main speech task. All these changes were transitory, with both self-reported and psychophysiological indices returning to their previous baseline levels during the recovery period. As for AAF, participants flexibly attended to each emotional component depending on the emotional charge of the feedback. When feedback was neutral, participants looked positive and negative faces in the same proportion. However, when feedback was mainly positive, they fixated more on positive faces and vice versa (i.e., fixated more on negative faces) when feedback was mainly negative. In sum, the pilot study supported the validity of the task to induce transient stress and to assess AAF under such conditions of stress.

5.3. Main Experiment

After validating the new procedure, the Main Study was designed to test the hypotheses that: a) motivational SFs (i.e., predominantly active promotion and/or prevention SFs) differentially affect context-based AAF (i.e., high promotion → higher AAF toward positive changes; high prevention → higher AAF toward negative changes).

The main change from the previous study was the inclusion of an additional experimental condition, concerning the order of the emotional feedback presented during the Speech Task. In one condition, the false feedback slides were presented in the order that was used in the Pilot Experiment: Balanced – Positive – Balanced – Negative – Balanced, whereas in the added second condition, feedback was presented as it follows:

Balanced – Negative – Balanced – Positive – Balanced. This inclusion was made for several reasons. First, it was necessary to confirm that the normative AAF processes validated in the Pilot Experiment were not dependent on a specific Feedback Order setting but were also evidenced in alternative contextual settings also requiring flexibility (i.e., reversed attention processing, first maximizing attention to negative and then to positive feedback). Second, this served to clarify whether stress reactivity and recovery processes observed in the Pilot Study were due to a specific Feedback Order setting (i.e., presentation of negative feedback at the second half of the speech task performance) or were generalizable to different forms of contextual changes in the stress induction procedure. Third, the inclusion of both Feedback Order conditions served to establish whether the directionality of the social feedback (from positive to negative vs. from negative to positive) would affect the way each group of participants preferentially attended to positive vs. negative feedback across the task, potentially producing differences in the relation between AAF and stress reactivity and recovery.

5.3.1. Method

5.3.1.1. Participants

The total sample comprised 102 undergraduates (81 female, mean age= 20.9 years old). All participants were native Spanish speakers and had normal or corrected-to-normal vision. Sample size was determined in line with previous studies testing group differences in AAF across multiple conditions of affective contextual switching (Godara et al., 2020). All participants provided written informed consent and received course credits for their participation. HRV data were not available for 15 participants and eye-tracking data were not available for 9 participants, due to technical problems. The study was conducted in

accordance with the Declaration of Helsinki and it was approved by the Faculty Ethical Committee.

5.3.2. Design Overview

Participants first completed the online questionnaire package the day before undertaking the experimental session (see full details on descriptives and psychometric properties, that were good for all questionnaires, in the Supplement). The experimental design of the speech task was similar as in the Pilot Study (see Figure 4), but with random assignation to two possible types of feedback order, as described above: receiving social feedback in the same order as in the Pilot Study (from now on, Order 1: balanced-positive-balanced-negative-balanced; n= 51, see Figure 3A) or receiving negative and positive feedback in the opposite temporal order (from now on, Order 2: balanced-negative-balanced-positive-balanced; n= 51, see Figure 3B). Participants underwent the same procedure as in the Pilot Study (i.e., Self-Attribute Task, Vanilla HRV Baseline, Speech Anticipation and Performance, Recovery Period).

5.3.3. Analytic approach

Initial analyses were referred to the validation of the self-reported instrument designed to evaluate individual differences in motivational SFs of promotion and prevention, the Promotion / Prevention Scale (Lockwood et al., 2002; see below). The main analyses were then conducted, which again comprised testing stress reactivity and recovery effects in self-reported moods and HRV across the experiment, and flexibility-based attention changes (i.e., AAF) as a function of contextual feedback changes across the speech. Repeated-measure ANOVAs included the effect of Time for each given outcome as within-subject factor, while Social Feedback Order (Order 1: balanced-

positive-balanced-negative-balanced, Order 2: balanced-negative-balanced-positive-balanced) was included as between-subject factor. Further, to model the role of the two dimensions of motivational SF of promotion and prevention on stress reactivity and recovery and contextual-based AAF under stress, analyses of covariance (ANCOVAs) were then performed. Based on results from the validation of the instrument assessing motivational SFs, each ANCOVA comprised modelling the Time and Order factors in relation to both motivational SF dimensions of promotion and prevention and their interaction as between-subject factors, while also controlling for individual differences in depression and anxiety levels as covariates.[2]

5.3.4. Results

5.3.4.1. Sample Characteristics

Table 2 provides full details on the demographics and self-reported psychological characteristics for each experimental group, based on feedback Order. There were no group differences in gender distribution, $X^2 = .06$, $p = .81$, in age, depression and anxiety levels, motivational SF dimensions and most of other psychological variables in the study, all t's < 2.44, all p's > .05 supporting the randomization procedure used in the study, except for the brooding subscale, which is not considered as a variable of interest in this study.

[2] Depression and anxiety levels were included as covariates in the model to control for their possible confounding effects in AF during the speech, as it has been shown their influence in other forms of AF (Godara et al., 2020), and in general emotional attention preferences toward negative vs. positive information (e.g., Armstrong & Olatunji, 2012).

Table 2. Descriptives of the main variables in the Main Study.

	Order 1 (n = 51)	Order 2 (n = 51)
Age	20.76 (2.22)	21.06 (2.72)
Gender	40 women; 11 men	41 women; 10 men
CESD-8	8.57 (4.35)	7.02 (3.89)
GAD-7	7.9 (3.87)	7.37 (4.02)
Promotion Subscale	57.33 (9.99)	58.47 (11.22)
Prevention Subscale	50.08 (14.49)	47.9 (12.76)
Nervousness Pre-stress	2.51 (2.38)	2.56 (1.97)
Nervousness During stress	5.49 (2.75)	5.64 (2.23)
Nervousness Post-stress	1.72 (2.05)	1.86 (1.83)
Relaxation Pre-stress	6.33 (2.09)	5.8 (2.13)
Relaxation During stress	4.1 (2.32)	3.24 (2.04)
Relaxation Post-stress	7.2 (1.82)	6.54 (2.09)
AAF Feedback 1 (Balanced)	.53 (.29)	.58 (.29)
AAF Feedback 2 (Pos/Neg)	.74 (.22)	.28 (.21)
AAF Feedback 3 (Balanced)	.49 (.29)	.5 (.27)
AAF Feedback 4 (Pos/Neg)	.29 (.21)	.72 (.2)
AAF Feedback 5 (Balanced)	.47 (.31)	.55 (.28)
RMSSD Baseline	44.75 (18.59)	43.7 (24.9)
RMSSD Anticipation	38.49 (17.42)	36.12 (15.85)
RMSSD Speech	37.91 (16.55)	35.33 (16.8)
RMSSD Recovery	47.2 (21.36)	45.38 (25.43)

5.3.4.2. Motivational SFs Indices

As a previous step, we estimated the reliability and validity of the instrument designed to index individual differences in motivational SFs in the study (see full details in the Supplement). The original Promotion / Prevention Scale (Lockwood et al., 2002) is a 18-item scale, composed by two 9-item subscales, designed to assess habitual activation of promotion and prevention SF. Participants are asked to indicate on a 9-point scale the extent to which they endorse items relevant to promotion SF (e.g., "*I frequently*

imagine how I will achieve my hopes and aspirations"; "I often think about the person I would ideally like to be in the future") and items relevant to prevention SF (e.g., "*I frequently think about how I can prevent failures in my life"; "I am anxious that I will fall short of my responsibilities and obligations*"), in line with the theoretical constructs proposed by Higgins et al. (1997). Exploratory factorial analyses supported a 2-factor structure, formed by the Promotion and Prevention Subscales.

Despite that the factor analysis confirmed these 2-factor structure, correlation analyses also showed a significant positive association between promotion and prevention levels (r= .28, p= .004), suggesting a certain degree of covariation among the SF dimensions. These results are in line with previous research using this instrument (Lockwood et al., 2002; van den Tooren & de Jonge, 2011), supporting the existence of other motivational profiles rather than exclusively independent promotion vs. prevention profiles. In line with these results, because we had different separate predictions for the role of promotion and prevention SF in relation to AAF, and to account for existing covariation between SF dimensions, we modelled both SF factors as well as its interaction in the main analyses.

5.3.4.3. Motivational SF and stress-induction effects on self-reported mood (VAS)

Mean and standard deviations for each VAS level at each time point in the study are reported in Table 2. First, 3x2 repeated-measure ANOVAs with Time as within-subject factor and Feedback Order as between-subject factor were performed for each mood state measure (Nervousness, Relaxation) as dependent variables. Analyses showed that Time was the only factor with a significant effect in both cases, $F(2,98) = 147.82$, $p < .001$, $\eta_p^2 = .75$ and, $F(2,98) = 75.72$, $p < .001$, $\eta_p^2 = .61$, respectively. Post-hoc

comparison supported the expected pattern, with a significant increase in levels of Nervousness and a decrease of Relaxation from pre- (Nervousness: M= 2.53, SD= 2.17; Relaxation: M= 6.07, SD= 2.12) to during-stress (Nervousness: M= 5.56, SD= 2.49; Relaxation: M= 3.67, SD= 2.21) (both, p´s < .001), followed by significant decreases and increases from during- to post-stress, respectively (Nervousness: M= 1.79, SD= 1.93; Relaxation: M= 6.87, SD= 1.98) (both, p´s < .001).

The 3 (Time) x 2 (Feedback Order) x Promotion Level x Prevention Level ANCOVAs, controlling for depression and anxiety as covariates, were then performed. This procedure was similarly applied for HRV and AAF analyses, (see below). The entire set of main and interaction effects for these ANCOVAs, either for self-reported mood, HRV and AAF measures are fully reported in the Supplement, whereas here we provide the relevant effects to test our hypotheses. In the case of nervous mood, beyond the significant effect of Time, only the main effect of Prevention was significant, showing that participants with high compared to those ones with low prevention SF levels reported higher levels of nervous mood across the entire session, $F(1,91) = 8.68$, $p = .004$, $\eta_p^2 = .09$. A similar trend was observed for the main effect of Prevention in relaxed mood, with participants with high compared to those ones with low prevention SF levels showing lower levels of relaxation across the entire session, $F(1,91) = 3.09$, $p = .08$, $\eta_p^2 = .03$. These effects were not accounted by individual differences in depression or anxiety levels.

5.3.4.4. Motivational SF and stress-induction effects on HRV

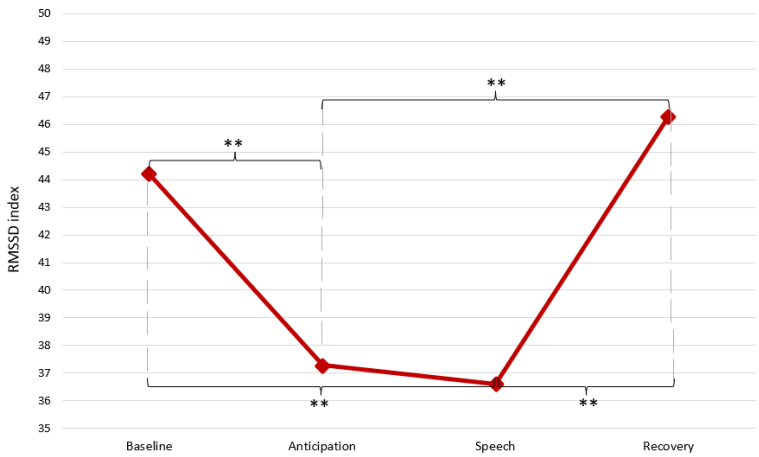
The 2 (Feedback Order) x 4 (Time) repeated measure ANOVA with HRV as outcome supported a main effect of Time $F(1.87, 159.41) = 22.42$, $p < .001$, $\eta_p^2 = .21$, not

accounted by a Feedback Order x Time interaction, $F(1.87, 159.41) = .11$, $p = .88$, $\eta_p^2 = .001$. Post-hoc comparison indicated that there were significant decreases in HRV levels from Time 1 (pre-stress/baseline) (M= 44.22, SD= 21.89) to Time 2 (stress anticipation phase) (M= 37.29, SD= 16.59), $p < .001$, remaining stable from Time 2 to Time 3 (stress task) (M= 36.6, SD= 16.63), $p > .99$, and increasing again from Time 3 to Time 4 (post-stress/recovery) (M= 46.28, SD= 23.39), $p < .001$, with no differences in HRV levels between Time 1 baseline and Time 4 recovery periods, $p = .6$ (see Figure 5A).

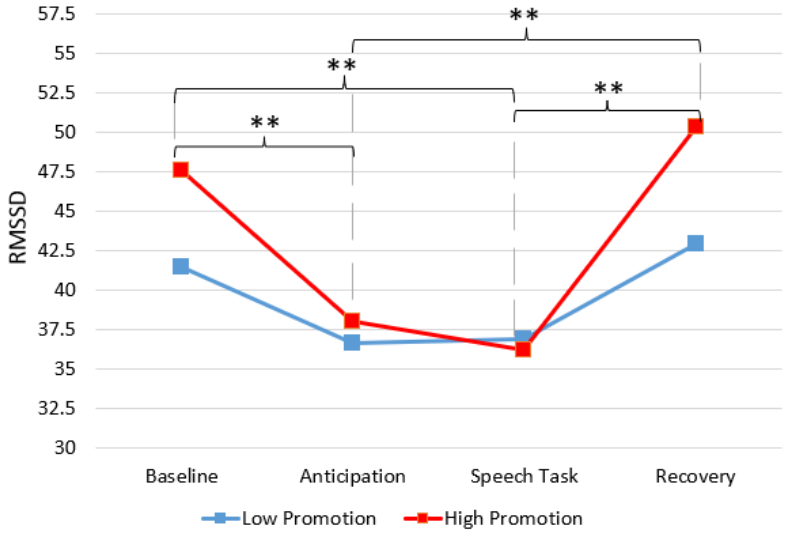
As for the 4 (Time) x 2 (Feedback Order) x Promotion Level x Prevention Level ANCOVA, controlling for depression and anxiety as covariates, there was a significant Promotion Level x Time interaction, $F(1.86,143.47) = 3.32$, $p = .04$, $\eta_p^2 = .04$., not accounted by Feedback Order, $F(1.86,143.47) = .26$, $p = .75$, $\eta_p^2 = .003$. Bonferroni-corrected post-hoc comparisons showed that the main induction effects found in stress reactivity and recovery were specific for participants reporting higher levels of promotion SF: Time 1 (M= 47.58, SD= 24.75) to 2 (M= 38.03, SD= 16.13), $p < .001$, Time 2 to 3 (M= 36.22, SD= 16.73), $p = .81$, Time 3 to 4 (M= 50.36, SD= 28.13), $p < .001$, with no differences between Time 1 and 4, $p > .99$. In contrast, participants reporting lower levels of promotion SF showed blunted psychophysiological reactivity to stress, with no changes in HRV across the different phases of the procedure (Time 1: M= 41.49, SD= 19.08, Time 2: M= 36.68, SD= 17.11; Time 3: M= 36.92, SD= 16.72; Time 4: M= 42.96, SD= 18.34), all p's > .14 (see Figure 5B). These effects were not statistically accounted by individual differences in depression nor anxiety.

Figure 5. Changes in HRV during each step of the experimental procedure of stress induction in the Main Experiment.

5A) Main effect in HRV in the Main Experiment.



5B) Effects in HRV by promotion group in the Main Experiment.



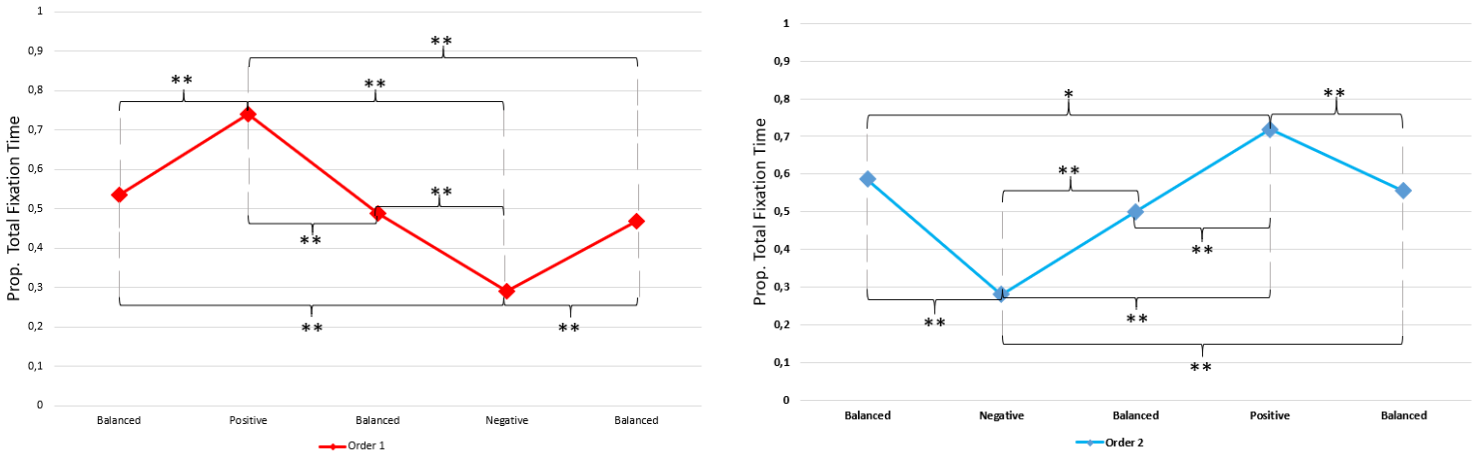
Notes. RMSSD = Root mean square of successive differences; **= significant at p < .001

5.3.4.5. Motivational SF and AAF under stress conditions

The 2 (Feedback Order) x 5 (Time) repeated measures ANOVA with the attention index as the outcome did not support a main effect of Time, $F(4,88) = .94$, $p = .44$, η_p^2

= .04, but a Feedback Order x Time interaction, $F(4,88) = 67.27$, $p < .001$, $\eta_p^2 = .75$. In line with the AAF design, post-hoc comparisons showed different Time effects in attention depending on the Feedback Order condition, in all cases in the expected directions (see Figure 6). In all cases, for both Feedback Order conditions, attention at balanced sections reflected balanced processing of positive and negative information, whereas attention at Positive Feedback sections was positive and significantly higher than the rest of sections, and attention at Negative Feedback sections was negative and significantly lower than the rest of sections, all *p's* < .05.

Figure 6. Differences in AAF depending on the Order Group in the Main Experiment.



Notes. *=significant at p< .05; **= significant at p< .01

Regarding the 2 (Feedback Order) x 5 (Time) x Promotion Level x Prevention Level ANCOVA, controlling for depression and anxiety as covariates, the significant Feedback Order x Time interaction was accounted by a significant three-way Promotion Level x Feedback Order x Time interaction, $F(4,80) = 4.01$, $p = .005$, $\eta_p^2 = .17$, whereas there was also a trend for a four-way Promotion Level x Prevention Level x Feedback Order x Time interaction, $F(4,80) = 2.23$, $p = .07$, $\eta_p^2 = .1$. Therefore, we conducted

separate 2 (Promotion Level) x 2 (Prevention Level) x 5 (Time) ANCOVAs for each Feedback Order condition.

As for Order 1, there was a significant Promotion Level x Prevention Level x Time interaction, $F(4,36) = 4.15$, $p = .01$, $\eta_p^2 = .32$. Groups did not differ in their attention to positive vs. negative feedback neither at Time 1 (Balanced) nor at Time 2 (Positive feedback), both p's > .1. However, at Time 3 (Balanced after Positive Feedback), participants who were predominantly promotion focused (i.e., higher promotion – lower prevention) showed significantly higher attention to positive feedback than those ones reporting both high promotion and prevention focuses (i.e., higher promotion – higher prevention), $p = .01$. At Time 4 (Negative Feedback), participants who were predominantly prevention focused (i.e., lower promotion – higher prevention) showed significantly higher attention to negative feedback than those ones reporting both low promotion and prevention focuses (i.e., lower promotion – lower prevention), $p = .002$. No group differences were found at Time 5 (Balanced after Negative Feedback), all p´s > .13. In terms of within-group AAF patterns, all groups characterized by any high motivational SF (i.e., high promotion and/or high prevention groups) showed significant within-group changes across time in the expected direction (balanced-positive-balanced-negative-balanced), p's < .05, whereas participants reporting low motivational SFs (i.e., low promotion – low prevention) showed an inflexible attention pattern, characterized by absence of changes in attention to positive vs. negative feedback across the five feedback times, all p's > .05 (see Figure 7A).

As for Order 2, there was a significant two-way Promotion Level x Time interaction, $F(4,39) = 3.54$, $p = .01$, $\eta_p^2 = .27$, whereas neither Prevention Level x Time

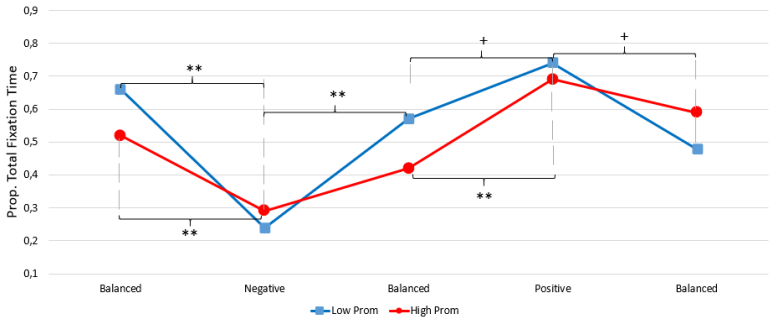
nor the three-way interactions were significant, both F's < 2.01, both p's $> .05$, both $\eta_p^2 < .18$. Post-hoc comparisons showed no differences between promotion groups at any feedback time, all p's $> .05$. In terms of within-group AAF patterns, participants reporting a low promotion SF showed significant within-group changes across time in the expected direction (balanced-negative-balanced-positive-balanced), whereas participants reporting high motivational SF showed initial decreases in attention to positive vs. negative from Time 1 (balanced) to Time 2 (clearly negative), $p = .01$, but inflexible attention after receiving negative feedback, Time 2 to Time 3 (balanced), $p = .99$. They then increased attention to positive information when receiving positive feedback, Time 3 to Time 4 (clearly positive), $p = .001$, but they were again inflexible after receiving negative feedback, Time 4 to Time 5 (balanced), $p = .99$ (see Figure 7B).

Figure 7. Modulatory effects of motivational SF on AAF in each Feedback Order Condition.

7A) Order1 effects by promotion and prevention groups.

Notes. Prom = Promotion. Prev = Prevention; **= significant at p < .01

7B) Order 2 effects by promotion groups.



Notes: Prom = Promotion. Prev = Prevention; + = significant at p < .1, * = significant at p< .05, **= significant at p< .01

5.3.5. Interim Discussion

As in the Pilot Study, the results confirmed that the experimental procedure was effective to induce transient stress (both self-reported and based on objective indicators

of HRV) as well as to index AAF patterns. Importantly, motivational SFs had different effects in stress processes. Participants with higher levels of prevention were characterized by higher levels of nervousness and (trend) lower levels of relaxation across the entire procedure. Participants with higher levels of promotion were characterized by normative psychophysiological responses to stress, as indicated by HRV, with significant decreases from the baseline to anticipation and confrontation of stress, followed by increases at the recovery period. In contrast, participants with low promotion SF did not show this pattern and were characterized by blunted HRV responses.

As for our main hypotheses on SF effects in AAF, the results supported different modulations of motivational SFs on AAF. Overall, as in the Pilot Experiment, participants showed normative processes of attention to positive vs. negative feedback in a context-based flexible way, depending on the emotional charge (i.e., balanced, clearly positive or clearly negative) of each slide. Motivational SFs were found to modulate these AAF patterns in the expected directions, although with different modulatory effects depending on the Feedback Order. As for Order 1 (i.e., balanced-positive-balanced-negative-balanced), participants with a predominantly higher promotion state (high promotion – low prevention) showed more attention to positive feedback than those ones with both high motivational SFs (high promotion – high prevention) at Time 3 (i.e., maintained positive processing after receiving clear positive feedback, despite reductions in the amount of positive feedback). Also, in line with our hypotheses, there were significant differences between participants with a predominantly higher prevention SF (low promotion – high prevention) compared to those ones with both low promotion and low prevention levels at Time 4, indicating more attention to negative stimuli in contexts of

clear negative feedback. Lastly, the results also revealed that the group with a low motivation profile (i.e., both low promotion and low prevention levels) did not show within-group changes in attention across the slides, thus being characterized by an inflexible attentional pattern, unlike the rest of the groups with any predominant SF, who demonstrated AAF across trials. In the case of Order 2 (i.e., balanced-negative-balanced-positive-balanced), the results supported an interaction between AAF and promotion levels. Specifically, in this reversed condition, as opposite to Order 1, participants with higher promotion levels showed more inflexible attention patterns following clearly negative and positive feedback, in contrast to those characterized by lower promotion levels.

5.4. General Discussion

A better understanding of the factors associated with processes of resilience and vulnerability to stress is crucial to formulate models capable of promoting adaptive functioning (Parsons et al., 2016). AAF and its potential modulation by individual differences in motivational SF of promotion and prevention are relevant to this issue and were studied across two experiments. We first validated a new experimental procedure (speech task) based on Sanchez, Romero, et al. (2017), with the purpose of generating transient social stress conditions that allow to measure AAF processes in response to dynamic changes on the socially emotional situation. Second, we evaluated differences between participants with specific profiles of motivational SFs in such AAF processes during social stress.

The results from both the Pilot and the Main Experiments support the effectiveness of the new procedure to induce transient changes in both self-reported mood

and objective indicators of HRV, in line with the results found by Sanchez, Romero, et al. (2017). Transient modulations of HRV due to the stress induction are also in line with results found by Delaney & Brodie (2000) and the meta-analysis of Kim et al. (2018), where it was shown that parasympathetic system withdrawal is one common way to respond to stress. Our results in both studies also allow to validate the capacity of the task to index AAF processes during the performance of the social stressor (i.e., participants were flexible in the way they attended to positive vs. negative faces across the stress situation, as a function of the changes in the amount of positive and negative feedback being received at each moment). This has several important implications. Based on these results, it can be assumed that AAF is a consistent phenomenon that can be assessed as a function of contextual changes (see also Godara et al., 2020). Furthermore, adaptive attention seems to go beyond a process associated with a specific biased information processing (Armstrong & Olatunji, 2012), such as preferential attention to positive over negative information. Instead, it may reflect regulatory strategies that can be used in a flexible way depending on contextual changes. These results extend those ones from previous studies postulating a regulatory effect of attention as a way to respond to stress (Southwick & Charney, 2012) and sad moods (Sanchez et al., 2014), and support conceptual claims on the flexible use of cognitive processes as a potential mean to influence well-being (Bonanno & Burton, 2013). Our results thus indicate that selective attention may not be a stable phenomenon, but a fluctuating process that varies across situational changes.

Based on the predictions of the Regulatory Focus Theory (Higgins, 1997) it was hypothesized 1) that individuals high in promotion SF levels would show preferential

attention to positive information when receiving clearly positive feedback and lower attentional shifting toward negative feedback when context varied from positive to balanced feedback, and 2) that individuals high in Prevention SF levels would show preferential attention to negative information when receiving clearly negative feedback and lower attentional shifting toward positive feedback when context varied from negative to balanced feedback (Shah & Higgins, 2001). These hypotheses were partially supported. The results confirmed some of the expected modulatory effects of motivational SFs on AAF in Order 1 (i.e., when participants first received positive and then negative feedback across the speech). Specifically, participants with a predominant promotion SF showed higher attention to positive faces in comparison to high promotion – high prevention individuals at Time 3 (i.e., after having received clearly positive feedback), but no differences were found at the precedent Time 2 (i.e., while receiving clearly positive feedback). As for the second prediction, participants with a predominant prevention SF showed higher attention towards negative feedback in comparison to low promotion – low prevention individuals at Time 4 (i.e., when receiving clearly negative feedback), but no differences were found at the subsequent Time 5 (i.e., after having received clearly negative feedback). These results suggest that in our sample (i.e., healthy undergraduates), all participants may have been equally responsive to clear positive feedback (Time 2) and then adequately adjust their attention after receiving clearly negative feedback (Time 5). Nonetheless, motivational SF modulatory effects still emerged in the expected directions at conditions of reductions of positive feedback (i.e., Order 1 T3, promotion) and increases of negative feedback (i.e., Order 1 T4, prevention). Overall, these results are in line with the model proposed by Higgins (1997, 1998),

claiming that each motivational SFs leads to the interpretation of reality in different terms, each one congruent with some specific cognitive schemas. High promotion would relate to interpretations of situations depending on the possible occurrence of positive outcomes (gain vs no gain), while prevention would guide interpretations depending on possible negative outcomes (loss vs no loss; Shah & Higgins, 2001). Thus, the higher access to each motivational SFs could affect the way individuals anticipate and thus attend to feedback under specific conditions, such as the ones observed in our main experiment.

Interestingly, participants with no predominant motivation SFs (i.e., both low promotion and prevention levels) showed an inflexible attentional patter across Order 1, being characterized by a lack of the normative AAF changes across contexts observed for the rest of the groups. Higgins' model can also help to explain this form of inflexibility, since by not habitually activating any of these motivational SFs, this type of anhedonic group would not activate specific schemes to preferentially direct attention to specific context-based emotional changes. However, the relationship between lower motivation and attention inflexibility and the interaction of predominant promotion and prevention SFs to modulate AAF across contexts must be more thoroughly investigated in future research. This will allow to fully understand how motivational SFs interact and guide (in)flexible attentional processing as a function of different contexts and environments.

Relatedly, Order 1 was the only condition where modulatory effects of promotion and prevention SFs in AAF were found in the expected directions. The hypothesized effects were not supported in the Order 2 condition. In contrast, we found further differential unpredicted motivation-based AAF patterns in the Order 2 condition. When first receiving clearly negative followed by positive clearly feedback across the speech

(i.e., Order2), individuals with higher promotion levels were more inflexible in adjusting attention (shifting attention) not only after receiving clear positive feedback, but also after receiving clear negative feedback. Part of these differences could be accounted by the nature of the social feedback dynamic in each Order condition. Initial positive feedback at Order 1 may be more congruent with the set of expectations of high promotion individuals whereas, in Order 2, the positive component of the task (i.e., clearly positive feedback) only appeared at the end of the procedure, potentially making high promotion individuals more reactive to initial, purportedly unexpected, clearly negative feedback. In contrast, this feedback setting might reduce the reactiveness to initial negative feedback in high prevention individuals, for whose no effects in AAF were found in the Order 2 condition. Whereas further research is necessary to clarify these issues, our results inform on specific feedback configurations that can be used to further study different processes of AAF as a function of individual differences in motivational factors.

Taken together, these findings have several interesting implications. Interventions that promote a flexible attentional behavior, as a function of emotional changes during stress, could be used to train AAF in a way that transferred to facilitate higher regulation and recovery from stress. Yet, our results implicate that such AAF processes and their modulation and potential transfer to stress adaption may depend on predominantly active motivational SFs. Observed differences between motivational SFs in stress changes implicate that the way people interpret a situation as a function of habitually active goals can differentially influence different processes of stress response. This was evidenced by results on specific differences in self-reported nervousness depending on prevention levels, and stress-based HRV modulation by promotion levels. Thus, participants

characterized by higher emotional reactivity (i.e., those ones characterized by higher prevention levels) and by blunted psychophysiological processes in response to stress (those ones characterized by lower promotion levels) could particularly benefit from strengthening AAF abilities, which could be trained directly (i.e., through attention trainings on flexibility, see Godara, Sanchez-Lopez, Baeken, et al., 2021). Future trainings on AAF must be defined in a way that facilitates related motivation manipulations in specific directions, as a mean to prevent the appearance of stress vulnerabilities and to promote well-being through greater adjusted AAF patterns. The last aim of this approach must be the stimulation of a flexible activation of motivational goals depending on context needs and related environmental goals, so people can adjust their expectations (and consequently their attentional processing and affective experiences) adaptatively, having a better management of stress and promoting stable well-being. With that aim, results from these initial studies, together with knowledge derived from the subsequent studies presented in the following Empirical Chapters, were used to inform a final training study that will be presented in the final Empirical Chapter of this Dissertation.

The study presents some limitations that must be considered. First, the proportion of men in our studies was relatively low and it will be necessary to increase it in future studies to generalize results to both types of gender. Second, according to Higgins' model (1997), each person is characterized by a predominant use of a motivational SF, as these systems tend to be self-sustaining, and each person tend to interpret different situations in a similar way. However, the activation of each motivational SF could also depend on other characteristics of the situation. This means that although we have assessed

motivation as a trait, we cannot discard that some participants had other forms of motivational SFs momentarily active during the performance of the speech, producing differences in the results. Thus, further research should include both trait and state measures of motivational SF, to disentangle specific contributions and interplays among them to account for AAF and stress regulation. Moreover, further studies must add experimental manipulations of motivational SFs, inducing high promotion or high prevention levels, to replicate and extend the differences found in our study. Several of these aims were pursued in the series of studies that are presented in the following next two Empirical Chapters (i.e., Studies 2 and 3).

Overall, the validated novel stress task and the AAF indices derived from this method, as presented in this study, may inform a number of exciting new areas of research in AAF, stress regulation, and cognitive intervention. Specifically, this approach has the potential to provide a much more fine-grained understanding on how inter- and intra-individual stress adaptation mechanisms (i.e., motivationally guided contextual-based AAF) contribute to stress regulation and ultimately identify ways to train ecological AAF processes to promote adaptive functioning and stress resilience. These aspects, in relation to how a novel affective attention flexibility training can be used to modulate them, will be considered in the final Empirical Chapter of the Dissertation (i.e., Study 4).

5.5. Supplementary Information of this Empirical Chapter

I. **5.5.1. Supplementary Methodological Details**

   a. **Self-report measures**

   b. **HRV (Heart Rate Variability)**

   c. **Self-Attribute Task**

   d. **Vanilla Baseline**

   e. **Speech Task**

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II. **5.5.2. Supplementary Analyses**

   a. **Self-reported baseline measures in the Pilot Experiment.**

   b. **Stress induction task effects on self-reports (VAS) in the Pilot Experiment.**

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   e. **Table 5. Descriptives and Cronbach's Alpha of each scale and subscale of the questionnaires used in the Main Experiment.**

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I. 5.5.1. Supplementary Methodological Details

a. Self-report measures.

Depressive symptom severity. The 8-item version of the Center for Epidemiologic Studies – Depression Scale (CES-D; Radloff, 1977) is a screening test that measures depressive symptoms severity. It is composed by 8 items scored on a four-point scale, where participants indicate to what extent they have suffered depressive symptomatology during the past week. This measure has good reliability and validity in both health and depressed samples (Radloff, 1977). The internal consistency in the Main Study was good, with an $\alpha = .84$.

Anxious symptom severity. The General Anxiety Disorder Scale (GAD-7; (Spitzer et al., 2006) is a screening test that measures anxious symptoms severity. It is composed by 7 items scored on a four-point scale, where participants indicate the degree to which they have suffered anxious symptomatology during the past two weeks. This measure has good reliability and validity in both healthy and anxious samples, and it is associated with higher risk for Generalized Anxiety Disorder (Spitzer et al., 2006). The internal consistency in the Main Study was $\alpha = .85$.

Promotion/Prevention Scale: The Promotion/Prevention Scale (Lockwood et al., 2002) is an 18 items questionnaire, designed to evaluate the habitual activation of goals associated to promotion and prevention self-focuses. The first one (Promotion System subscale) is related to goals associated to a higher attention on possible positive outcomes/gains, and the second one (Prevention System subscale), is related to goals associated to a higher attention on possible negative outcomes/losses. The Spanish

translation was based on the study of Lockwood et al. (2002) and the internal consistency of both subscales was very good, being α=.82 and α=.82 in the Main Study.

Behavioral Inhibition and Activation: The Behavioral Inhibition/Behavioral Activation Scales (BIS/BAS; Carver & White, 1994) consist of 24 items, divided in two subscales. The behavioral activation subscale (BAS) assesses individual differences in the behavioral approach system (BAS), which is thought to regulate appetitive motives (i.e., goal: to move toward something desired). The behavioral inhibition subscale (BIS) assesses individual differences in the avoidance (or inhibition) system (BIS), which is thought to regulate aversive motives (i.e., goal: to move away from something unpleasant). The internal consistency of both subscales was good, being α=.65 for BAS and α=.79 for BIS, in the Main Study.

Use of acceptance, positive refocusing, positive reappraisal and planning: The Cognitive Emotion Regulation Questionnaire (Garnefski et al., 2002) is a 16-item questionnaire that evaluates to what extent participants habitually use different types of emotion regulation strategies in response to negative events, including acceptance, positive refocusing, positive reappraisal and planning. The internal consistency of all these subscales was good, with α's being .66, .86, .86 and.82 in the Main Study, respectively.

Use of rumination: The Ruminate Responses Scale (RRS; Hervás Torres, 2008; Nolen-Hoeksema & Morrow, 1991) assesses different forms of rumination, divided in two subscales. The Brooding Subscale assesses a continuous habitual focus on negative thoughts and moods, and the Reflection Subscale assesses the use of an adaptive

reflection on the causes of events. The internal consistency of both subscales was good, being α=.74 and α=.74 in the Main Study, respectively.

Use of worry: The Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990), is a 16-item questionnaire that evaluates to what extent participants engage with worry, comprising repetitive thoughts about future uncertain problems and threats. The internal consistency was very good, reaching an α=.94 in the Main Study.

b. Heart Rate Variability. A Polar V800 and a Polar H7 sensor attached to a chest strap were used to register HRV. This system allows for a detection of R-R intervals with a resolution equivalent to 1 ms (i.e., sampling rate: 1000 Hz) and has proven feasible to record psychophysiological changes linked to emotional activation (see Giles et al., 2016). The equipment was adjusted at the beginning of the experimental session. Then participants seated and rested comfortably during a brief acclimation phase to monitor the quality of the recording. Participants then continued performing a Self-Attribute Task, while the experimenter monitored the quality of the recording, before starting the actual Vanilla Baseline HRV Recording Phase (see full details below). Data were then recorded across the entire session, and data for each of the relevant sections of the experiment (i.e., baseline, anticipation, performance of the speech, and recovery period) were imported using the Polar Flow program. Resulting R-R intervals (times elapsed between successive heartbeats), obtained for each participant at each experiment section, were analyzed using Kubios 2.0 (Tarvainen et al., 2014). Each record was first visually inspected and detected artifacts were corrected using a piecewise cubic spline interpolation method.

c. Self-Attribute Task: In this task, participants had to rate in what extend some positive adjectives define them**.** Positive adjectives comprising the list were pre-selected using the resource emoFinder (http://usc.es/pcc/emofinder), a Web-based search engine for searching of Spanish word properties taken from different normative databases (Fraga et al., 2018). Adjectives were selected in terms of their valence (positive) in accordance to validation data from previous research (Guasch et al., 2016; Hinojosa et al., 2016; Redondo et al., 2007; Stadthagen-Gonzalez et al., 2017) (Table 3).

Participants had to indicate to what extent each of those adjectives defined them using a four-point scale ranging from 1 ("It does not define me at all") to 4 ("It clearly defines me"). Each trial started with a black cross in the middle of the screen presented for 500 ms. Then, one adjective was shown in the center of the screen and participants had to rate the extent to which that adjective described them. This procedure was repeated for the total list of twenty adjective, presented in random order, and without time constrains to provide each of the responses. The purpose of the task was to facilitate the selection of five individualized self-relevant positive attributes, as rated by each participant, that would be then used as speech topics in the subsequent main experimental task.

Table 3. Positive Validated word from used during the Self-Attribute Task of this study.

Original Adjective in Spanish	**Translated Adjective in English**	**Valence (0 very negative to 10 very positive)**
Alegre	Happy	8.41
Fuerte	Strong	6.3
Animada	Lively	8.03
Capaz	Capable	7.52
Sensible	Sensitive	6.33
Hábil	Skilled	7.26
Divertida	Funny	7.23
Competente	Competent	7.23
Inteligente	Intelligent	7.7
Trabajadora	Hard-working	6.73
Independiente	Independent	6.8
Admirable	Admirable	7.33
Atractiva	Attractive	7.3
Enérgica	Energic	7.16
Interesante	Interesting	6.57
Honesta	Honest	7.52
Entusiasta	Enthusiastic	7.86
Amable	Friendly	7.81
Saludable	Healthy	7.74
Tranquila	Quiet	7.53

d. Vanilla Baseline. This kind of task was used to measure resting state in order not to measure baseline through a relaxation task, which could be less natural. The task comprised the serial presentation 10x12 cm squares on the screen that changed in color every 10 sec. Colors (red, blue, green, purple, and yellow) were presented randomly and with equal probability of occurrence. The task lasted 5 min. At the end of baseline, participants were required to report the number of times a designated color (green) has appeared. Participants correctly reported the number in all cases, proving the low demand of the task.

e. Speech Task. Participants were asked to prepare and deliver five 1-minute speeches on the topic "Why do you consider you are … (and one out of the five positive self-

referent adjectives that were rated with higher scores by the participant in the Self-Attribute Task)?". Participants were told they would be delivering each of the five speeches through a web-camera, and 4 expert psychologists would act as jury members who would evaluate their speech for security, clarity and conviction. Participants were also informed that they would receive this feedback on their performance in real time during the speech delivery, consisting of avatar faces representing evaluators' expressions presented on the screen. Although participants were told that they were being evaluated by jury members, the feedback presented on the screen were pre-programmed emotional avatars, and there were no real people evaluating the speech. Then the experimenter started the video connection of a webcam showing the participants' image on the screen, provided the five selected positive adjectives to prepare the 1-minute speeches and gave the participants 2 minutes to prepare them. The experimenter stated that during the 2-min speech preparation, he/she would go to check whether the video signal was well received in the evaluators' room and left the participant alone. After the 2 minute-preparation period, the experimenter came back to the room and stated that everyone was ready in the other rooms. Participants were then calibrated in the eye-tracker and the experimenter simulated talking by a microphone with the evaluators, by asking whether they were ready and playing voice recordings of people stating that they were ready to start with the evaluation. The overall preparation procedure (i.e., anticipation period) lasted approximately 5 minutes. After that, participants gave the series of five 1-minute speeches during which false feedback on their performance was shown on the screen.

Each trial comprised the presentation of the cue positive adjective that would be the topic of the new speech on the screen. When participants were ready to start the

corresponding speech, they pressed spacebar and started their talk. While participants delivered their speech, they were first presented with a fixation oval for 30 seconds (feedback anticipation), which was followed by the corresponding false feedback slide, presented for another 30 seconds. Thus, each trial, comprising a speech for one of the preselected positive adjectives, lasted a total of 1 min (5 min speech in total). After each 1-minute speech, there was a small break consisting on a small survey of three questions (not relevant to the main hypotheses tested in this study), asking participants to rate on a 10-point scale (from 0 to 9) the perceived intensity of the precedent feedback, the perceived ability of participants to influence jury's rating, and the expected feedback in the subsequent speech-trial (i.e., with the latter been completed for the first time before performing the first speech-trial).

f. Eye tracker. Participants' eye-movements were recorded using a Tobii Tx-120 infrared eye- tracker at a frequency of 120 Hz. Participants were seated in an anatomic chair with a distance of 60 cm between their eyes and the eye-tracker system. A 9-point grid calibration gaze calibration was done for each participant before starting the speech. Stimuli presentation and eye-tracker assessment were controlled with E-prime Professional 2.0 software (Schneider et al., 2012) and Tobii Studio Software (2.0.6), respectively, being coordinated and synchronized with E-prime extensions for Tobii (i.e., Clearview PackageCalls). Conversion of eye movement signals to visual fixation data, AOI's definition and total fixation time computations were conducted through Tobii Studio Software.

II. 5.5.2. Supplementary Analyses

a. Self-reported baseline measures in the Pilot Experiment.

In this section the descriptives and Cronbach's alphas for each measure in the pilot experiment is presented (Table 4):

Table 4. Mean, Standard Deviation and Cronbach's Alpha of each scale and subscale of the questionnaires used in the Pilot Experiment.

	Mean	**Standard Deviation**	**Cronbach's Alpha**
CESD-8	6.94	3.38	.835
GAD-7	8.25	4.25	.835
Promotion	63.62	10.80	.878
Prevention	51.78	12.09	.763

Notes. CESD-8 = Center for Epidemiologic Studies – Depression Scale 8 item version; GAD-7 = General Anxiety Disorder scale; Promotion = Promotion Subscale; Prevention = Prevention Subscale;

b. Stress induction task effects on self-reports (VAS) in the Pilot Experiment.

Repeated-measures ANOVAs with Time (Time 1: pre-stress/baseline; Time 2: during stress; Time 3: post-stress/recovery) as within-subject factor were performed for each mood state (Nervousness, Relaxation) as dependent variables. As for Nervousness, Time was significant, $F(2,29) = 31.98$, $p < .001$, $\eta_p^2 = .69$, indicating differences in Nervousness across experimental phases. Post-hoc comparisons supported increases in nervous mood from Time 1 (pre-stress/baseline) (M= 2.93, SD= 2.55) to Time 2 (during stress) (M= 5.48, SD= 2.69), $p < .001$, and decreases from Time 2 to Time 3 (post-

stress/recovery) (M= 1.97, SD= 2.02), $p < .001$, with no differences in nervous mood levels between Time 1 and Time 3, $p = .08$. As for relaxation, analyses also revealed a significant effect of Time, $F(2,29) = 19.54$, $p < .001$,$\eta_p^2 = .57$. Post-hoc comparison supported relaxation decreases from Time 1 (M= 5.81, SD= 2.47) to Time 2 (M= 3.81, SD= 2.34), $p = .001$, followed by increases from Time 2 to Time 3 (M= 6.74, SD= 1.63), $p < .001$, with no differences in relaxed mood levels between Time 1 and Time 3, $p = .09$. Further analyses modelling individual differences in suspiciousness variables, regarding the beliefs of not being video recorded and not being evaluated by a real jury member during the speech showed that neither of these factors accounted for any of the Time effects, all F's < 2.50, all p's > .05, all $\eta_p^2 < .09$.

c. Stress induction task effects on Physiological variables (RMSSD) in the Pilot Experiment.

The repeated-measures ANOVA with Time (Time 1: pre-stress/baseline; Time 2: stress anticipation phase; Time 3: stress task; Time 4: post-stress/recovery) as within-subject factor to test effects on HRV, supported a significant effect of Time, $F(3, 25) = 3.88$; $p = .02$; $\eta_p^2 = .32$. Post-hoc comparisons showed a reduction in RMSSD from the baseline assessment (M= 33.82, SD= 15.43) to the anticipation phase (M= 29.02, SD= 11.67), $p = .005$, remaining stable from the anticipation to the speech performance period (M= 27.76, SD= 11.55), $p = .28$, and then increasing from the speech to the recovery period (M= 35.06, SD= 16.76), $p = .004$. In the same way, there was a significant decrease from anticipation to recovery phase, p = .01. RMSSD levels at baseline and recovery were not statistically different, $p = .56$, indicating that HRV returned to baseline levels after the

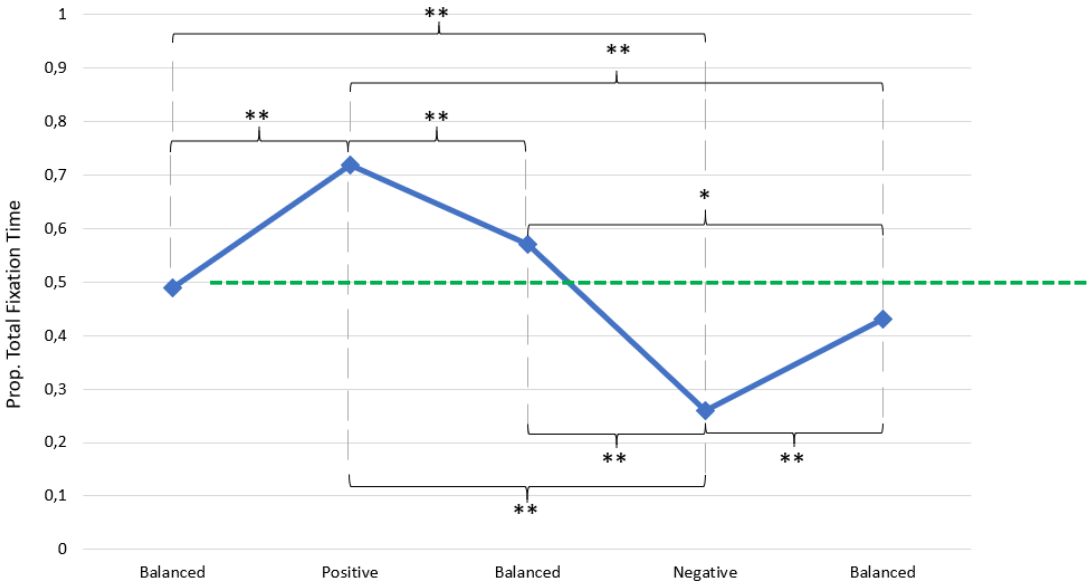
stress induction. Further analyses modelling individual differences in suspiciousness levels showed that neither of these factors accounted for the observed Time effect, both F's < 2.16, both p's > .05, both η_p^2 < .23.

d. Attention Flexibility in the Pilot Experiment.

As it is mentioned in the main manuscript, a repeated-measures ANOVA with Time (Time 1: balanced feedback; Time 2; positive feedback; Time 3: balanced feedback; Time 4: negative feedback; Time 5: balanced feedback) as within-subject factor was performed with attention as the dependent variable. The analysis supported a significant effect of Time, $F(4,25)= 29.63$; $p< .001$, $\eta_p^2= .83$. Post-hoc comparisons showed that there were context-based differences in attention to positive over negative feedback in the expected directions, reflecting by-design AAF (see Figure 8). There were increases in positive attention from Time 1 (balanced feedback) (M= .49, SD= .16) to Time 2 (positive feedback) (M= .72, SD= .17), $p< .001$, followed by decreases from Time 2 to Time 3 (balanced feedback) (M= .57, SD= .21), $p= .01$, and subsequent decreases from Time 3 to Time 4 (negative feedback) (M= .26, SD= .15), $p< .001$, lastly increasing from Time 4 to Time 5 (balanced feedback) (M= .43, SD= .17), $p= .001$. Attention at balanced feedback sections reflected balanced processing of positive and negative information, whereas attention at Time 2 was positive and significantly higher than the rest of sections, and attention at Time 4 was negative and significantly lower than the rest of sections, all *p's* < .01. In the same way, there were no differences between balance feedback phases, all p´s > .12. Further analyses modelling individual differences in suspiciousness levels

showed that neither of the two factors accounted for the observed Time effect, both F's < 0.38, both p's > .05, both η_p^2 < .01.

Figure 8. Attentional Flexibility of participants during Speech Task in the Pilot Study.



Notes. *=significant at p< .05; **= significant at p< .01; dotted line at 0.5 indicate balanced processing of positive and negative feedback (i.e., over 0.5 preferential positive processing, below 0.5 preferential negative processing).

e. *Table 5*. Descriptives and Cronbach's Alpha of each scale and subscale of the questionnaires used in the Main Experiment.

Measure	Order 1 (n= 51) M (SD)	Order 2 (n= 51) M (SD)	**Cronbach's Alpha**	t test
CESD-8	8.57(4.35)	7.02(3.89)	.84	t(100)= 1.89, p= .06
GAD-7	7.9(3.87)	7.37(4.02)	.85	t(100)= .68, p= .50
Promotion	57.33 (9.99)	58.47(11.22)	.82	t(100)= -.54, p= .59
Prevention	50.08(14.49)	47.9(12.76)	.82	t(100)= .8, p= .42
BIS Total	21.63(4.06)	21.67(3.22)	.79	t(100)= -.05, p= .95
BAS Total	39.08(3.87)	38.27(3.85)	.65	t(100)= 1.05, p= .29
BAS Drive	10.75(1.83)	10.82(1.91)	.63	t(100)= -.21, p= .83
BAS Fun Seek.	11.43(2.1)	10.94(2.17)	.68	t(100)= 1.16, p= .25
BAS Rew. Respond	16.9(1.89)	16.51(1.75)	.55	t(100)= 1.09, p= .28
RRS Brooding	12.69(3.32)	11.12(3.18)	.74	t(100)= 2.44, p= .02
RRS Reflection	12.63(3.47)	11.61(3.19)	.74	t(100)= .84, p= .17
PSWQ	49.82(14.45)	49.80(12.64)	.94	t(100)= .01, p= .99
CERQ-ACCEPT	13.43(3.18)	13.69(3.08)	.66	t(100)= -.41, p= .68
CERQ-POSREF	9.43(3.91)	9.55(4.02)	.86	t(100)= -.15, p= .88
CERQ-REAPP	14.47(4.29)	14.06(4.04)	.86	t(100)= .5, p= .62
CERQ-REFPLAN	14.98(3.85)	14.31(3.1)	.82	t(100)= .96, p= .34

Notes. CESD-8 = Center for Epidemiologic Studies – Depression Scale 8 item version; GAD-7 = General Anxiety Disorder scale; Promotion = Promotion Subscale; Prevention = Prevention Subscale; BIS Total = Behavioral Inhibition Subscale; BAS Total= Behavioral Avoidance Subscale; BAS Drive = BAS Drive Subscale; BAS Fun Seek. = BAS Fun Seeking Subscale; BAS Rew. Respond. = BAS Reward Responsiveness Subscale CERQ Accept = Acceptance; CERQ POSREF = Positive Refocusing; CERQ REAPP = Reappraisal; CERQ REFPLAN = Refocus on Planning.

f. Promotion / Prevention Scale: Psychometric Properties and Validity of the Spanish Version

We developed a Spanish adaptation of the Promotion / Prevention Scale for the present project, using a back translation procedure to adapt the original English items to Spanish language. Then, we aimed to ensure that the adapted questionnaire met the same properties in terms of factorial structure than the one from the original instrument created by Lookhood et al. (2002). An exploratory factor analysis was performed, which indicated that the best model adapted to the data from the Main Study was a 2 factors solution, loading into separate promotion and prevention scales. KMO and Bartlett tests were done and both were valid and significant, being the first one .79 (the model is valid when is higher than .7) and the second one, $X^2 = 712{,}31$ p < .01. A maximum likelihood factor analysis (with Oblimin rotation) was then conducted with all the 18 items of the Promotion/Prevention Scale, specifying the previously supported 2 factor-solution. This model accounted for 38.62% of variance and it is composed by 2 subscales of 9 items, with eigenvalues greater than 1.00 (3.44 and 3.51). The first factor is called "Promotion Subscale" and it is formed by the items 3, 5, 6, 8, 12, 14, 16, 17 and 18, with a Cronbach's alpha index of .821 in the Main study and .878 in the Pilot Study (no items had to be removed because of a non-increase of alpha index). The second factor is called "Prevention Subscale" and it is formed by the items 1, 2, 4, 7, 9, 10, 11, 13 and 15, with a Cronbach's alpha index of .817 in the Main Study and .763 in the Pilot Study (no items had to be removed because of a non-increase of alpha index). Convergent validity was met, with promotion levels being positively correlated with a theoretically convergent measure of motivational behavioral activation, and prevention levels being positively

correlated with a theoretically convergent measure of motivational behavioral inhibition. Full details of the factor analysis are reported in Table 6 below.

Table 6. Item loadings of the Promotion / Prevention Scale Items in the 2-factor solution

	FACTOR 1	FACTOR 2
Item 6: Normalmente me centro en el éxito/los logros que me gustaría conseguir en el futuro (*I typically focus on the success I hope to achieve in the future*)	**.71**	.09
Item 16: En general, me centro en conseguir que ocurran resultados positivos en mi vida (*In general, I am focused on achieving positive outcomes in my life*).	**.66**	-.1
Item 18: En general, suelo estar más orientado a conseguir éxitos que a evitar fracasos (*Overall, I am more oriented toward achieving success than preventing failure*).	**.63**	-.34
Item 14: Me veo a mí mismo como alguien que se esfuerza principalmente por alcanzar mi "yo Ideal": conseguir mis deseos y aspiraciones (*I see myself as someone who is primarily striving to reach my "ideal self"—to fulfill my hopes, wishes, and aspirations*).	**.59**	.08
Item 3: Con frecuencia imagino cómo lograré mis deseos y aspiraciones (*I frequently imagine how I will achieve my hopes and aspirations*).	**.58**	.05
Item 5: A menudo pienso en la persona que me gustaría ser idealmente en el futuro (*I often think about the person I would ideally like to be in the future*).	**.57**	.36
Item 8: A menudo pienso en la forma de lograr mis metas académicas (*I often think about how I will achieve academic success*).	**.52**	.28
Item 12: Ahora mismo, mi principal meta en los estudios es lograr éxitos académicos (*My major goal in school right now is to achieve my academic ambitions*).	**.48**	.16
Item 17: A menudo me imagino experimentando cosas buenas que espero que me ocurran (*I often imagine myself experiencing good things that I hope will happen to me*).	**.47**	-.15
Item 11: Suelo estar más orientado a evitar pérdidas que a conseguir ganancias (*I am more oriented toward preventing losses than I am toward achieving gains*).	-.26	**.78**
Item 9: A menudo me imagino experimentando situaciones negativas que me preocupa que me puedan ocurrir (*I often imagine myself experiencing bad things that I fear might happen to me*)	-.06	**.73**
Item 2: Me produce ansiedad pensar que no cumpliré con mis responsabilidades y obligaciones (*I am anxious that I will fall short of my responsibilities and obligations*).	.04	**.66**
Item 10: Con frecuencia pienso en cómo puedo prevenir los fallos en mi vida (*I frequently think about how I can prevent failures in my life*).	.28	**.57**
Item 1: En general, me centro en prevenir que ocurran sucesos negativos en mi vida (*In general, I am focused on preventing negative events in my life*).	.12	**.54**
Item 13: Ahora mismo, mi principal meta en los estudios es evitar fracasos académicos (*My major goal in school right now is to avoid becoming an academic failure*).	-.1	**.53**
Item 7: A menudo me preocupa no poder cumplir mis metas académicas (*I often worry that I will fail to accomplish my academic goals*).	-.04	**.49**
Item 15: Me veo a mí mismo como alguien que se esfuerza principalmente por convertirse en el "yo que debería ser": cumplir con mis responsabilidades y obligaciones (*I see myself as someone who is primarily striving to become the self I "ought" to be—to fulfill my duties, responsibilities, and obligations*).	.32	**.45**
Item 4: A menudo pienso en la persona que no me gustaría convertirme en el futuro (*I often think about the person I am afraid I might become in the future*).	.14	**.4**

Based on previous results supporting the hypothesized 2-factor solution, we then examined the properties of each of the two factors related to the "Regulatory Focus Theory", with the rest of the self-reported variables measured in the study. These analyses served to test different aspects of convergent and predictive validity of each motivational component. Bivariate correlations analyses were performed, whose results are summarized in Table 7.

Table 7. Bivariate correlations between promotion and prevention factors and the rest of self-reported measures in the study.

	PROMOTION	PREVENTION
PROMOTION	1	-
PREVENTION	**.284****	1
CESD	**-.289****	**.384****
GAD	.013	**.482****
BIS	.074	**.571****
BAS	**.39****	-.028
RRS BROODING	.062	**.498****
RRS REFLECTION	**.213***	.175
PSWQ WORRY	.077	**.582****
CERQ ACCEPTANCE	.067	.110
CERQ POSREF	**.252***	.005
CERQ REAPP	**.231***	-.146
CERQ REFPLAN	**.435****	.042

Notes. *=significant at p< .05; **= significant at p< .01; CESD = Center for Epidemiologic Studies – Depression Scale 8 item version; GAD = General Anxiety Disorder scale; BIS = Behavioral Inhibition Subscale; BAS = Behavioral Avoidance Subscale; CERQ POSREF = Positive Refocusing; CERQ REAPP = Reappraisal; CERQ REFPLAN = Refocus on Planning.

As for the Promotion factor, it can be seen that higher levels of promotion were related to lower depression symptomatology (r = -.284, *p* = .004), higher reward sensitivity (r = .39, *p* = .001), higher levels of reflection (r = .213, *p* = .031) and higher use of adaptative emotion regulation strategies, including "Positive Refocusing", "Reappraisal" and "Refocus on Planning" (r = .252, *p* = .01; r = .231, *p* = .02; r = .435, *p* = .001, respectively). In contrast, higher levels of prevention were associated with higher depression (r = .384, *p* = .001) and anxiety symptomatology (r = .482, *p* = .001), higher sensitivity to punishment (r = .571, *p* = .001), and higher use of maladaptive emotion regulation strategies like higher rumination (r = .498, *p* = .001) and higher worry levels (r = .582, *p* = .001).

Taking on account these results, data are in accordance with most of the predictions of the theoretical model proposed by Higgins. People with higher promotion levels, are focused on possible positive outcomes, an aspect related to higher sensitivity to reinforcement (i.e., higher BAS scores), lower levels of symptomatology and a better use of adaptative emotion regulation strategies. In contrast, people with higher prevention levels, are focused on possible negatives outcome, more specifically, avoiding them (i.e., higher BIS scores). Furthermore, higher levels of prevention were also related to higher levels of symptomatology, and the use of rumination and worry.

Previous studies have opted for only considering participants who were predominantly promotion-focused versus participants who were predominantly prevention-focused (i.e., dummy coded with high prevention – low promotion focus (vs. high promotion – low prevention focus) as reference category; van den Tooren & de Jonge, 2011). However, because we had different separate predictions for the role of

promotion and prevention SF in relation to AAF during social stress, to account for existing covariation between motivational dimensions, we modelled both SF factors and their interaction in our main ANCOVAs. When significant promotion x prevention interactions were supported, we then ran post-hoc comparisons, differentiating groups of participants with high and low scores across both types of motivational dimensions, based on median cutoff scores for each motivational dimension. Participants with values higher than the median in the promotion and prevention subscales (58 and 50, respectively) formed the High Promotion/Prevention Groups, respectively. Participants with values lower or equal than the median in the promotion and prevention subscales formed the Low Promotion/Prevention Groups, respectively. This classification supported the existence of four equally distributed groups as a function of levels for both motivational dimensions (low promotion – low prevention, n = 32; high promotion – low prevention, n = 22; low promotion – high prevention, n = 23; high promotion – high prevention, n = 25).

g. Table 8 with Motivational SF and interactions VAS Nervousness, VAS Relaxed, RMSSD and AAF.

	VAS Nervous		VAS Relaxed		RMSSD		AAF	
	F	η_p^2	*F*	η_p^2	*F*	η_p^2	*F*	η_p^2
Time	18.05***	.17	7.74***	.08	3.36*	.04	1.46	.07
Promotion	.03	.001	1.17	.01	1.29	.02	1.88	.02
Prevention	8.68**	.09	3.09+	.03	.72	.009	3.55	.04
Time X Depression	1.11	.01	2.44	.03	1.52	.02	2.16	.10
Time X Anxiety	.22	.002	.96	.01	1.91	.02	2.47	.11
Time X Feedback Order	.11	.001	.28	.003	.16	.002	77.29***	.79
Time X Promotion	1.96	.02	1.61	.02	3.32*	.04	1.04	.05
Time X Prevention	1.07	.01	.28	.003	.35	.005	1.57	.07
Time X Feedback Order X Promotion	1.99	.02	2.07	.02	.26	.003	4.00**	.17
Time X Feedback Order X Prevention	.02	.001	.15	.002	.55	.007	.32	.02
Time X Promotion X Prevention	2.25	.01	.04	.001	.49	.006	3.35*	.14
Time X Feedback Order X Promotion X Prevention	2.3	.02	1.74	.02	.5	.006	2.23+	.10

Notes. + p < .10; * p < .05; ** p < .01; *** p < .001.

Chapter 6: Study 2 - Individual differences in motivational self-focus modulate context-based affective attention flexibility toward goal-relevant information: an eye-tracking study

Overview:

Whereas the previous series of experiments in Study 1 allowed to analyze affective attention flexibility in an intra-situational manner (i.e., for emotional changes that are occurring within a constant context: i.e., social feedback during the performance of a speech), flexible attention toward relevant positive or negative information further depends on specific contextual affective goals that can be changing as contexts and their demands change. Such inter-situational affective attention flexibility underlies resilience and is also thought to be modulated by individual differences in motivational self-focuses. Thus, in Study 2, it was tested how promotion and prevention motivational SFs modulate context-based affective attention flexibility toward goal-relevant emotional information in a task that comprised changes in contexts and associated goals. A sample of 102 participants with different promotion and prevention levels completed a novel eye-tracking task, requiring switching attention toward positive or negative goal-relevant emotional information in different motivationally relevant contexts, congruent with promotion or prevention SFs. Overall, the results presented below indicated that high promotion participants showed difficulties in affective attention switching (i.e., less flexibility) in prevention but not in promotion contexts. Conversely, high prevention

participants showed difficulties in affective attention switching in promotion but not in prevention contexts. These results thus support that inter-situational contextual affective attention flexibility also depends on specific motivational SFs and can be used to study the contribution of affective attention flexibility to related processes of emotional functioning and stress regulation.

6.1. Introduction

Daily life involves behaving in different contextual environments (e.g., going to work/class in the morning, having a meal with colleagues or friends at the cafeteria, going back to work/class after lunch), which may have different associated demands and goals to fulfill (e.g., to deal efficiently with a complex work assignment - to feel calmed -, to disconnect and have a relaxed time with others - to feel happy -, to anticipate new potentially problematic work demands and elaborate a plan to address them in advance - to avoid feeling nervous -, respectively). The ability to flexibly shift cognitions and associated behaviors between these changing contexts and their associated affective goals is thus another crucial aspect of flexibility to develop adaptive responses to life stressors (Fresco et al., 2006). Specifically, adaptive functioning is thought to rely on an optimal balance between focusing on current mental-sets (cognitive stability) and shifting and updating mental-sets when the contextual demands change (cognitive flexibility; see Goschke & Bolte, 2014). Therefore, understanding the mechanisms supporting cognitive flexibility for efficient contextual goal maintenance or shifting both within and across situations is of high relevance to promote efficient context adaptation and stress regulation (e.g., Bonanno & Burton, 2013; Pruessner et al., 2020).

6.1.1. Affective attention flexibility for contextual goals

Among those mechanisms, as already discussed, selective attention is thought to be key for the flexible processing of relevant affective information across contexts and thus to influence optimal affective functioning (Gross, 2015; Gross & Thompson, 2007). For instance, some studies have shown that the momentary modulation of attention to temporarily maximize the processing of positive information (Sanchez et al., 2014) and/or reduce the processing of negative information (Sanchez et al., 2013; Sanchez, Romero, et al., 2017) may be instrumental for the downregulation of negative moods. However, attention towards negative or positive information may not be inherently adaptive or maladaptive in nature (Kashdan & Rottenberg, 2010), but depend on specific contextual demands and associated affective goals (Godara et al., 2020). As previously reviewed, to test this, Godara and colleagues (2020) developed a novel eye-tracking paradigm, in which participants must direct their attention as quickly as possible to the most adaptive emotional information (i.e., either positive or negative faces), depending on the momentarily active contextual goal in each trial (e.g., the distal goal "enjoy the party" associated to the proximal goal "attend to positive faces to feel well" or "avoid getting sick from eating bad food" associated to the proximal goal "attend to negative faces to avoid feeling sick", respectively, within a context comprising a dinner with colleagues). Further, contexts were repeated or changed across trials to other relevant contexts, prompting to activate other series of affective goals across contexts.

Using this paradigm, Godara et al. (2020) showed that dysphoric individuals had a clear facilitation (i.e., were more flexible) in switching attention towards negative but not toward positive goals. The opposite pattern was found for non-dysphoric individuals,

who became more adept (i.e., flexible) at switching attention towards positive goals but not toward negative goals. Therefore, facilitated processing of negative or positive information emerged as a function of individual differences in dysphoric mood levels. In a similar vein, conceptual models of cognitive flexibility (e.g., Goschke & Bolte, 2014) posit that not only affective but also motivational factors may modulate context-based flexible processing. As such, this Chapter present a study aimed to establish whether specific processes of affective attention flexibility, as measured by Godara et al. (2020), are furtherly modulated by related SF motivationally relevant factors.

6.1.2. Affective attention flexibility as a function of motivational self-focuses

The Regulatory Focus Theory (Higgins, 1997, 1998), as commented before, defines a series of motivational dimensions that may help to account for facilitated affective attention flexibility under different types of contexts and associated affective goals. The framework postulates that the coordination of psychological processes guiding context-based behaviors depends on the differential activation of promotion and prevention motivational SFs and their corresponding associated affective goals (Higgins, 1997). Therefore, the activation of a given motivational SF promotes a different type of self-regulation. A promotion SF would thus guide attention to preferentially process emotional information that promotes affective states in a cheerfulness-dejection emotional continuum, related to achieving certain positive goals, rewards or aspirations (i.e., feeling happy, not feeling sad; Higgins, 1997, 1998). In contrast, a prevention SF would be expressed by a selective attention towards emotional information that supports affective states in a quiescence-agitation emotional continuum, related to goals of protection, security and avoidance or termination of possible negative outcomes or punishments (i.e.,

feeling calmed, not feeling nervous; (Higgins, 1997, 1998, 2012). Initial evidence from Shah & Higgins (2001) supports these assumptions, showing that individuals with higher levels of promotion were faster in a reaction time task in appraising information within cheerfulness-dejection categories, whereas individuals with higher levels of prevention were faster in appraising information within quiescence-dejection categories.

Thus, previous findings support a preferential focus and efficient processing of motivationally congruent information for each type of SF (Shah & Higgins, 2001). The preferential activation of promotion or prevention SFs could therefore influence affective attention flexibility, modulating the way that goal-relevant information is selectively attended and efficiently processed (Klenk et al., 2011). However, to date, it remains to be tested whether such specific facilitations of processing are supported by a higher affective attention flexibility for specific motivationally-relevant information that is congruent with each specific SF (i.e., higher promotion SF relating to higher flexibility in contexts activating proximal goals within the cheerfulness-dejection continuum; higher prevention SF relating to higher flexibility in contexts activating proximal goals within the quiescence-agitation continuum).

6.1.3. The present study

The aims of this study thus were: 1) to evaluate affective attention flexibility (i.e., maintenance vs. switching in attention toward positive and negative goals) across different contexts activating affective goals that were motivationally promotion (contextualized around an emotional continuum of cheerfulness-dejection affective states) or prevention-oriented (contextualized around an emotional continuum of quiescence-agitation affective states), and 2) to test how inter-individual differences in

promotion and prevention SF influence efficient attention flexibility to those context-based affective goal changes. For these purposes, a novel variant of the eye-tracking task developed by Godara et al. (2020) was created, where affective attention flexibility was assessed across contexts with affective goals reflecting different promotion or prevention orientations.

In line with previous research on selective processing of motivationally relevant information as a function of motivational SFs (Shah & Higgins, 2001), we expected that context-based affective attention flexibility towards promotion and prevention goals would be influenced by individual differences in motivational SFs. In the affective attention flexibility task used in this study (fully described below), changing between goals across trials required switching attention toward new information and, therefore, by design more time was typically required to direct gaze towards new information in switching goal trials than towards repeated information in repeating goal trials (see Godara et al., 2020). Based on this design, we hypothesized that such general attentional cost effect would be reduced (i.e., reflecting facilitated attention flexibility) for specific motivational contexts of the task (i.e., promotion or prevention contextual affective goals) that were congruent with the primary active motivational SF of the individuals (i.e., promotion or prevention SF individual levels, respectively). Thus, we expected that the attentional cost would be reduced for high promotion participants in the promotion context, reflecting facilitated affective attention flexibility, in a motivationally-congruent promotion context (Hypothesis 1a), but not in a motivationally-incongruent prevention context (Hypothesis 1b). Conversely, we expected that the attentional cost would be reduced for high prevention participants, reflecting facilitated affective attention

flexibility, in a motivationally-congruent prevention context (Hypothesis 2a), but not in a motivationally-incongruent promotion context (Hypothesis 2b).

6.2. Method

6.2.1. Participants

A sample of 102 undergraduates (81 female, mean age = 20.9 years old) took part in the study. Sample size was determined through a priori power analyses using GPower 3.1.9.2, based on estimated expected effects sizes for three-way Context x Goal x Group interactions according to previous work with this attention task (Godara et al., 2020). Setting α at .05, power (1—β) at .80, expecting small-to-medium effect size of Cohen's *d* = .37, and controlling for two covariates (i.e., depression and anxiety levels, see below), a sample size of 97 participants was estimated to yield adequate power to detect the expected effect size on the three-way interactions relevant to our hypotheses.

Eleven participants (10.8% of the sample) were excluded for the final analyses due to non-valid gaze data (i.e., no gaze positions recorded, n= 6; or gaze data not reflecting valid fixation data of at least 100 ms and 1 radius degree recorded, n= 5; see further details of the design below) in at least one of the attention indices of the attention task. The final sample thus comprised 91 participants. Participants provided written informed consent before their participation. All participants had normal or corrected-to-normal vision and received course credits for their participation. The study was conducted in accordance with the Declaration of Helsinki and it was approved by the Faculty Ethical Committee.

6.2.2. Materials

6.2.2.1. Questionnaires

The *Promotion/Prevention Scale* (Lockwood et al., 2002) was used to measure motivational SFs. As described in the previous Chapter, it is an 18-item instrument, designed to assess habitual activation of motivational self-regulation focuses of promotion and prevention. The questionnaire consists of two subscales, each one based on one of the motivational SF dimensions. All items, 9 per subscale, are answered using a 9-point Likert scale ranging from "Not at all true of me" to "Very true of me". The Promotion/Prevention scale has demonstrated a high internal consistency, both for the Promotion and for the Prevention subscales (Lockwood et al., 2002). In the current study, the consistencies were high, being 0.82 for both subscales. Further control of individual levels of depression and anxiety symptoms were controlled as covariates in the study, being assessed as follows.

The *Center of Epidemiological Studies-Depression* (CESD-8; Radloff, 1977) was used to measure depressive symptom levels experienced during the last week. The questionnaire consists of 8 items rated using a 4-point Likert scale ranging from "none or almost none of the time" to "all or almost or all of the time". The CESD-8 has shown high internal consistency in previous studies (Van de Velde et al., 2010). In the current study, internal consistency was good (α= 0.84).

The *General Anxiety Disorder scale* (GAD-7; Spitzer et al., 2006) was used to assess anxiety symptom levels experienced during the last two weeks. The questionnaire consists of 7 items rated using a 4-point Likert scale ranging from "Not at all" to "Nearly

every day". Internal consistency of the questionnaire is very high (Garcia-Campayo et al., 2010). In the current study, internal consistency was good (α= 0.85).

6.2.2.2. Apparatus

A Tobii Tx-120 infrared eye-tracker was used to measure participants' eye movements at a frequency of 120 Hz, following the procedure and methodological characteristics as described for the series of studies of the previous Chapter. Tobii Studio software was used to extract raw eye movement data to compute first fixation reaction time indices, indicating the time elapsed since the stimuli appearance to make the "first fixation on a goal-relevant stimulus". Visual fixations were defined and computed based on the Tobii I-VT Fixation Filter algorithm, defined as a minimum duration of 100 ms and a maximum fixation radius of 1 degree.

6.2.2.3. Affective Attention Flexibility Task

Stimuli. As in Godara et al. (2020), all emotional stimuli were extracted from the Karolinska Directed Emotional Faces (KDEF; Goeleven et al., 2008) and Radboud Faces Database (RaFD; Langner et al., 2010). KDEF stimuli were selected based on representative scores of valence in KDEF (Caucasian, Adult, Frontal subset), with sixty pictures of negative categories (angry, disgust, sad and fearful emotions; $M_{Negative}$ = 5.74, $SD_{Negative}$ = 1.70) and thirty-seven pictures of the positive category (happy emotion; $M_{Positive}$ = 6.10, $SD_{Positive}$ = 1.63), and controlling for equal levels of arousal ($M_{Negative}$ = 3.61, $SD_{Negative}$ = 1.81; $M_{Positive}$ = 3.72, $SD_{Positive}$ = 1.91). Similarly, based on representative scores for valence in the RaFD (Caucasian, Adult, Frontal subset), the stimuli set in the task was completed with forty-three negative category (fearful, disgust and angry emotions; $M_{Negative}$ = 2.03, $SD_{Negative}$ = 0.20) and twenty-five positive category (happy

emotion; $M_{Positive}$ = 4.20, $SD_{Positive}$ = 0.30) stimuli, with equal levels of arousal ($M_{Negative}$ = 4.10, $SD_{Negative}$ = 0.33; $M_{Positive}$ = 4.10, $SD_{Positive}$ = 0.04). As for the contexts used in the task, based on Godara et al. (2020), two context images were selected and associated with descriptive context texts (see Figure 9 below). Context images were selected from Google Images, that were marked as "Labeled for reuse" and "Labeled for noncommercial reuse".

Task. To make the task as ecologically valid as possible, contexts comprised social situations that undergraduates encounter in their daily life. The two textual contexts and images were chosen to represent a "party with friends" and a "presentation at the university" (see Figure 9 for further details). The combination of textual and visual information was used to generate informative relevant contexts where participants could immerse themselves. Unlike Godara et al. (2020), contexts were designed to be specifically relevant to motivational promotion or prevention SFs. Thus, the "party with friends" context was designed to be identified from a promotional perspective (affective goals related to an emotional continuum between cheerfulness-dejection), whereas the "presentation at the university" context was designed to be identified from a prevention perspective (affective goals related to an emotional continuum between quiescence-agitation; Higgins, 1997;1998).

Figure 9. Context and goal combinations used in the Attention Flexibility Task.

Context	Goal	Context Image
"Party with Friends" To enjoy the party, it is best to look at those of my friends who seem to be having a good time. To resolve a conflict/problem with my friends and not feel bad about it, it is best to pay attention to those who seem sad or upset.	 (Promotion Goal to Positive Information) (Promotion Goal to Negative Information)	
Cheerfulness ⟷ Dejection		
"Presentation at the University" To be calm and feel safe during my presentation, it is best to look at those of my colleagues who have more positive expressions. In order not to get nervous, it is best to quickly resolve questions that may arise during my presentation, looking at those of my colleagues who have more negative expressions.	 (Prevention Goal to Positive Information) (Prevention Goal to Negative Information)	
Quiescence ⟷ Agitation		

Each context had two different associated distal goals, associated with a proximal goal of either directing attention to positive or negative information in the ongoing environment. In the context "party with friends" (i.e., promotion context), one distal goal

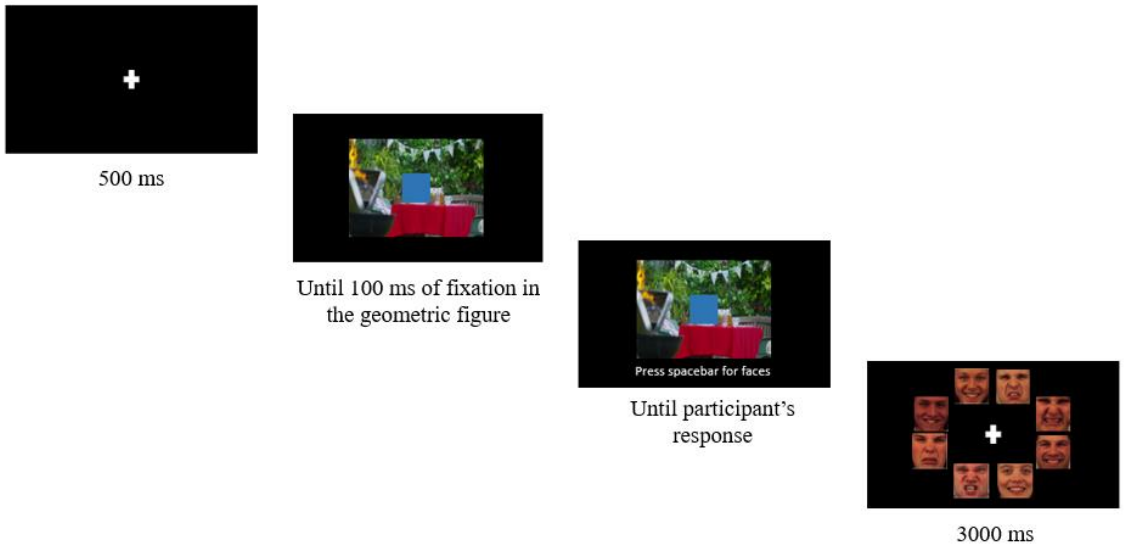
prompted to focus on enjoying the party to feel happy, activating a proximal goal of looking to positive stimuli, whilst the other distal goal prompted to focus on resolving a conflict with friends to not feel sad, activating a proximal goal of looking on negative stimuli. In the context “presentation at the university” (i.e., prevention context), a similar procedure was followed, in such a way that there was a distal goal prompting to feel calm and safe during the presentation, activating a proximal goal of looking to positive stimuli and another distal goal prompting not to get nervous by quickly resolving questions that may arise from the audience, activating a proximal goal of looking at negative stimuli. Every goal had an associated geometric figure (blue square or blue circle), indicating which goal had to be activated in that particular context for that specific trial. The blue square figure in the context “party with friends” was associated with the positive goal, while the blue circle figure was associated with the negative one. In the context "presentation at the university", the order was reversed, associating the blue circle to the positive goal and the blue square to the negative one. This counterbalancing procedure was implemented to avoid the possibility of simply associating a specific figure with an emotional component in every context. Therefore, we could assure that participants processed the combination of context-goal-emotional components in every trial of the task.

The task consisted of 64 trials. Each trial started with a fixation cross in the center of the screen for 500 ms. After this, one of the context images (“party with friends” or “presentation at the university”) appeared with one of the geometric figures (“blue square” or “blue circle”) in the center of the image, indicating the specific goal in that trial. This combination was presented on the screen during 3000 ms, and participants had to direct

their eye-gaze in the figure for at least 100 ms, before a text ("Press Spacebar for faces") appeared, giving participants the possibility to continue with the task. Participants could look at that screen (with the context image, the associated goal figure, and the text) as long as they needed to remember the correct response (e.g., "party with friends" + blue square = enjoy the party and look to positive faces). Participants were asked not to continue with the task until they were sure about their answer and to keep watching the figure until pressing the spacebar. When participants pressed the button, once a visual fixation in the center of the screen was detected by the eye-tracker, 8 emotional faces (4 positive and 4 negative) appeared around the center of the screen and participants had to direct their eye-gaze/attention, as quickly as they could, to the correct goal-relevant emotional stimuli, depending on the combination of the context image and goal figure. Each trial ended after 3000 ms of free viewing of emotional faces (see Figure 10).

The design of the task was pseudorandomized, having the same number of repeat/switch context and goal changes across trials. The trial sequence was adapted from Godara et al. (2020), with the same number of trials for each Context Type (Promotion, Prevention) x Context Condition (Repeat, Switch) x Goal Type (Positive, Negative) x Goal Condition (Repeat, Switch) combination: repeat context-repeat goal to positive, repeat context-repeat goal to negative, repeat context-switch goal to positive, repeat context-switch goal to negative, switch context-repeat goal to positive, switch context-repeat goal to negative, switch context-switch goal to positive and switch context-switch goal to negative.

Figure 10. Schematic of each trial sequence in the Attention Flexibility Task.



*Attention Indices***.** The "First Fixation to goal-relevant emotion" was defined as the attention dependent variable (i.e., time elapsed since the onset of the faces' appearance until a valid visual fixation is detected within any of the pre-established goal-relevant emotion faces, i.e., positive or negative, in each trial). This variable was first obtained for each of the 64 trials, indicating the speed at which participants were able to look at the goal-relevant faces (either positive or negative), depending on the given context image and associated goal-figure in each trial. Reaction times shorter than 100 ms in the first fixation variable were removed. The remaining first fixation RT data were averaged for each context-goal condition: motivational context type (party or presentation), context condition (repeat-switch context), goal type (positive, negative), and goal condition (repeat-switch goal). Following our hypotheses, we were interested in the effects of individual differences in motivational SF dimensions on Context Type x Goal Condition interactions. Consequently, internal consistencies were computed for the relevant indices under study, with Cronbach's alphas reflecting good reliability for all of them: Promotion

context – goal repeat: α= .60; Promotion context – goal switch: α= .67; Prevention context – goal repeat: α= .72; Prevention context – goal switch: α= .75.

2.3. Procedure

Participants first completed an online survey including self-report questionnaires (i.e., assessments of depression, anxiety and motivational SFs), together with the fulfillment of a digital informed consent. The day immediately after, participants performed the individual experimental session. They were first instructed about the attention task they had to perform, and they were given all the time they needed to learn the different context image x goal figure combinations. After this, a practice phase was completed to ensure all combinations were adequately remembered, followed by the eye-tracking calibration test. Participants then completed the actual affective attention flexibility task and finished performing a final knowledge check test to re-ensure that all context image x goal figure combinations had been adequately activated during the performance of the task. No participant showed problems in learning the procedure and completing the task according to the learned context x goal combinations.

6.3. Results

Mean, standard deviation and Cronbach's alpha for each variable are shown in Table 9.

Table 9. Mean, standard deviation and Cronbach´s alpha of the variables in the study.

Variable	Mean (*SD*)	Cronbach's Alpha
Age (years)	20.97 (2.55)	
Sex (percentage of female participants)	79.1%	
Depressive symptom level, CESD-8 (range 0 to 24)	7.85 (4.23)	.84
Anxiety symptom level, GAD-7 (range 0 to 21)	7.57 (3.84)	.85
Promotion SF level (range 9 to 81)	57.75 (10.52)	.82
Prevention SF level (range 9 to 81)	48.95 (14.05)	.82

Notes. CESD-8 = Center for Epidemiologic Studies - Depression Scale 8 item version; GAD-7 = General Anxiety Disorder scale; SF = Self-focus

Preliminary correlation analyses were conducted to test the relations between the self-reported measures in the study. Correlation analyses showed that promotion and prevention SF levels were positive and significantly correlated ($r = .284$; $p < .01$) Further, promotion SF was negative and significantly correlated with depressive symptom ($r = -.289$; $p < .01$) but not anxiety symptom levels ($r = .01$; $p = .89$). In contrast, prevention SF was positive and significantly correlated with both depressive symptom ($r = .384$; $p < .001$) and anxiety symptom levels ($r = .482$; $p < .001$). Given this medium level of covariance between SF levels and emotional symptom levels, and with the aim of evaluating unique modulatory effects of each motivational SF in affective attention flexibility processes, depressive and anxiety symptom levels were included as covariates in the main analyses.

In order to test our hypotheses, the main analyses thus comprised a 2 (context type: promotion, prevention) x 2 (context condition: repeat, switch) x 2 (goal condition: repeat, switch) x 2 (goal type: positive, negative) x 2 (promotion SF level) x 2 (prevention SF level)[3] mixed analysis of covariance (ANCOVA) with the indices based on "first fixation on goal-relevant emotion" as dependent variables, while controlling for depression and anxiety levels as covariates [4]. The between-subject factors were promotion and prevention SF levels, whereas context type, context condition, goal condition and goal type were the within-subject factors.

Table 10 shows the full set of main and interaction effects in the model that are relevant to our hypotheses (i.e., "context type" x "goal condition" x "SF levels"). No other motivational SF-based effects were expected for other types of interactions within the model (e.g., specific attentional costs for positive vs. negative information processing, without considering motivational contexts and active goals) and thus these effects are merely exploratory.

Results showed a main effect of "goal condition", $F(1, 85) = 10.51$, $p = .002$, $\eta_p^2 = .11$. This main effect was qualified by two significant three-way interactions: "context type" x "goal condition" x "promotion SF level", $F(1, 85) = 4.71$, $p = .03$, $\eta_p^2 = .05$, and

[3] The analyses reported in the main manuscript consider motivational groups, as created based on median split of the 102 participants in each SF variable. Participants with values higher than the median in the promotion and prevention subscales (58 and 50, respectively) formed the High Promotion/Prevention Groups, respectively. Participants with values lower or equal than the median in the promotion and prevention subscales formed the Low Promotion/Prevention Groups, respectively.
[4] Depression and anxiety symptomatology levels were included as covariates in the model to control for their possible confounding effects in attention flexibility performance in the task, as evidenced by Godara et al. (2020), and in general emotional attention preferences toward negative vs. positive information, as extensively evidenced in previous research (e.g., Armstrong & Olatunji, 2012).

"context type" x "goal condition" x "prevention SF level", $F(1, 85) = 5.15$, $p = .03$, $\eta_p^2 = .06$. Based on these interactions, the specific hypotheses were tested through post-hoc analyses.

Table 10. Main relevant results from the repeated measures ANCOVA.

	Time to First Fixate on relevant stimuli	
	F	η_p^2
Depression Symptoms	.9	.01
Anxiety Symptoms	.06	.001
Context Type	1.06	.012
Context Type x Promotion	0.132	.002
Context Type x Prevention	2.58	.029
Goal Condition	10.51**	.11
Goal Condition x Promotion	0.274	.003
Goal Condition x Prevention	0.159	.002
Context Type x Goal Condition	3.69	.04
Context Type x Goal Condition x Promotion	4.71*	.05
Context Type x Goal Condition x Prevention	5.15*	.06

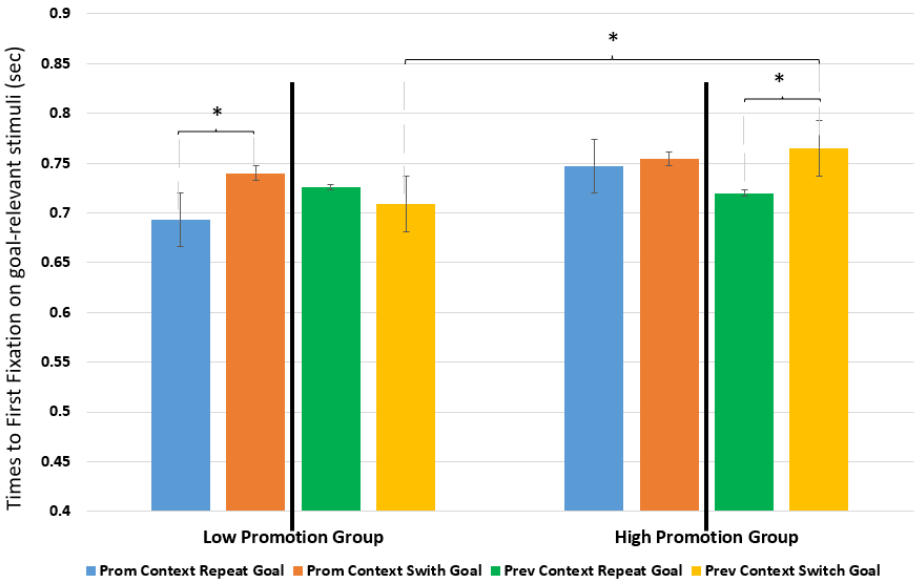
Notes. * $p < .05$; ** $p < .01$; η_p^2 = partial eta square

6.3.1. Hypotheses 1: Affective attention flexibility as a function of promotion SF levels.

In terms of between-group comparisons, post-hoc follow-ups of the context type x goal condition x promotion SF level interaction showed a significant difference between high and low promotion SF individuals for the goal switch condition in the prevention context. Specifically, when participants had to switch goals in the Prevention Context ("presentation at the university"), low compared to high promotion SF participants were able to fixate faster on the goal-related faces, $F(1, 85) = 4.13$, $p = .04$, $\eta_p^2 = .05$. The rest of the between-group comparisons were not significant, all F's < 3.3; p's > .07; $\eta_p^2 < .04$.

As for within-group comparison, results indicated that low promotion SF participants had no difficulties for goal switching (i.e., no differences in first fixation times in the repeat vs. switch goal conditions), in the Prevention Context ("presentation at the university"), $F(1, 85) = .78$, $p = .38$, $\eta_p^2 = .009$, but they had difficulties (higher times to first fixate goal-relevant stimuli in switch vs. repeat conditions) in the Promotion Context ("Party with friends"), $F(1, 85) = 4.7$, $p = .03$, $\eta_p^2 = .05$. As for high promotion SF individuals, they had no difficulties in goal switching (i.e., no differences in first fixation times in switch vs. repeat goal conditions) in the Promotion Context ("party with friends"), $F(1, 85) = .09$, $p = .76$, $\eta_p^2 = .001$, but they had difficulties (i.e., longer fixation times in goal switch vs. goal repeat conditions) in the Prevention Context ("presentation at the university"), $F(1, 85) = 4.32$, $p = .04$, $\eta_p^2 = .05$ (see Figure 11).

Figure 11. Between and within-group differences depending on promotion SF levels in goal switching in both contexts (Promotion Context = "party with friends" on the left, and Prevention Context = "presentation at the university" on the right).



Notes. Prom = Promotion; Prev = Prevention; *= significant at $p < .05$

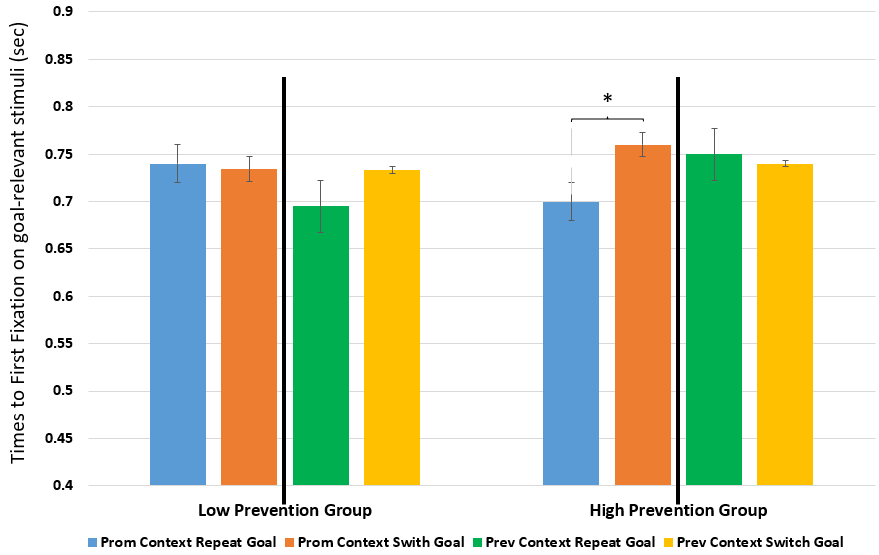
6.3.2. Hypotheses 2: Attention flexibility as a function of prevention SF level.

In terms of between-group comparisons, post-hoc follow-ups of the significant context type x goal condition x prevention SF level interaction did not reveal significant between-group differences between prevention SF level groups, all F's < 3.3; *p*'s > .07; $\eta_p^2 < .04$.

As for within-group comparisons, in the case of individuals with low prevention SF levels, they did not show attentional costs associated with the change of goals (i.e., higher times to first fixate goal-relevant stimuli in switch vs. repeat conditions) in the promotion context, $F(1, 85) = .7$, $p = .79$, $\eta_p^2 = .001$, or in the prevention context, although in this case there was a congruent marginally significant trend, $F(1, 85) = 3.13$,

p= .08, η_p^2 = .04. As for participants with high prevention SF levels participants required significantly more time for goal switching vs. repeat in the Promotion Context ("party with friends"), $F(1, 85) = 6.42$, p= .01, η_p^2 = .07, but these differences were not found in the Prevention Context ("presentation at the university"), $F(1, 85) = .22$, p= .64, η_p^2 = .003[5] (see Figure 12).

Figure 12. Between and within-group differences depending on prevention SF levels in goal switching in both contexts (Promotion Context = "party with friends" on the left, and Prevention Context = "presentation at the university" on the right).



Notes. Prom = Promotion; Prev = Prevention; *= significant at p < .05

[5] Further analyses considered specific comparisons between repeat vs. switch goal trials, for each stablished hypothesis (high promotion SF in promotion context, high prevention in prevention context), differentiating conditions of context repetition and context switch for each type of context. In both cases, the hypothesized flexibility effects (i.e., lack of general cognitive cost observed for repeat vs. switch for high promotion individuals in promotion contexts, for high prevention individuals in prevention contexts) was found in both context repetition and context switch conditions, all F's < .66, all p's > .42, all ŋp2 < .008. However, separate analyses of the Context Type x Goal Condition x SF interactions when the data were restricted to only context repetition trials did not support significant interaction effects in specific occasions of repetition of context: F's < 2.56, all p's > .11

6.4. Discussion

The main aim of this study was to test whether context-based affective attention flexibility is influenced by individual differences in promotion and prevention motivational SFs. For this purpose and based on the task developed by Godara et al. (2020), we developed a variant of this affective attention flexibility task that allowed to assess the ability to switch attention between emotional goals across specific motivationally-relevant contexts. Contexts represented ecological social naturalistic situations and were manipulated to be interpreted according to motivational SFs defined in Higgin's theory (1997, 1998), thus generating a promotion context (expressed in terms of goals related to cheerfulness-dejection) and a prevention context (expressed in terms of goals related to quiescence-agitation).

First, in line with Godara et al. (2020), a general attentional cost was evidenced in switch compared to repeated goal trials. Thus, participants needed more time to fixate the given goal-relevant emotional face type when there was a goal change compared to when the goal was repeated. As expected, this effect was modulated by differences in the type of context (i.e., promotion, prevention) and individual differences in motivational SFs. In line with our hypotheses, results indicated that participants characterized by a predominant activation of different motivational SFs (i.e., promotion or prevention) were more flexible, based on the velocity needed to first attend (fixate) the goal-relevant stimuli in each trial, specifically in the context that was congruent with their habitual motivational SF. High promotion participants did not show significant differences (i.e., attentional costs) between the trials with repetitions of goals and those in which there was a change of goals in the motivationally-congruent promotion context (i.e., for context-based

affective goals related to “feeling happy” or “not feeling sad”), showing facilitated affective attention flexibility in this context. In contrast, high promotion participants showed significant differences between repeat and switch trials in the prevention context, where they needed more to fixate the goal-relevant stimuli when there was a goal switch compared to when the goal was repeated. Conversely, high prevention participants showed the reversed pattern. In this case, results indicated that, in the prevention context (i.e., for context-based affective goals related to “feeling calmed” or “not feeling nervous”), high prevention participants did not show significant differences in the time needed to first attend (fixate) the goal-relevant stimuli in the conditions with repeated goals and change of goals, showing facilitated affective attention flexibility in this motivationally congruent context. In contrast, in the promotion context, the times to first fixate on goal-relevant stimuli of high prevention participants were longer in the condition of goal change compared to the condition of goal repeat. Current data suggests that the capacity to flexibly adjust attention to affective goals within different types of motivationally relevant contexts is modulated by the predominantly active motivational SF of the individuals. When there was congruence between the habitual motivational SF and the ongoing motivational context, participants were able to switch affective goals efficiently, as evidenced by facilitated affective attention flexibility in those specific contexts. These results are in line with previous findings reported by Shah & Higgins (2001), who found that participants with a predominantly active promotion SF were more efficient (i.e., faster) in appraising contextual objects and their own emotions in terms of cheerfulness-dejection, which is the emotional continuum associated with this promotion SF, whereas participants characterized by a predominantly active prevention SF were

more efficient in appraising contextual objects and their own emotions in the prevention-based quiescence-agitation emotional continuum. The present findings suggest that motivational SF not only facilitate affective processing of specifically congruent motivational contexts but that one mechanism for such contextual efficiency in processing can be a facilitated context-based affective attention flexibility.

Results from this study support the relevance of studying affective attention as a context-based dynamically changing process. Unlike previous studies in which attention towards positive and negative information are studied through general free viewing paradigms, without considering the role of contextual variables (Armstrong & Olatunji, 2012), the study of context-based affective attention flexibility allows for a deeper investigation of temporally adaptive patterns of information processing that may causally contribute to efficient stress management and emotion regulation (Godara, Sanchez-Lopez, Baeken, et al., 2021; Sanchez, Romero, et al., 2017). General individual differences in biased cognitions (i.e., tendencies to preferentially attend, interpret and remember specific affective information) has been shown to causally influence (dys)functional emotion regulation processes (e.g., Joormann & Vanderlind, 2014). However, current research on stress and emotion regulation highlights how context is an essential variable to adequately understand of the mechanisms allowing for flexible use of regulatory behaviors (Aldao et al., 2015; Bonanno & Burton, 2013; Sanchez-Lopez, 2021). Methods such as the one developed by Godara et al. (2020) and its adaptation in the current study are well-suited to study the flexible modulation of affective attention processes as a function of time-varying contexts and associated affective goals, and therefore to test their role as proximal mechanisms of emotion regulation flexibility.

Future research should thus investigate whether enhanced affective attention flexibility for contexts that are congruent with a given emotional state and/or a given motivational SF supports more efficient motivationally-relevant goal fulfillment (e.g., gains' achievement or promotion of happy moods vs. loss' avoidance or prevention of anxious moods), depending on specific contextual demands (see, for instance, Sanchez-Lopez, 2021). With that idea, in the following Chapter Study 3 was designed to test how these forms of contextual and affective attention flexibility accounted for fluctuations in affective states ecologically, during daily life functioning, at different daily life situations prompting different types of demands. Recent frameworks (Scholer et al., 2019) argue that an approach motivation may not always be beneficial, just as an avoidance motivation may not always be dysfunctional in every context. Therefore, future research should not only study the adaptiveness of motivationally-based mechanisms of flexible processing but also extend the knowledge on when and how they can turn dysfunctional. Such studies may help to establish, for instance, whether contextual affective inflexibility contributes to elevated stress vulnerability in the form of increased depression and/or anxiety risk (English et al., 2017; Klenk et al., 2011; Millgram et al., 2019).

Context-based affective attention flexibility is a relatively new conceptualization aimed to better understand individual variability in affective functioning. This framework thus needs to be extended with further research to establish the implications of attention flexibility in information processing for consequent emotion regulation flexibility, in line with current proposals (e.g., Bonanno & Burton, 2013; Coifman & Bonanno, 2010; Godara et al., 2020). Therefore, next steps in the field should consider the cognitive, emotional or psychophysiological consequences that context-based affective attention

flexibility has for individuals with different affective and motivational characteristics, such as the predominance of specific motivational promotion or prevention SF. In addition, research can benefit from the development of new experimental manipulations to improve the flexible component of context-based affective attention, in order to test whether this generates improvements in the effectiveness to interpret and process different contextual demands (for example, when changing goals within and across contexts) and/or reducing difficulties in the flexible processing of emotional information (e.g., difficulties in attentional disengagement from negative material in individuals with depression, Sanchez et al., 2013; Sanchez, Romero, et al., 2017). In line with this, as previously mentioned, Godara, Sanchez-Lopez, Baeken, et al. (2021) recently developed an affective attention flexibility training through a task focused on goal changes between contexts applying music reinforcements based on the contextually active emotional goal. Using this approach, trainees demonstrated increased affective attentional flexibility and were able to maximize attention to positive or negative information depending on the active goals in a stress task comprising context-based goal changes. Therefore, the final Empirical chapter, Study 4 was designed to integrate a new form of affective attention flexibility training integrating new knowledge on the role of motivational SFs for its modulation and application in emotionally disordered individuals.

In sum, results from Study 2 may inform new venues of future research. They were established with sufficient statistical power to test our main hypotheses concerning 3-way interactions and were based on reliable attention indices using a novel eye-tracking task. Yet, these findings should be considered with caution due to certain limitations. First, the sample was composed mainly of women, and further research should extend the study

of context-based affective attention flexibility to more balanced samples and heterogeneous populations. Moreover, despite that our hypotheses were tested based on planned contrasts of 3-way interactions, they implied multiple comparison analyses that could generate an inflation of risk for type 1 error. In addition, the main results should be interpreted with certain caution since the supported flexibility phenomena found did not seem to be specific for conditions were the motivationally-relevant context for each type of SF remained constant (i.e., conditions of repeat context). The hypothesized flexibility effects (i.e., lack of general cognitive cost observed for repeat vs. switch for high promotion individuals in promotion contexts, for high prevention individuals in prevention contexts) was found in both context repetition and context switch conditions. Further Context Type x Context Condition x Goal Condition x SF interactions were not significant, which might be due to a lack of statistical power to test additional 4-way interactions. Moreover, separate analyses of the Context Type x Goal Condition x SF interactions when the data were restricted to only context repetition trials did not support significant interaction effects in those specific occasions of repetition of context. Thus, our findings do not fully clarify whether the observed faster responding on the corresponding relevant trials for each type of SF may have occurred because participants high in the corresponding SF were faster to adopt the new task-set within specific contexts, and/or because they had faster disengagement of task-sets across contexts. For all these reasons, future studies are warranted to replicate the present results, also extending our set of planned contrasts, in order to clarify the specificity of SF-related flexibility patterns in larger samples. Furthermore, although former evidence supports that individuals tend to differ in the type of motivational SF they predominantly activate across situations

(Higgins, 1997; Klenk et al., 2011), the interpretation and processing of specific contexts is affected by the characteristics of the own situation. In our study, we experimentally manipulated such contexts in a way that interpretations and related affective goals were pre-established and matched to specific types of SF. Yet, to fully understand the interplay between motivational factors, contexts and goal-related affective processing, the evaluation of motivation as a trait is only an initial step, and further research integrating state measures of these variables is warranted (e.g., naturalistic momentary motivational SF activation during daily life through ESM studies). Moreover, despite the use of ecologically relevant motivational contexts in our study, they were framed into the performance of an experimental task. Whereas this is a necessary step to understand affective attention flexibility under controlled conditions, the future study of the interplay of motivation and attention within and across contexts could benefit of also using other types of assessment techniques such as ecological momentary assessment procedures (see, for instance, Shiffman et al., 2008). These methods would allow to further assess temporal changes in motivation SF states as well as the associations of different forms of affective attention flexibility with momentary affective functioning, as it unfolds across different contexts during daily life functioning, and thus were the focus of the subsequent empirical Study 3 presented in the following Chapter.

6.5. Conclusion

Overall, this current study opens a series of new avenues for the study of context, motivation and attention flexibility. Our results provide initial support for the hypotheses that motivation (based on the activation of different types of promotion and prevention motivational SF) can influence contextual affective attentional flexibility. Taken together,

these findings may help to better understand the functioning of affective attentional flexibility, considering the importance of motivational individual differences and contexts, and were the basis of the following empirical steps taken in the research program of this Dissertation.

Chapter 7: Study 3 - Is flexibility always optimal? Role of Contextual and Affective Attention Flexibility as a predictor of emotional functioning in daily life. An ESM study.

Overview:

Affective and contextual attention flexibility, understood as the individual's ability to switch between contexts and emotional goals efficiently, has been proposed to be a causal mechanism of the individual's emotional functioning. Thus, this study examined how individual differences in different forms of affective and contextual flexibility predicted ecological emotional functioning during daily life. We recruited 124 undergraduates who performed an affective attention flexibility task, validated in Study 2 presented in the previous Chapter, followed by an experience sampling method (ESM) monitoring emotional levels across multiple times during the day for 10 days. Results showed that affective and contextual attention flexibility indices predicted different types of daily life affective levels. Higher attention flexibility towards positive information predicted lower levels of sadness during daily life, whereas higher attention flexibility towards negative information predicted higher feelings of tiredness. Higher contextual attention flexibility towards contexts prompting prevention goals (i.e., to feels safe, to prevent issues) predicted higher momentary lower levels of relaxation and a tendency to higher levels of nervousness during daily life. Overall, these findings indicate the importance of considering affective and contextual attention flexibilities to potentially

elucidate causal mechanisms of emotion regulation dynamics in everyday life and ultimately intervene them.

7.1. Introduction

As it is been revised across this Dissertation, the ability to switch between mental sets and schemes according to different context-dependent goals is a hallmark of mental health (Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010). This global concept of "cognitive flexibility" has been studied during decades (see for instance the seminal work of Scott, 1962), giving rise to numerous research lines that have aimed to define and understand specific psychological processes favoring flexibility, such as 'emotion regulation flexibility' (Aldao et al., 2015; Sanchez-Lopez, 2021), 'affective flexibility' (Wen & Yoon, 2019), 'psychophysiological flexibility, based on cardiac vagal control' (Rottenberg, 2007; Thayer et al., 2009), and ultimately affective attention flexibility (e.g., Godara et al., 2020).

7.1.1 General Affective Attention Flexibility

The ability to selectively attend and process different types of emotional information as a function of the demands of an occurring event is crucial for psychological adaptation and it has to be proposed to be an important process implicated in the efficient regulation of emotions (Malooly et al., 2013). Affective flexibility is typically assessed through affective switching tasks (AST) that prompt the participant to switch their responses based on affective (either positive or negative) or non-affective (neutral) rules of the stimuli. Lower cost associated to changes toward affective and non-affective information depending on the trial rules are interpreted as higher levels of flexibility. Empirical research using these methods has shown that affective inflexibility

is related to lower levels of trait resilience (Genet & Siemer, 2011), lower levels of effective use of reappraisal (Malooly et al., 2013), higher levels of habitual use of rumination (De Lissnyder et al., 2010) and, ultimately, higher levels of emotional symptoms (i.e., both GAD and depression levels; Wen et al., 2019; Wen & Yoon, 2019). Affective inflexibility may thus be seen as an issue that potentially aggravates negative mood and hinders emotion regulation. However, although these previous results are in line with the proposal that affective flexibility would be a causal component of adaptation to the environment demands, these associations between forms of affective flexibility and emotional functioning are not always supported. In this sense, other studies have shown opposite patterns, such as that higher levels of some forms inflexibility (in the processing of positive material, as assessed with the AST) was related to lower levels of habitual use of rumination (Genet et al., 2013), or that higher affective flexibility is related to lower levels of resting-state HRV, which reflect a low activation of the parasympathetic system, implicated in efficient emotion and stress regulation (Grol & De Raedt, 2020).

Considering this initial evidence, it seems necessary to not inherently attribute an adaptative nature to multiple forms of flexibility, but to study the links to emotional functioning that different forms of flexibility have, as they may not always seem to facilitate adaptive emotional consequences (Aldao et al., 2015; Genet et al., 2013). Some of these studies have evaluated affective flexibility through an affective-switching task, which requires shifting attention between affective and non-affective rule-dependent information. For example, Malooly et al. (2013) and Grol & De Raedt (2020) used the affective switching-task where participants had to sort between different rules based on an affective component (identify the valence of an image: negative, positive) and a non-

affective component (identify the number of people in an image). Combining these conditions, it is possible to generate trials requiring switching away and towards affective and non-affective information, evaluating the efficiency of participants to inhibit the processing of irrelevant information at the same time that they shift their attentional focus to relevant information depending on a pre-determined rule. These studies showed that higher affective flexibility (e.g., efficient switch toward the no affective information of negative images and toward the affective information of positive images) predicted higher efficiency in reappraisal use in response to a sad mood induction (Malooly et al., 2013) and lower levels of resting HRV (Grol & De Raedt, 2020). Thus, results using this method are in line with conceptual frameworks that establish attention as an important step in emotion regulation processes (Gross & Thompson, 2007; Joormann & Vanderlind, 2014; Mehu & Scherer, 2015).

7.1.2 Specific Forms of Affective Attention Flexibility

Contrasting with the previous findings, deficits in attentional processing of negative information have been related to poorer emotion regulation (Holas et al., 2018) and poorer negative mood recovery from stress (Sanchez et al., 2013; Sanchez, Romero, et al., 2017). These deficits comprise an inability to efficiently disengage from negative material (Sanchez et al., 2013; Sanchez, Romero, et al., 2017) that could be expressed in terms of affective attention inflexibility. Consequently, the study of affective attention (in)flexibility could provide a new perspective to the study of mechanisms of emotion regulation. This would imply considering not only how individuals switch attention between affective and non-affective aspects of the situation (Grol & De Raedt, 2020; Malooly et al., 2013) but how individuals can efficiently process different types of

affective information (either positive or negative) depending on the contextual demands. In this sense, the momentary selectivity and maximization of attentional processing of positive or negative affective information would not be inherently (mal)adaptive, but their adaptiveness would depend on the specific goals and contextual demands that individuals experience at each moment, in such a way that the most optimal affective focus would be determined by a fit between the ongoing context demand and the associated goal (Mancini, 2015).

Based on this idea, Godara et al. (2020) designed an eye-tracking based affective attention flexibility task based on changes between contexts and affective goals, in such a way that participants had to be as fast as possible in selectively attending (i.e., fixating) the most adaptive emotional component (either positive or negative faces) in each trial, depending on specific contexts and goals. In each context (i.e., a party with friends, a presentation at the university, etc.), different goals were presented (i.e., party: enjoy the party, or resolve a conflict with your friends, presentation: feel relaxed and calm in a university presentation, or identify potential issues of unclarity during your presentation), which were associated with a specific adaptive emotional component (i.e., preferentially attend to positive or negative faces, depending on the context x goal combination in each trial). These context x goal combinations changed across consecutive trials, in such a way that the individual had to switch attention to emotional information as a function of switches between the goals and contexts. Results indicated that dysphoric participants showed an attention pattern characterized by the maximization to negative information (i.e., higher attention flexibility to negative information in combinations prompting changes in both contexts and goals leading to an adaptive value of processing negative

information), whereas non-dysphoric participants maximized attention to positive information (i.e., higher attention flexibility to positive information in combinations prompting changes in both contexts and goals leading to an adaptive value of processing positive information).

The affective attention flexibility task developed by Godara et al. (2020), provides a naturalistic means to evaluate different forms of affective attention flexibility, associated to individual differences in affective levels. It would thus be highly relevant considering its use to analyze how these forms of affective flexibility relate to indicators of emotional functioning, as they occur during daily life. This was the first aim of the present study. Beyond this initial aim, it must be noted that the inclusion of different contexts also allows evaluating flexibility processes that are associated with the efficiency to switch attention between context changes that prompts different forms of motivational goals (i.e., contextual flexibility). This related but distinct second form of attention flexibility is considered below.

7.1.3. Further Forms of Contextual Attention Flexibility

Contextual characteristics have been considered key aspects in theoretical conceptualizations of adaptive ways of emotion regulation (Aldao & Nolen-Hoeksema, 2012a; Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Sanchez-Lopez, 2021). Specifically, the distal goals (i.e., high-order goals that an individual would like to achieve in a specific context) of an individual or the way they regulate in order to achieve them (proximal goals; i.e., short-term goals that are dependent and are based on achieving distal goals) can change depending on the specific nature and demands in each context. For instance, if an individual is returning home through a dangerous area, his/her main goal

may probably be to return home safely (distal goal), so he/she will look at the possible negative aspects of the environment (proximal goal). For this reason, not only affective flexibility processes in general need to be considered when aiming to characterize forms of flexible attention processing related to emotional functioning, but also other specific contextual attention flexibility processes.

Within this idea, another important factor that can influence contextual flexibility processes is motivation, more specifically, the activation of specific individual's goals to respond to different demands at each type of context. In line with this idea, as reviewed before, the Regulatory Focus Theory (RFT; Higgins, 1997, 1998, 2012) defines the variability in goals achievement though the activation of different context-dependent motivational SFs. The RFT establish the existence of two main forms of motivational SF that would guide individuals' appraisals of the situations, the activation of specific types of goals, and the strategies directed to accomplish each type of goal. A promotion SF would be associated with fulfilling distal goals related to hopes and aspirations, namely, achieving positive results. A prevention SF would be associated fulfilling distal goals related to safety and security needs, in such a way that the priority is based on avoiding negative results. In general, the promotion SF would influence the activation of goals within an emotional continuum focused on achieving/no experiencing cheerfulness-dejection emotions, while a prevention SF would influence the activation of goals within a continuum focused on achieving/no experiencing quiescence-agitation emotions. This does not mean that individuals with tendencies to preferentially activate a specific form of specific SF cannot activate the other one, since the activation of these SFs can also be context-dependent (Higgins, 1997, 1998, 2012).

In fact, in line with emotion regulation frameworks focused on considering the adaptiveness of different emotion regulation strategies in response to different contexts (Aldao et al., 2015; Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Sanchez-Lopez, 2021), the most adaptive strategy would be based on context-dependent motivational SF shifting, in such a way that this could influence the maximization of an attentional pattern towards one domain of positive and negative emotions, depending on the context and the specifically activated motivational SF. This would give rise to the activation of a promotion SF in situations prompting to positive results and experiencing feelings of happiness, and at the same time to the activation of the prevention SF in situations that require the avoidance of possible negative results and experiencing feelings of security. Initial evidence, as shown in the study presented in the previous chapter, highlights how individual tendencies to active promotion and prevention SFs guides the way that individuals are more flexible in adjusting attention to specific contexts activation promotion-related or prevention-related goals. As previously highlighted, studying how these forms of contextual attention flexibility account for emotional functioning aspects, beyond pure forms of affective attention flexibility (Godara et al., 2020) would help to define what specific aspects of flexibility relate to different forms of emotional experiences and their potential regulation. Thus, in order to evaluate attention flexibility processes that can explain the variability in emotional functioning, the inclusion of different forms of contextual flexibility, which have not been studied so far in this issue, can be helpful establish different related but distinct components of flexibility potentially having different emotional consequences in daily life.

7.1.4. Emotional consequences of different forms of attention flexibility in daily life

The evaluation of the relation between flexibility processes and emotional functioning has mostly relied on laboratory studies (Genet & Siemer, 2011; Malooly et al., 2013). However, evaluating the influence of flexibility processes in affective functioning using real life settings can provide more informative and naturalistic ways to identify mechanisms of emotion regulation (Genet et al., 2013). ESM has become a useful tool to evaluate ecological daily life emotional dynamics (Affleck et al., 1999; Csikszentmihalyi, 2014; Newman & Stone, 2019), in addition to study the influence of different types of contextual demands and appraisals in the flexible momentary use of emotion regulation strategies (i.e., Haines et al., 2016; Socastro et al., 2022). Further, some ESM studies have been conducted to analyze how attention biases and cognitive control dysfunctions affect to these emotional dynamics, when they are assessed during daily life. These studies have shown that higher inflexibility processing negative information was associated with higher levels of rumination (Pe, Raes, Koval, et al., 2013) and greater negative and reduced positive affects during daily life (Yaroslavsky et al., 2019), while higher inflexibility processing positive information has been found to predict lower levels of rumination (Genet et al., 2013). Moreover, higher processing of positive information has been associated with higher levels of satisfaction and a more balanced affect during day life functioning (Pe, Koval, et al., 2013). Similarly, ESM has been used to monitor psychological functioning after training in cognitive control. For example, Hoorelbeke and colleagues (2016, 2023) implemented a multisession training in cognitive control and then asked their trainees to respond for one (Hoorelbeke et al., 2016) to four weeks (Hoorelbeke et al., 2023) to an ESM monitoring of day-to-day

emotion regulation and emotional levels. They found that, an increase of cognitive control produced a reduction on the risk of participants to respond with rumination when experiencing low levels of positive affect. Despite their relevance, these studies considered evaluations and/or interventions on related components of attention bias, cognitive control or general affective attention flexibility (i.e., switching between emotional and non-emotional information). Yet, no studies to date have considered how specific forms of affective (i.e., switching between processing positive and negative information) and contextual attention flexibility (i.e., switching between processing emotional information in contexts prompting promotion-related and prevention-related contextual goals) contribute to ecological markers of emotional functioning using ESM.

7.1.5. The present study

In order to evaluate how affective and contextual attention flexibility can account for specific forms of emotional functioning during daily life, a variant of Godara's et al. (2020) affective attention flexibility task was used to derive attention flexibility indices predicting emotional functioning, that was assessed in a subsequent ESM protocol of 10 days. We modified the original affective attention flexibility task in order to generate specific promotion and prevention contexts, each one based on the conceptual framing of the RFT (Higgins, 1997, 2012). This task has been previously adapted and validated to derive specific indices of affective and contextual attention flexibility in our previous work (i.e., Study 2, presented in the previous Chapter). Higher flexibility is derived by lower differences in performance when participants have to switch to the detection of a specific type of emotional/motivational content compared to when participants just have to repeat that same detection of emotional/motivational content as in the previous trials

(see previous chapter). Due to the impossibility of carrying out laboratory studies for reasons associated with the COVID-19 (no laboratory studies were open at the moment of data collection), the study had to be implemented entirely online. In this new online version of the task, participants had to direct the computer mouse as fast as possible to the most adaptive type of emotional face (i.e., positive or negative) according to a designated type of motivational context (i.e., promotion- or prevention-based) and associated goal (i.e., positive or negative). Consequently, attention flexibility indices were created through the subtraction of response times (RT) to detect the adaptive stimuli in affective or contextual switch trials from RTs to detect the same type of stimuli in repetition trials (i.e., higher differences indicating higher flexibility for that specific emotion/contextual condition).

Using this task, it was evaluated how individual differences in each of the four flexibility indices (i.e., positive, negative, promotion, prevention) predicted the subsequent levels of daily emotions experienced by the participants during the subsequent ESM protocol. The main hypotheses of the study refer to the possible differential adaptive or maladaptive consequences associated with each of these forms of attention flexibility. Following results from previous studies (Godara et al., 2020; Godara, Sanchez-Lopez, Baeken, et al., 2021; Higgins, 1997; Shah & Higgins, 2001) and those ones obtained in previous Empirical Studies of this Dissertation, the following hypotheses were formulated:

Regarding affective attention flexibility towards positive information, it was hypothesized that higher levels of flexibility would be related to higher levels of positive emotions (e.g., content, relaxation, happy) and lower levels of negative emotions (e.g.,

sad, nervous, tired). On the contrary, the opposite pattern was expected with respect to affective attention flexibility towards negative information, giving rise to lower levels of positive emotions (e.g., content, relaxation, happy,) and higher levels of positive emotions (e.g., sad, nervous, tired).

Taking into account the emotional specificity associated with each motivational SF in literature (Higgins, 1997; Klenk et al., 2011), results on these forms of flexibilities obtained in Study 2, and the results on higher levels of nervousness and lower levels of relaxation in individuals high in prevention SF during stress induction found in Study 1, it is hypothesized that the contextual attention flexibility associated with each motivational context would have specific relationships with different emotions within the emotional continuum of each motivational SF. Therefore, higher contextual attention flexibility towards the promotion context was expected to be related to higher levels of cheerfulness (e.g., happy) emotions and lower levels of dejection emotions (e.g., sad), while higher levels of contextual attention flexibility towards the prevention context was expected to be related to higher levels of agitation emotions (e.g., nervous) and lower levels of quiescence emotions (e.g., relax).

7.2. Methods

7.2.1. Participants

The original sample for this study comprised 139 undergraduates from Complutense University of Madrid (120 females; 19 males) with a mean age of 20.5 (2.27). From that entire sample, 124 participants (107 females, 17 males; mean age = 20.56, SD age = 2.34) were finally included in the analyses. Fifteen participants had to be excluded, as they did not correctly complete the experimental tasks and/or dropped out

or showed low compliance with the subsequent ESM protocol (all these aspects are fully explained in the Data Cleaning section below). All the participants were native or high-level Spanish speakers. They received university credits for the participation in the study. This study was carried out under the approval of the ethical review board of the Complutense University of Madrid.

7.2.2. Measures

7.2.2.1. Attention Flexibility Task (AF Task)

Stimuli: The emotional stimuli used in the task were selected from the Karolinska Directed Emotional Faces (KDEF; Goeleven et al., 2008) and the Radboud Faces Database (RaFD; Langner et al., 2010), as conducted in the original version of the tasl (Godara et al., 2019). Stimuli from both databases were selected based on representative scores of valence. For the KDEF, twenty-eight negative valence pictures (angry, disgust, sad and fearful emotions; Intensity of Valence: $M_{Negative}$ = 6.78, $SD_{Negative}$ = .53; Arousal: $M_{Negative}$ = 4.01, $SD_{Negative}$ = .51) and twenty-two positive valence pictures (happy emotion; Intensity of Valence: $M_{Positive}$ = 6.68, $SD_{Positive}$ = .36; Arousal: $M_{Positive}$ = 3.95, $SD_{Positive}$ = .24) were selected. Similarly, from the RaFD, twenty-four negative valence pictures (fearful, disgust and angry emotions; Valence: $M_{Negative}$ = 2.01, $SD_{Negative}$ = .22; Intensity: $M_{Negative}$ = 4.27, $SD_{Negative}$ = .13) and nineteen positive valence pictures (happy emotion; Valence: $M_{Positive}$ = 4.33, $SD_{Positive}$ = .24; Intensity: $M_{Positive}$ = 4.33, $SD_{Positive}$ = .2) were selected. All the emotional stimuli represented Caucasian adults (half men, half women) with frontal face views.

As for the contexts images used in the task, context images (“Party with Friends” and “Presentation at the University”) were selected, each one associated with a

description of the situation (see Figure 13). Both context images were chosen from Google Images since its use was permitted for non-commercial purposes.

Task: Context images and their description were selected to simulate a “Party with Friends” and a “Presentation at the University” (see Figure 13), in order to represent social situations that are relevant for undergraduates in their daily life. Unlike (Godara et al., 2020),context images and their descriptions were designed to represent contexts prompting specific regulatory demands associated to specific motivational self-focuses, so “Party with Friends” was designed to represent a promotion context while “Presentation at the University” was designed to represent a prevention context. The description of each context as well as the emotional consequences of each one was expressed in terms of RFT and following the emotional continuum associated with each type of self-focus. Thus, "Party with Friends" (promotion context) was expressed in terms of goals related to cheerfulness-dejection emotions, the emotional continuum characterizing a promotion self-focus, while "Presentation at the University" was expressed in terms of goals related to quiescence-agitation emotions, the emotional continuum characterizing a prevention self-focus (Higgins, 1997, 1998).

Figure 13. Context and goal description used in the Attention Flexibility Task.

Context	Goal	Context Image
"Party with Friends" To enjoy the party, it is best to look at those of my friends who seem to be having a good time. To resolve a conflict/problem with my friends and not feel bad about it, it is best to pay attention to those who seem sad or upset.	 (Promotion Goal to Positive Information) (Promotion Goal to Negative Information)	
Cheerfulness ⟷ Dejection		
"Presentation at the University" To be calm and feel safe during my presentation, it is best to look at those of my colleagues who have more positive expressions. In order not to get nervous, it is best to quickly resolve questions that may arise during my presentation, looking at those of my colleagues who have more negative expressions.	 (Prevention Goal to Positive Information) (Prevention Goal to Negative Information)	
Quiescence ⟷ Agitation		

Each context was associated with two types of goals, distal and proximal goals, this last one referred to specific goals of directing attention to the most adaptative type of emotion (positive or negative information), depending on the context and the corresponding distal goal. In the promotion context ("Party with Friends"), one distal goal

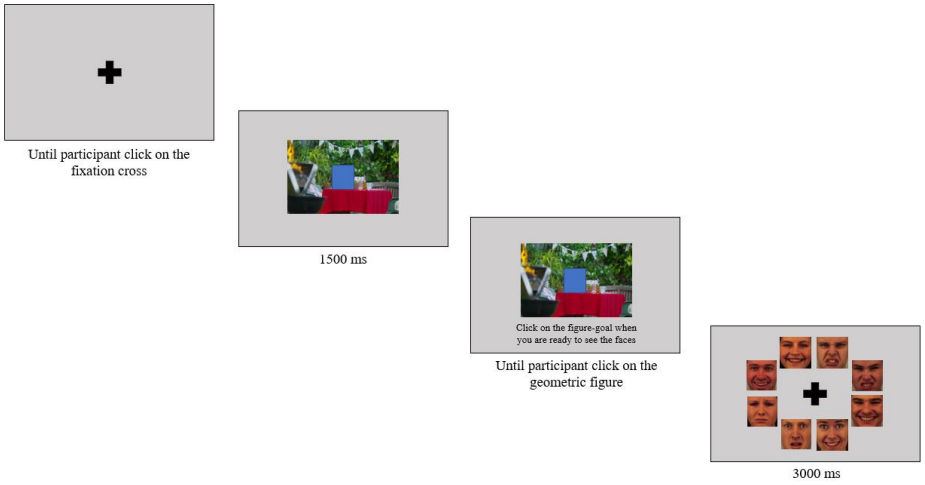
prompted to enjoy the party, activating a proximal goal to look at positive stimuli, while the other distal goal prompted to focus on resolving a conflict/problem with friends in order to not feel sad, activating a proximal goal to look at negative stimuli. In the prevention context ("Presentation at the University"), there was a distal goal prompting to feel calm and safe during the presentation, activating a proximal goal of looking at positive stimuli, while the other distal goal prompted to avoid not getting nervous by detecting issues during the presentation and resolving the questions that audience might have, thus activating a proximal goal of looking at negative stimuli. In order to memorize the relation between context and each type of distal and proximal goals, there was an associated geometric figure (blue square or blue circle), indicating which type of goal had to be activated for that context in each specific trial. The blue square was associated with the positive goal in the promotion context, but with the negative goal in the prevention context. The blue circle was associated with the negative goal in the promotion context, but with the positive goal in the prevention context. The counterbalance presented in the association between emotional goals and geometric figures was done in order to assure that participants had to learn the full combination of context images, geometric figures and emotional goals, rather than only associating a geometric figure with an emotional component.

The AF Task was composed by 64 trials. Each trial began with a fixation cross at the center of screen that participants had to click with the mouse to move to the next screen. Next, one of the combinations previously presented (context image + geometric figure) appeared at the center of the screen for 1500 ms, indicating the context and the goal associated to that context in the trial. Then, a text appeared in the bottom of the

screen ("Click on the figure-goal when you are ready to see the faces"), indicating that when participants were prepared, they could continue with the task. This trial section had no time limit, and thus participants could remain in viewing that screen (with the context image, the geometric figure and the text) as much as they needed to remember the correct adaptive emotion to be attended (i.e., selected) associated with the combination presented (e.g., "party with friends" + blue circle = resolve a conflict with friend looking at negative faces). Once participants clicked with the mouse on the geometric figure, eight emotional faces (4 positives and 4 negatives, balanced in sex, valence and position) appeared around a fixation cross situated in the center of the screen. Participants had to direct the mouse and click[6], as fast as they could, the correct goal-relevant emotional stimuli (either positive or negative), depending on the specific context and goal associated with that trial. After participants' response or 3000 ms, the trial ended up and another trial started (see Figure 14). After completing the main task, participants had to perform a final knowledge check with the aim of confirming that they had remembered and used the correct associations between context images, geometric figures and the specific associated goals during the task performance. The presentation of the stimuli was programmed through e-Prime Go (Psychology Software Tools, Pittsburgh, PA).

[6] Unlike Godara et al. (2020), which used eye-tracking methodology in order to evaluate attention, this study has focused on RT through mouse-tracking. This was because the study was conducted in the period following the COVID-19 lockdown (2021) during which the university did not allow lab studies in order to avoid further contagions. As an alternative, the task was adapted in such a way that it could be fully carried out online in a way that indices were reliable.

Figure 14. Trial sequence in the AF Task.



Attention Flexibility Indices: the attention flexibility dependent variable was based in the "Time to move the mouse courses over the goal-relevant emotion". This RT variable was obtained for every of the 64 trials, expressing the efficiency, in terms of speed, at which participants were able to attend to (i.e., select) the goal-relevant stimuli, either positive or negative, depending on the context image and geometric figure in each trial. All the RTs were subdued to a data cleaning procedure (this procedure is detailed in the Data Cleaning section below).

Four Attention Flexibility Indices were computed, based on the subtraction between trials based on repetition of both the context and the goal from those ones that required a corresponding switch, either contextual (contextual flexibility indices) or emotional (affective flexibility indices), as done in other studies using RTs to index flexibility (Genet et al., 2013; Grol & De Raedt, 2020; Malooly et al., 2013). Thus, four attention flexibility indices were made, based on the differentiation between types of contexts (promotion and prevention) and types of emotional goals (positive and negative).

The *Specific Index of Affective Switch towards Positive Information (SIASP)* was created by subtracting those RTs in which there was a prompted shift towards positive emotional goals (regardless of the type of context) from those attentional RTs that only comprised a repetition prompting to attend towards positive information (regardless of the type of context). With this method, an affective flexibility index was generated referred to the effort involved in affective switching towards positive-goal information.

The *Specific Index of Affective Switch towards Negative Information (SIASN)*: was created by subtracting those attentional indices in which there was a prompted shift towards negative emotional goals (regardless of the type of context) from those attentional indices RTs that only comprised a repetition prompting to attend towards negative information (regardless of the type of context). This affective flexibility index referred to the effort involved in affective switching towards negative-goal information.

The Specific Index of Contextual Switch towards Promotion Context (SICSProm) was created by subtracting those attentional indices in which there was a prompted shift towards the promotion context (regardless of the type of goal emotion) from those attentional indices RTs that only comprised a repetition prompting to attend towards promotion context (regardless of the type of goal emotion). Thus, a contextual flexibility index referred to the effort involved in context switching towards promotion context was generated.

The Specific Index of Contextual Switch towards Prevention Context (SICSPrev) was created by subtracting those attentional indices in which there was a prompted shift towards the prevention context (regardless of the type of goal emotion) from those

attentional indices RTs that only comprised a repetition prompting to attend towards prevention context (regardless of the type of goal emotion). Therefore, a contextual flexibility index referred to the effort involved in context switching towards prevention context was generated.

The four attention flexibility indices were used as predictors of emotional functioning in daily life as indexed through the subsequent ESM protocol.

2.2.2. Experience Sampling Method (ESM)

In order to evaluate daily emotional functioning of the participants, a protocol based on experience sampling for 10 days was applied following the completion of the AF task. With this methodology, it is possible to assess the daily dynamics of participants, giving a greater value to the context and the interaction of the individual within it (Csikszentmihalyi, 2014; Newman & Stone, 2019). ESM methodology has been widely used in previous studies, either to ecologically assess emotions, stress, emotion regulation use, or even the interplay between these variables (e.g., Genet & Siemer, 2012; Hoorelbeke et al., 2016; Moberly & Watkins, 2008; Ruscio et al., 2015; Socastro et al., 2022). The ESM protocol of this study consisted of a survey where participants reported their experienced emotions, motivation, stress perception and use of emotion regulation strategies 3 times per day. Participants completed the ESM protocol during the following 10 days after finishing the online experimental session. The ESM protocol was developed and modeled based on previous studies which focus on the evaluation of momentary affective processes (Connolly & Alloy, 2017; Socastro et al., 2022). In this case, the protocol included the evaluation of momentary psychological processes for 10 days, having to complete the survey three times a day, one in the morning, one in the afternoon

and one at night (30 surveys in total). In order to assure that the participants completed the largest number of surveys, email notifications were sent to them just at the beginning of each evaluation period (morning = 10:00 a.m. - 11:00 a.m.; afternoon = 3:00 p.m. - 4:00 p.m.; night = 8:00 pm - 9:00 pm), having one hour in order to complete the ESM survey since receiving each notification.

ESM Emotions Assessments: daily emotion functioning was measured using seven items, each one referred to a different emotion with different levels of valence and arousal, following the circumflex model of emotions (Russell, 1980) and other previous ESM studies (Socastro et al., 2022). Items on current affect at each assessment were formulated as follows: "At this moment, to what extent do you feel…" "content", "nervous", "happy", "sad", "energetic", "relaxed" and "tired". Each question included in the ESM survey was rated in a continuous scale from 1 (not at all) to 9 (very much).

7.2.3. Procedure

The day before the experimental online session, participants completed a series of questionnaires as well as the informed consent via Qualtrics software (Qualtrics, Provo, UT). These questionnaires included measures of depression and anxiety levels as done in the baseline protocols of the rest of studies of this Dissertation. During the subsequent online individual session[7], participants completed the adapted version of the AF Task (Godara, et al., 2020) for this study and then they were trained on how to complete the ESM protocol through a dedicated webapp (http://www.e-motion-test.com/index.html) in

[7] All this data comes from a more extend online experimental protocol including another experimental task measuring self-discrepancies and further follow-up measures, not relevant for the specific hypothesis related to the value of attention flexibility in predicting emotions tested in this study.

their phones during the following next 10 days. After these 10 days, participants completed some questionnaires regarding the usability of the webapp used to complete the ESM (not relevant to the current study) and received their university credits and finished the study.

7.2.4. Data Cleaning

Data cleaning of the AF task followed different steps. First, participants who did not correctly remember the goals associated with each context optimally (evaluated in the post-task knowledge check) and those ones that could not end the experimental task due to computer problems (slow computer performance or task not finished) were excluded. Only two participants (1.44% of 139 participants) did not remember goals properly and five participants (3.6% of 139 participants) could not finish the task due to technical issues with their internet servers, so they were excluded from final analyses. Second, RTs equal to 0 ms and those ones that were above or below 2.5 standard deviation of the RT mean were removed from the final database, reducing the effect of possible extreme responses due to the fact that the task was completed online. Moreover, only those participants whose attention flexibility indices were composed of at least 50% of available RT data (e.g., repetition and switch trials) were included in the analyses. Only 1 participant (0.72% of 139 participants) was excluded due to this issue. Therefore, taking into account the entire data filtering process associated with the AF Task, only eight participants were excluded due to issues with the performance of the task (5.76% of total sample).

As for the ESM, data cleaning was based on the number of ESM surveys answered (i.e., percentage of compliance). Compliance rates were examined in such a way that only those participants who answered a minimum of 70% of ESM surveys (i.e., 21 surveys)

were included in final analyses, based on similar ESM studies applying these criterion (Socastro et al., 2022). Seven participants did not meet the criterion and were excluded from the analyses.

In consequence, the final sample of this study comprised 124 participants from a total of 139 (89.21% of the sample). Regarding the ESM data, participants in the final sample answered an average of 27 surveys. Given this data and the low rate of participants excluded, it can be assured that there was a high degree of compliance with the use of the ESM methodology. Regarding the AF Task, 96.33% of the total data was maintained, having, as with the ESM, a very low rate of data loss in the final sample. The use of this series of data cleaning criteria allowed to increase the reliability of the analyses carried out, since the AF indices and ESM evaluations are made up of a large set of data, thus being able to better represent the operationalized constructs.

7.2.5. Statistical Analyses

In order to evaluate the role of the four attention flexibility indices in predicting each type of emotions in daily life, multilevel analyses were performed, due to the nested structure of the data, with survey (1-30) nested within individuals (1-124). Analyses were performed through *lmer* function of the *lme4* package for R (Bates et al., 2015). Maximum likelihood was the method used to estimate the models. Momentary assessments of each type of emotion were entered as level 1 outcome variables. Level 2, predictors (i.e., the four attention flexibility indices) were grand-mean centered (Aguinis et al., 2013; Ohly et al., 2010).

Multilevel null models were first computed for every outcome variable in order to evaluate the intraclass correlation (ICC) of each one, decomposing their variance depending on between- and within-person components. This was followed by the main multilevel models (e.g., random intercept models) testing the role of flexibility indices to account for individual differences in each type of emotion. These models were conducted separately for each type of predictor and emotional outcome.

7.3. Results

7.3.1. Preliminary Results

Mean and standard deviations for each of the attention flexibility indices in the study were as follows: SIASP (Mean: 26.01; SD: 89.71), SIASN (Mean: -15.85; SD: 115.32), SICSProm (Mean: -9.09; SD: 119.39), SICSPrev (Mean: 23.49; SD: 110.72).

Multilevel null models were conducted of each ESM-based emotion, in order to assess how their variability was divided across within- and between-subject levels. Table 11 shows mean, standard deviation, ICC and percentage of variance of each emotion variable. ICC results suggests that in general, every ESM-based emotion item showed larger variations at the within-subject level, in contrast to the between-subject level. However, there were some emotional items that showed less variance differences, such as “nervous” or “sad” in comparison to “energetic” or “tired”. Overall, results indicated that participants showed fluctuations in their emotions in daily life, being characterized by emotional dynamics during ESM protocol for each of the emotions tested. In consequence, the use of multilevel models was totally justified to test our hypotheses.

Table 11. Mean, Standard Deviation, ICC and percentage of variance of emotion variables.

	Mean	SD between-subject	SD within subject	ICC	% Within subject variance	% Between-subject variance
Content	6.02	1.04	1.57	.30	69.51%	30.49%
Nervous	3.13	1.37	1.72	.39	61.15%	38.85%
Happy	6.03	1.06	1.55	.32	68.12%	31.88%
Sad	2.42	1.07	1.38	.38	62.38%	37.62%
Energetic	5.02	1.02	1.77	.25	75.03%	24.97%
Relaxed	5.12	1.1	1.71	.29	70.8%	29.20%
Tired	4.98	1.21	1.9	.29	71.12%	28.88%

7.3.2. Main results

In order to assess how attention flexibility, both affective and contextual, predicted each form of emotional functioning on a daily basis, level 2 multilevel analysis were performed, using affective (SIASP and SIASN) or contextual (SICSProm and SICSPrev) attention flexibility indices as predictors of each type of emotion.

7.3.2.1. Affective Attention Flexibility (SIASP and SIASN)

No significant effects of the affective attention flexibility, either for positive or negative information (SIASP and SIASN), were found in relation to the emotions of "content", "nervous", "happy", "energetic" and "relaxed", $t > -1.29$ and $< .66$, all $p´s > .2$. However, a significant effect was found when predicting "sad" and "tired" emotions for SIASP and SIASN, respectively. The affective flexibility towards positive information (SIASP) significantly predicted subsequent levels of sadness, in such a way that higher

levels of flexibility towards positive information predicted lower daily life levels of sadness (Estimate = -.003; *SE* = .001; *t* = -2.41; *p* = .02). The affective flexibility towards negative information (SIASN) was significantly predicted subsequent tiredness, in such a way that higher levels of flexibility towards negative information predicted greater daily life levels of tiredness (Estimate = .003; *SE* = .001; *t* = 2.88; *p* = .005). No interaction effects between the affective cognitive flexibility indices (SIASP and SIASN) were found for any type of emotion, t > -1.54 and < 1.79, all p´s > .07. Table 12 shows the fixed effects of each main model relating affective attention flexibility and ESM-based emotions.

Table 12. Fixed effects of main model relating emotions and affective attention flexibility.

	Fixed effects				
Model	**Effect**	**Estimate**	***SE***	***t***	***p***
"Content"	Intercept	6.03	.1	62.19	**< .001**
	SIASP	-.0005	.001	-.43	.67
	SIASN	-.0004	-.0009	-.51	.61
	SIASP*SIASN	-.00001	.000009	-1.54	.12
"Nervous"	Intercept	3.16	.1	25.04	**< .001**
	SIASP	-.002	.001	-1.29	.2
	SIASN	.0003	.001	.27	.78
	SIASP*SIASN	-.00001	.00001	-.85	.4
"Happy"	Intercept	6.04	.1	60.89	**< .001**
	SIASP	.0007	.001	.66	.51
	SIASN	-.0004	.0009	-.42	.67
	SIASP*SIASN	-.000009	.000009	-.97	.34
"Sad"	Intercept	2.43	.1	24.8	**<.001**
	SIASP	-.003	.001	**-2.41**	**.02**
	SIASN	.0001	.0008	.17	.87
	SIASP*SIASN	.000003	.000009	.31	.75
"Energetic"	Intercept	5.23	.1	54.08	**<.001**
	SIASP	-.0006	.001	-.59	.56
	SIASN	-.0008	.0009	-.91	.36
	SIASP*SIASN	-.00001	.000009	-1.47	.14
"Relaxed"	Intercept	5.11	.1	49.38	**<.001**
	SIASP	.0006	.001	.5	.62
	SIASN	-.001	.0009	-1.1	.27
	SIASP*SIASN	-.000003	.00001	-.27	.79
"Tired"	Intercept	4.97	.11	45.04	**<.001**
	SIASP	-.0001	.001	-.13	.9
	SIASN	.003	.001	**2.88**	**.005**
	SIASP*SIASN	.00002	.00001	1.79	.07

*Note*s. "SIASP" = "Specific Index of Affective Switch towards Positive Information"; SIASN" = "Specific Index of Affective Switch towards Negative Information"

3.2.2. Contextual Attention Flexibility (SICSProm and SICSPrev)

No significant effects of the contextual attention flexibility indices, neither to the promotion or the prevention context (SICSProm and SICSPrev), were supported in predicting the ESM-based emotions of "content", "happy", "sad", "energetic" and "tired", t > -1.68 and < 1.17, all p´s > .24. However, contextual attention flexibility towards the prevention context (SICSPrev) significantly predicted subsequent relaxation levels, in such a way that higher levels of flexibility towards the prevention context predicted lower relaxation levels during daily life (Estimate = -.002; *SE* = .0009; *t* = -2.25; *p* = .03). A similar trend but with opposite direction was found for the ESM-based emotion of nervousness: thus, contextual attention flexibility towards the prevention context (SICSPrev) tended to predict subsequent higher levels of nervousness during daily life (Estimate =.002; *SE* = .001; *t* = 1.91; *p* = .06). There were no significant interactions between the contextual flexibility indices in any model, t > -.75 and < .01, all p´s > .45. Table 13 shows the fixed effects of all the models referred to contextual attention flexibility indices.

Table 13. Fixed effects of main model relating emotions and contextual attention flexibility.

	Fixed effects				
Model	**Effect**	**Estimate**	***SE***	***t***	***p***
"Content"	Intercept	6.01	.1	62.29	**<.001**
	SICSProm	-.0005	.0008	-.65	.52
	SICSPrev	.001	.0009	1.17	.24
	SICSProm*SICSPrev	-.0000002	.000007	-.03	.97
"Nervous"	Intercept	3.15	.1	25.54	**<.001**
	SICSProm	-.002	.001	-1.68	.1
	SICSPrev	.002	.001	**1.91**	**.06**
	SICSProm*SICSPrev	-.000004	.00001	-.45	.65
"Happy"	Intercept	6.03	.1	61.15	**<.001**
	SICSProm	.0002	.0008	.24	.81
	SICSPrev	.0008	.0009	.94	.35
	SICSProm*SICSPrev	-.0000001	.000007	-.02	.98
"Sad"	Intercept	2.44	.1	24.61	**<.001**
	SICSProm	-.0008	.0008	-.97	.33
	SICSPrev	.0001	.0009	.13	.89
	SICSProm*SICSPrev	-.000006	.000008	-.75	.45
"Energetic"	Intercept	5.21	.1	53.94	**<.001**
	SICSProm	-.0004	.0008	-.53	.6
	SICSPrev	.0006	.0009	.66	.51
	SICSProm*SICSPrev	-.000004	.000007	-.61	.54
"Relaxed"	Intercept	5.11	.1	50.75	**<.001**
	SICSProm	.001	.0008	1.16	.25
	SICSPrev	-.002	.0009	**-2.25**	**.03**
	SICSProm*SICSPrev	-.000002	.000008	-.27	.79
"Tired"	Intercept	4.99	.11	44.61	**<.001**
	SICSProm	.002	.0009	1.8	.07
	SICSPrev	.0005	.001	.51	.61
	SICSProm*SICSPrev	.00000006	.000009	.01	.99

Notes. "SICSProm" = "Specific Index of Contextual Switch towards Promotion Context"; "SICSPrev" = "Specific Index of Contextual Switch towards Prevention Context"

7.4. Discussion

The aim of this study was to test the predicting value of different forms of affective and contextual attention flexibility in emotional functioning during daily life. For this reason, a modified version of the AF task (Godara et al., 2020) was completed together with an ESM during 10 days in a final sample of 124 participants. Results indicated that the attention flexibility, both affective and contextual, is related to affect, but with different contributions to different types of emotions and in different directions. More specifically, higher affective attention flexibility towards positive information predicted lower levels of sadness. Thus, the more efficient a participant was in shifting towards positive emotional goals in the AF task, the lower levels of sadness he/she experienced during his/her daily life. This is in line with our hypotheses that higher flexibility toward positive information would be related to lower levels of negative emotions. Nonetheless, we also expected a relation between this form of flexibility and a higher experience of positive emotions. This latter prediction was not supported. It is possible that positive flexibility could be a better predictor of efficient negative mood regulation than a promoter of positive moods. One of the mechanisms that act in positive flexibility is the individual's ability to disengage from negative to positive information. This form of attentional disengagement has been specifically related to negative mood regulation capacities (Sanchez et al., 2013; Sanchez, Romero, et al., 2017).

In addition, affective attention flexibility towards negative information predicted higher levels of tiredness, thus greater efficiency when switching attention toward processing negative goals was related to higher levels of fatigue. This relation was only part of the effects hypothesized, as we expected that higher flexibility towards negative

information would be related to lower levels of positive emotions and higher levels of negative emotions experiences. In contrast to these hypotheses, results may be indicative that a higher capacity to switch attention is not inherently maladaptive, but yet comprises higher levels of cognitive cost. Future studies could consider analyzing samples with varying emotional symptom levels, as it could be hypothesized that the hypothesized relationships might be more specifically found at different levels of emotional symptomatology.

Overall, results found for affective flexibility are supported by other studies that have studied attention and cognitive control processes predicting emotion regulation. In this study, higher affective flexibility towards positive information predicted lower levels of sadness, suggesting that efficient shifting to positive information is a key ability potentially implicated in the regulation of negative emotions. In line with this, affective flexibility has been related in the laboratory with higher levels of well-being (higher flexibility to positive information predicted higher well-being; Pe, Koval, et al., 2013) and resilience (higher flexibility predicted higher resilience levels; Genet & Siemer, 2011). One mechanism through which this form of affective flexibility could contribute to emotion regulation might be through the facilitation of the use of specific emotion regulation strategies. In fact, affective flexibility has been shown to have an influential role in the relationships between emotion regulation use and affect, in such a way that there are differences in the effectiveness of the use of different emotion regulation strategies to change affective states depending on the individual levels of flexibility. For example, one study showed that reappraisal only predicted lower levels of negative affect in high-flexibility participants, while in low-flexibility participants, this relation was not

significant (Pe, Raes, Koval, et al., 2013). Similar results have been found not only in laboratory studies, but also in studies using ESM methodology. In these studies, different levels of affective (in)flexibility have been associated with differences in well-being (higher flexibility to positive information predicted higher satisfaction; Pe, Koval, et al., 2013), negative and positive affect (higher inflexibility to positive and negative information predicted higher negative and lower positive affect; Yaroslavsky et al., 2019), rumination (higher inflexibility to negative information predicted higher levels of rumination, while higher inflexibility to positive information predicted less use of it; Genet et al., 2013) or a moderating role in the effectiveness of emotion regulation strategies (i.e., rumination and reappraisal; Pe, Raes, Koval, et al., 2013). However, being affectively flexible has not always led to adaptive outcomes. This assumption is supported by other studies where greater flexibility towards negative information was related to lower levels of resting-state HRV (Grol & De Raedt, 2020). In line with this, in our study, higher flexibility toward negative information predicted higher levels of tiredness. Taken together, results may suggest that this other form of affective flexibility might not be inherently maladaptive and serve to specific purposes (e.g., facilitating the enactment of rumination and experience of affect, as shown by Pe, Raes, & Kuppens, 2013, or Yaroslavsky et al., 2019), but yet at the extent of requiring higher cognitive efforts than other forms of affective flexibility.

Regarding the analysis of contextual attention flexibility, it was found that higher contextual flexibility towards the prevention context was related to lower levels of relaxation and trend related to higher levels of nervousness, suggesting a main role in relation to emotions of an anxious nature. This is in line with our hypotheses and with

previous studies that have shown that higher prevention levels are characterized by lower levels of calmness and higher levels of nervousness when undergoing stress (e.g., results from the first and second study of this Dissertation). Our hypotheses regarding contextual flexibility towards the promotion context were not supported, with data pointing that this form of flexibility did not have any apparent direct contribution to emotional functioning during daily life. It is important to note that we tested our hypotheses with relatively healthy individuals (i.e., unselected undergraduates). As commented for other forms of affective flexibility above, there could be low variability in promotion levels in these type of sample (i.e., high non-differing levels of tendencies to habitually activate a promotion SF). Therefore, low variability in promotion levels across this sample might help to explain a lack of predictive power of this contextual flexibility dimensions and hypothetically congruent emotions experienced in daily life. Future studies should be conducted with other more specific samples (e.g., depressed vs. non-depressed individuals) where there should be greater variation in levels of promotion SF, and this component could have a greater importance in explaining different affective dynamics related to ongoing depressed moods.

Overall, results for contextual flexibility indices, although partially supportive of the established predictions, are in line with the hypotheses of the RFT (Higgins, 1997, 1998, 2012). This framework establishes that the prevention SF would be directly related to the emotional continuum of quiescence-agitation, in this study represented through the emotions of nervousness and relaxation. Our results are thus in line with those studies that have found a higher efficiency of appraising each emotional continuum depending on the activation of each motivational self-focus (i.e., prevention being associated with

processing of emotions of quiescence-agitation, as the ones tested in our ESM; Shah & Higgins, 2001). At the same time, contextual flexibility analyses also suggest that contextual factors are important in order to understand emotional functioning, as suggested by current views in emotion regulation flexibility (Aldao et al., 2015; Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Sanchez-Lopez, 2021) and highlight the interest of further considering these contextual forms of flexibility as additional predictors of emotional functioning and stress resilience in future studies.

These results highlight two important issues. The first one is the need to include context variables when conceptualizing different forms of psychological flexibility (i.e., attentional, emotional, psychophysiological). Several authors have emphasized the importance of context to understand the individual processes of psychological functioning (Aldao & Nolen-Hoeksema, 2012a; Bonanno et al., 2007; Bonanno & Burton, 2013; Gross & Thompson, 2007; Kashdan & Rottenberg, 2010; Sanchez-Lopez, 2021). It is important that new research lines help to clarify how the environment can influence psychological processes of attention, emotion regulation and stress recovery, since context can change the efficiency or the use of different cognitive and emotion regulation strategies depending on differences in the perception of contextual demands and associated goals. In order to assess cognitive flexibility, different methods have been previously used, either at questionnaire level (CFI; Yu et al., 2020), and at experimental level through the Wisconsin Card Sorting Task (Johnco et al., 2014) or the affective flexibility task (Genet et al., 2013). However, in all cases these methodologies did not include changes between usual contexts, but instead evaluated operations of set-shifting through changes between non-emotional and emotional rules, not optimally representing

the construct associated with it. For this reason, future research lines should study the influence of context in order to assess the ability to change through emotional goals in subsequent different context. The second important issue that is derived from our findings is the erroneous conceptualization of all forms of attention flexibility as an inherently adaptive (Aldao et al., 2015; Genet et al., 2013). Indeed, there are several results indicating that some types of cognitive flexibility are not associated with an adaptive result. In this study, higher efficiency in shifting to prevention context was related to lower levels of relaxation and trend-related to higher levels of nervousness. Although these results are in line with the expected emotional continuum of consequences of a higher activation of a prevention SF and flexibility toward prevention contexts, the emotional consequences of this process are not adaptive. In other studies, affective flexibility to negative information has been related to lower levels of HRV (Grol & De Raedt, 2020). Thus, to advance knowledge on precise mechanisms of mental health, it seems necessary to evaluate to what extent each form of attention flexibility processes generate adaptive results or not in terms of emotion and stress regulation.

A derived conceptual implication of the present results is the importance of studying attention to emotional information and its potential role in regulating emotions from a dynamic perspective (Gross & Thompson, 2007; Joormann & Vanderlind, 2014; Mehu & Scherer, 2015). Accordingly, the inherent conception of attention as a linear process does not seem to be useful when introducing contextual demands and associated motivational goals as modulating variables of the process itself, in such a way that the maximization of attention towards positive or negative information would not be inherently (mal)adaptive. Given that individual differences in attention flexibility can

predict different forms of emotional functioning during daily life, a potential new venue should be developing trainings of these flexibility processes, in such a way that participants are induced to use their attentional resources flexibly as a function of specific contexts and goals. In relation to this, there have already been certain attempts to train attentional processes using a flexibility perspective. Godara et al. (2021) developed an attentional training with the aim to modulate attention to positive and negative information in a flexible way. In this training, participants received musical reinforcements contingent on their attentional performance, in such a way that they could listen to pleasant music or avoid listening to white noise, when fitting their attention to contextually relevant goals. Results indicated that the training served to improve trainees' levels of affective attention flexibility in both an affective attention flexibility task (Godara et al., 2020) and a social stress task promoting for different forms of flexibility during the stressor (Sanchez, Romero, et al., 2017). Based on these promising results and in our findings in the current study, in the final Study 4, presented in the next chapter of this Dissertation, a new form of attention flexibility training, in line with Godara et al. (2021) was implemented. In this case, our training targeted both forms of affective and contextual attention flexibility and its transfer effects were assessed both in relation to attention flexibility performance (using the tasks implemented in the previous studies of this Dissertation), but also in relation to objective markers of stress recovery capacities (i.e., HRV).

Regarding the current study, there are a number of limitations that need to be taken into account. First, the sample mainly comprised women. Future studies should aim to extend these results to more sex-balanced samples, as well as to consider individual

differences in emotional problems, in order to establish how the flexibility processes evaluated are influenced by ongoing emotional symptoms. Regarding the AF Task, because of its nature, we cannot perfectly know the exact cognitive process that were inherent to affective flexibility indices in the study, since inhibition and shifting processes are both used consecutively throughout the evaluated task. The inhibition processes would occur when a participant tries to ignore the previous information, since in the following trial it is not relevant, while the shifting processes would occur when the individual needs to change between goals or contexts. Other tasks used in previous studies have the same limitation (Genet et al., 2013; Malooly et al., 2013), but affective flexibility still seems to be a stronger significant predictor, above and beyond general cognitive flexibility performances, when tasks assessing each type of flexibility are included in the analysis (Genet & Siemer, 2011). Future research using the AF task might further include an inhibition task in order to evaluate if affective flexibility is the specific factor predicting emotional functioning and or regulation, above and beyond specific operations of affective inhibition.

Finally, another important limitation is based on the specific methodology used in this study. Due to the fact that laboratory studies were not allowed when the study was carried out, the attention flexibility task had to be adapted to be performed online and used RT-based proxy estimations of attention. For this reason, these results should be interpreted with some caution. It is plausible that, although some expected relationships were supported, other hypothesized relationships between flexibility indices and emotional functioning might not have been confirmed due to a lower sensitivity of this online RT-based test to index pure covert attentional processes, compared to direct eye-tracking

estimations. Future studies should thus be conducted, using eye-tracking based flexibility measures to establish whether the present results are replicated and/or extended to other of the hypothesized relationships with daily life emotional functioning that were not supported in the current study.

7.5. Conclusion

In this study, we aimed to test the role of affective and contextual attention flexibility indices to predict emotions as they ecologically occur in daily life. In line with some of the formulated hypotheses, results indicated that affective and contextual flexibility both predicted specific forms of daily life emotional functioning, but with different implications (i.e., not all forms of attention flexibility accounted for purportedly adaptive emotional outcomes). Overall, findings suggest that not all forms of attention flexibility may be optimal in terms of their emotional consequences. This study supports the inclusion of these attention flexibility indices to better understand emotional dynamics while emphasizing the importance of context in understanding the relationships between cognition and emotion.

Chapter 8: Study 4 -Affective Attention Flexibility Training in contextual-goal approach facilitate stress recovery in individuals with clinical levels of emotional disorders

Overview:

Affective attention flexibility has been conceptualized as a cognitive process associated with adaptive psychological functioning and stress resilience that is affected in individuals suffering from depression and anxiety. Consequently, trainings aimed to enhance flexible attention processing of the most adaptive information in each type of context and associated goal should transfer to better capacities of stress recovery. In this study, a novel attention flexibility training was developed to evaluate their effects to enhance contextual and affective attention flexibility (close transfer) and stress recovery (far transfer) in 56 participants with varying degrees (subclinical and clinical status) of emotional problems (i.e., depression and/or anxiety). Participants were randomly assigned to complete an active training comprising the use of music reinforcement contingent to flexible adaptive attention deployment (through eye-tracking methodology) to context-based goal-dependent information, or to a control condition (i.e., completing the same task just listening to the same music, but not contingently to attentional performance). Results indicated that there was not a clear enhancement of contextual or affective attention flexibility in the close transfer task but there was a significant far transfer effect in a subsequent stress induction task. Specifically, according to the trained

flexible attention deployment, during the stressor trainees maintained their gaze significantly more time to positive feedback when the feedback was mainly positive in comparison to control participants. Moreover, participants with a clinical status in the training condition showed a flexible psychophysiological pattern of recovery from the stressor in comparison to clinical participants in control condition, whose pattern of reactivity to and recovery from the stressor was blunted. This study confirms that affective attention flexibility can be trained in emotionally-disordered individuals and show its causal role in stress recovery.

8.1. Introduction

As reviewed in the conceptual section of this Dissertation, selective attention has been one of the most studied cognitive mechanisms implicated in the development, maintenance and relapse of emotional disorders (both of depression and anxiety; Clauss et al., 2022; Gross & Thompson, 2007; Joormann & Vanderlind, 2014; Lazarov et al., 2018). The role of selective attention in emotional processing is essential, influencing other different cognitive processes, such as interpretation and memory and emotion regulation (Beck, 1967; Everaert et al., 2013; Joormann & Vanderlind, 2014). However, individual processes of selective attention have been typically studied as static phenomena (e.g., a tendency to selectively attend to negative information being consistently showed across different situations). Contrasting this traditional view, several authors have emphasized the importance of integrating the study of context to better understand emotion regulation and the cognitive mechanisms implicated on it (Aldao, 2013; Aldao & Nolen-Hoeksema, 2012a; Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Sanchez-Lopez, 2021). These frameworks emphasize that the use of

different strategies would not be inherently (mal)adaptive, but rather depends on its fit to specific contextual demands and associated goals. This idea can also be applied to the mechanisms subserving emotion regulation, such as selective attention. From this view, although it has been observed that emotional disorders are characterized by a sustained negative attention bias (Armstrong & Olatunji, 2012; Clauss et al., 2022), this negative attentional maintenance would not be the maladaptive mechanism itself, but its indiscriminate use across contexts without taking into account the environmental needs in each situation (Mancini, 2015). From this perspective, adaptive selective attention can be characterized as a context-dependent process and, consequently, the attentional rigidity processing negative information characterizing emotion disorders (e.g., difficulties disengaging from negative information; Sanchez et al., 2013; Sanchez, Romero, et al., 2017) could be conceptualized as a lack of attentional flexibility, hindering adaptive emotion regulation and prolonging negative moods.

Consequently, and as framed in the present Dissertation, the concept of affective attention flexibility has been defined as the individual's ability to process changes between different types of emotional and non-emotional information within and across contexts on specific goals (Malooly et al., 2013). Affective attention flexibility (initially measured through reaction time-based measures of switching between emotion and non-emotional aspects of information) has been associated with adaptive forms of psychological functioning in experimental studies, such as with higher levels of well-being (Pe, Koval, et al., 2013), higher efficient use of putatively adaptive emotion regulation strategies (i.e., reappraisal; Malooly et al., 2013), lower use of putatively maladaptive emotion regulation strategies (i.e., rumination; De Lissnyder et al., 2010)

and higher levels of resilience (Genet & Siemer, 2011). Also, when studying different components of cognitive control of emotional information, studies including ESM protocols have shown that the efficient regulation of attentional processing of emotional information is related to higher positive and lower negative emotional states (Yaroslavsky et al., 2019), higher well-being (Pe, Koval, et al., 2013), and lower use of rumination in daily life (Genet et al., 2013). Other studies, have also shown that this attentional functions to have a moderating role in the relation between emotion regulation and resulting affect (Pe, Raes, & Kuppens, 2013; Pe, Raes, Koval, et al., 2013). Moreover, previous studies have shown differences in affective processing flexibility in both depressed and anxious individuals (Wen et al., 2019; Wen & Yoon, 2019).

However, most of these studies have relied in proximal measures of affective attention flexibility (i.e., attentional disengagement or cognitive control over emotional information; De Lissnyder et al., 2010; Sanchez et al., 2013; Sanchez, Romero, et al., 2017) or have assessed general forms of affective flexibility through tasks such as the affective switching task, which assesses the efficiency changing between a non-affective rule (related to the number of people on an image) and an affective rule (related to the valence of an image; e.g., Grol & De Raedt, 2020; Malooly et al., 2013). The first task designed to index processes of attention flexibility toward different sources of emotional information was the affective flexibility task created by Godara et al. (2020), which measures the efficiency of participants to switch vs. repeat between emotional goals (prompting to attend either towards positive or negative information) in different contexts. As demonstrated in the previous studies of the Dissertation, this task can be adapted to index complex components of affective attention flexibility toward different types of

motivationally relevant contexts (Study 2). Furthermore, our results have also proven the role of different indices of affective and contextual flexibility derived from this task to predict emotional functioning during daily life (Study 3).

Considering all this previous evidence, since individual differences in contextual and affective attention flexibility can predict emotional states and their regulation, training specific forms of attention flexibility might be a promising way to improve psychological functioning in individuals suffering from emotional disorders. In this line, some initial studies have supported the possibility to modulate affective attention flexibility processes through experimental training (e.g., Godara, Sanchez-Lopez, Baeken, et al., 2021). Godara et al. (2021) reinforced context-dependent flexible attention through music, applying contingent pleasant music rewards when participants focused their attention on the appropriate emotional information based on the type of emotional goal and context presented, while applying white noise punishment when the attended emotional information was not appropriate to the active context and associated goal. Results indicated that participants in the training condition were faster switching from negative to positive information in comparison to a control comparison condition both in close transfer (i.e., the task developed by Godara et al. (2020), and adapted in our Studies 2 and 3) and in a far transfer tasks (i.e., the stress induction procedure adapted in our Study 1). However, this initial training study did not consider whether such affective attention flexibility improvements would transfer to measures of emotion or stress regulation, which is essential to establish its potentiality as an intervention for emotional disorders.

Stress not only affects our subjective experience of emotions, but also influence our psychophysiological functioning (e.g., heart rate, HR). Therefore, the flexible regulation of these psychophysiological mechanisms needs facilitate the correct adjustment between available resources and environmental demands (Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010). As it has been previously discussed, heart rate variability (i.e., HRV), understood as the beat-to-beat variability produced by changes in vagal dominance, is a psychophysiological indicator of stress reactivity and recovery, capable of measuring environmental adjustment (Thayer et al., 2009). HR is in a constant process of inhibition through the influence of the parasympathetic system via the vagus nerve, which indicates the predominant activity of prefrontal regions (i.e., vmPFC) over other limbic areas (i.e., amygdala) (Thayer et al., 2012). When there is a perception of stress, the inhibition of the vagus nerve disappears, disinhibiting the sympathetic system, increasing HR and decreasing its variability (Beauchaine et al., 2007; Thayer et al., 2009). Based on this, HRV has been used not only as a measure of resting-state stress regulatory capacities (Chalmers et al., 2014; Colzato et al., 2018; Grol & De Raedt, 2021; Kemp et al., 2012), but also as a marker of changes in real-life stress situations (Filaire et al., 2010) and in controlled laboratory conditions using stress induction tasks (Grol & De Raedt, 2021; Weber et al., 2010; Zandara et al., 2018). Overall, the latter type of studies has shown that individuals typically show significant decreases in HRV while confronting stressors and a subsequent increases when the stressors are over, which is considered an adaptive mechanism of stress regulation (Hamilton & Alloy, 2016; Kim et al., 2018; Weber et al., 2010). In contrast, individuals with high levels of both depression and anxiety are characterized by low resting-state HRV levels (Chalmers et al., 2014;

Friedman, 2007; Kemp et al., 2010, 2014), and maintain these same low HRV levels during the confrontation of stressors (i.e., blunted reactivity), not generating adequate context-dependent responses and therefore maintaining a high sympathetic system activation (Hamilton & Alloy, 2016; Weber et al., 2010). Thus, adequate HRV changes in response to and after a stressor is a reliable measure of the individual's vagal control and a prefrontal neural indicator at an indirect level that reflect stress resilience and should be considered a relevant target to test the efficacy of affective attention flexibility trainings in promoting stress resilience.

With this idea, in this final study, a novel affective flexibility training was implemented, based on procedure of musical reinforcement, as in Godara, Sanchez-Lopez, Baeken, et al. (2021), in a sample of individuals with varying subclinical and clinical levels of emotional problems. The original training program from Godara, Sanchez-Lopez, Baeken, et al. (2021) was adapted to target different forms of contextual and affective attention flexibility, in line with the findings from the previous studies of this Dissertation (Studies 1, 2 and 3) on the modulatory role of contextual motivational goals based on promotion and prevention SFs. Thus, for promotion contexts participants received pleasant (i.e., happy) music or avoided receiving unpleasant (i.e., sad) music when their attention was directed towards the appropriate emotional component depending on the goal and the context of each trial (i.e., ‘to feel happy’, ‘to not feel sad’), and they stopped listening to the pleasant music or listened to the unpleasant music when they focused on the inappropriate emotional component depending on the goal and the context of the corresponding trial. A similar design was applied for prevention trials but in this case receiving pleasant (i.e., relaxing) music or avoided receiving unpleasant (i.e.,

anxiety-arousing) music when their attention was directed towards the appropriate emotional component depending on the goal and the context of each trial (i.e., 'to feel calmed', 'to not feel nervous'), and so on.

In order to evaluate the transfer effects of the training program to modulating affective attention flexibility, the tasks validated in the first set of studies were used to assess effects in inter-situational (Study 2) and intra-situational affective attention flexibility (Study 1). The first task was performed before and after training (close transfer), together with the social stress task performed at the end of the session (far transfer). Further, training effects in stress regulation were indexed through changes in HRV across the different reactivity and recovery phases of the social stress task.

The following hypotheses were formulated. As for training effects in inter-situational affective attention flexibility (close transfer), as in previous studies (Godara, Sanchez-Lopez, Baeken, et al., 2021), it was hypothesized that the training condition participants would improve trainees' levels of attention flexibility towards positive and negative information, while individuals in the control group would maintain their baseline levels. Regarding intra-situational affective attention flexibility (far transfer), it was hypothesized that as a result of trained increased affective attention flexibility, individuals in the training condition would maintain their attention toward positive information when the feedback switched to be mainly positive, as well as their attention toward negative information when the feedback switched to be mainly negative. In contrast, individuals in the control group were not expected to have a flexible attention behavior, being characterized by not maintaining attention toward positive information when the feedback was mainly positive (i.e., lack of positive attention bias characteristic of clinical

conditions of emotionally disorders; Armstrong & Olatunji, 2012). Finally, regarding emotional and psychophysiological performance in the stress induction, based on results from Study 1, it was hypothesized that both groups would show a reactivity-recovery pattern in self-reports of subjective emotional levels. However, for HRV indices, while participants in the control group were expected to present a blunted HRV pattern (no reactivity or recovery) across the sections of the momentary stressor, individuals in the training group were expected to be able to react (decrease their levels of HRV when facing the stress task) and recover from it (increase their HRV levels after completing the stress task), indicating a flexible psychophysiological pattern of response of stress.

8.2. Method

8.2.1. Participants

A sample of 56 undergraduates with varying subclinical to clinical levels of emotional problems from Complutense University of Madrid (52 females; 4 males) with a mean age of 20.93 (2.78) participated in the study. All participants were Spanish or high-level Spanish speakers and received university credits for the participation. The Complutense University of Madrid ethical faculty review board approved the experimental protocol.

Participants were pre-selected to undergo the training if they showed sub-clinical to clinical levels of either depression and/or anxiety. A first screening was conducted to detect the presence of potential emotional problems in a total pool of 136 participants. The PHQ-9 and the GAD-7 (see full details of these instruments below) were used to pre-screen depressive and anxiety symptom levels over pre-established cut-off criteria of severity. Several studies have stablished a cutoff of ≥ 10 to identify subclinical symptom

levels in both the PHQ 9 (Kroenke & Spitzer, 2002; Levis et al., 2019) and the GAD 7 (Spitzer et al., 2006). Thus, only participants that surpassed one or both cutoff criteria were invited to participate in the study. Pre-selected participants completed a clinical assessment to determine the possible existence of an emotional disorder (i.e., either affective or anxiety disorder, or both), using a semi-structured interview (SCID I; First et al., 1996) based on DSM IV diagnostic criteria. Demographic and clinical characteristics of the sample are presented in Table 14.

Table 14. Demographic and clinical characteristics of total sample.

	Training Condition		Control Condition	
	Subclinical (n= 15)	Clinical (n= 14)	Subclinical (n= 14)	Clinical (n= 13)
Age	20.47 (1.19)	21.07 (2.92)	20.57 (1.22)	21.69 (4.68)
Sex (women/men)	15/0	12/2	13/1	12/1
PHQ-9	12.13 (3.54)	14.57 (4.33)	10.36 (4.01)	12.69 (4.92)
GAD-7	12.67 (4.71)	12.36 (4.63)	10.43 (2.76)	12.54 (4.09)
DASS-21, Dep Subscale	4.73 (2.31)	8.71 (5.55)	4.71 (3.45)	9.85 (6.07)
DASS-21, Anx Subscale	6.07 (3.69)	8 (5.93)	3.64 (2.17)	11.15 (3.85)
DASS-21, Stress Subscale	9.6 (4.47)	10.28 (4.87)	9.36 (2.87)	13.38 (2.81)
Current Pharmacological Treatment	6 (40%)	5 (35.7%)	0 (0%)	2 (15.4%)
Current Psychological Treatment	1 (6.7%)	8 (57.1%)	2 (14.3%)	4 (30.8%)
Primary Diagnosis				
Depression		4 (28.57%)		1 (7.69%)
Anxiety		2 (14.28%)		4 (30.76%)
Mixed		8 (57.14%)		8 (61.54%)

8.2.2. Measures

8.2.2.1. Questionnaires

PHQ 9 (Patient Health Questionnaire; Kroenke et al., 2001; Diez-Quevedo et al., 2001). The PHQ 9 is a nine-item questionnaire used to evaluate depressive symptoms. It assesses the frequency of a certain of series of depressive symptoms during previous two weeks in a scale from 0 (not at all) to 3 (nearly every day). Higher scores in the scale indicate higher levels of depressive symptoms. PHQ 9 has showed high internal consistency, being the Cronbach's alpha in this study .71.

GAD 7 (The General Anxiety Disorder Scale; García-Campayo et al., 2010; Spitzer RL et al., 2006). The GAD 7 is a seven-item measure that assesses the severity of anxious symptoms during the previous two weeks in a scale from 0 (not at all) to 3 (nearly every day). Higher scores in the scale indicate higher levels of anxiety symptoms. The GAD 7 has showed high internal consistency in different studies, with values that goes from .92 (Spitzer et al., 2006) to .94 (Garcia-Campayo et al., 2010) and .81 in this study.

DASS 21 (Depression, Anxiety and Stress Scale; Daza et al., 2002; Lovibond & Lovibond, 1995). Besides the pre-screening measures, selected participants completed an additional self-reported assessment of emotional symptoms, together with the diagnostic clinical interview. This assessment was done with the DASS 21, which is a 21-item questionnaire that evaluate depression, anxiety and stress symptoms during the previous week, in a scale from 0 (not apply to me) to 3 (applied to me very much or most of the time). It is composed by three subscales, measuring depressive, anxiety and stress related symptoms. The DASS 21 has showed high internal consistency in every subscale, both in other studies ($\alpha_{dep_DASS} = .93$; $\alpha_{anx_DASS} = .86$; $\alpha_{stress_DASS} = .91$) (Daza et al., 2002) and

in this sample (α_{dep_DASS} = .88; α_{anx_DASS} = .84; α_{stress_DASS} = .81). This measure served to confirm the presence of high subclinical to clinical levels of emotional symptomatology of the selected participants (see Table 14), as an adding to the categorical diagnostic criteria used through the SCID interview.

8.2.2.2. Apparatus

All the tasks performed by the participants in the study were presented through e-Prime 3.0 (Psychology Software Tools, Pittsburgh, PA). For the attention tasks, a Tobii Pro Fusion eye-tracker at a sampling of 250 Hz (binocular) was used. Participants seated in a distance between 60-65 cm from the screen and prior to every eye-tracking task, a 9-point calibration was done.

8.2.2.3. Emotion stimuli

The positive and negative stimuli used for the close transfer task were the same as validated in Study 2 & 3. The positive, negative, and balanced stimuli in the far transfer stress task were the same as validated in Study 1. As for the affective attention flexibility training, Radboud Faces Database (RaFD; Langner et al., 2010) were selected as the emotional stimuli. Thirty-nine positive (happy) and seventy-one negative images (disgust and angry) were used based on their intensity ($M_{negative}$ = 3.74, $SD_{negative}$ = 0.41; $M_{positive}$ = 4.21, $SD_{positive}$ = .25) and valence levels ($M_{negative}$ = 2.05, $SD_{negative}$ = 0.32;$M_{positive}$ = 4.29, $SD_{positive}$ = 0.21), the same way as in the previous training study using this procedure (Godara, Sanchez-Lopez, Baeken, et al., 2021). Emotional stimuli for the training task were selected in a way that were not the same as the ones used in the rest of affective attention flexibility tasks used in the study to ensure close or far transfers.

8.2.2.4. Audible material used in the training

Musical rewards and punishments were used to reinforce attention to specific context-based emotional goals in each trial. For this purpose, four songs were chosen based on the type of emotion they elicited. Each song was used in a specific context in order to generate emotions consistent with the emotional continuum of each motivational context in each trial. This referred to conditions aimed to increase emotions of happiness, to reduce emotions of sadness, to increase emotions of calmness, and to reduce emotions of tension/anxiety. The songs used to induce each of these for types of emotions were ’Another Day of Sun‘, ’Into the Dark‘ (Fakhrhosseini et al., 2014), ‘Natural Light’ and ’Blood Starve Beast, Bloodborne’, respectively. The use of these songs was established through previous piloting of their capacities to induce specific forms of the intended emotions (see Supplementary information of the study below).

8.2.2.5. Heart Rate Variability (HRV)

A Polar V800 (Polar Electro Oy, Kempele, Finland) was used to evaluate beat-to-beat heart rate (HR) during the study (Giles et al., 2016). HR data was received from a H10 chest band (Schaffarczyk et al., 2022) that was worn by participants. RR intervals were extracted from each register phase and then analyzed through Kubios HRV Standard software 3.5.0 (Biosignal Analysis and Medical Imaging Group, n.d.; Tarvainen et al., 2014). Data were visually examined in order to find possible artifacts and then, if necessary, corrected through Kubios, whose method is based on using cubic spline interpolation. Root mean square of successive differences in beat-to-beat intervals (RMSSD) is a HRV index widely used in psychophysiology research (Colzato et al., 2018; Grol & De Raedt, 2020; Pulopulos et al., 2020; Wang et al., 2013; Weber et al.,

2010) due to several reasons: (a) the RMSSD index is capable of reflecting the balance between prefrontal (i.e., mPFC) and limbic regions (i.e., amygdala) through the autonomic regulation (para/sympathetic antagonistic processes) via vagus nerve mediated cardiac cycles (Mulcahy et al., 2019; Thayer et al., 2009, 2012) and (b) is not relatively affected by respiratory influences[8] like other HRV indices (i.e., HF-HRV) (Laborde et al., 2017). This index used thus used to index HRV markers of resting-state, stress reactivity and stress recovery across the different phases of the study.

8.2.2.6. Affective Flexibility Training

Two social context images were used in the training to present ecological situations related to the activation of different forms of promotion and prevention goals. One image represented a "family meal", while the other represented a "work interview", both being everyday life contexts with which participants could feel identified (Figure 15). Along with the images, a description of two associated goals appeared. Each goal prompted to direct and fixate attention of the participants to different adaptive emotional types of information (e.g., in the family meal scene, if the distal goal was 'having a good time', the most optimal behavior was to focus on faces expressing positive emotions; see full details below). In addition, each goals had an associated geometric figure (a diamond

[8] In order to control for other possible influences factors, the experimental procedure was made in a faraday cabin where temperature was controlled, fluctuating between 21 and 24 degrees Celsius. In addition, participants were asked to limit their consumption of caffeinated beverages (i.e., coffee, coke, energy drinks) or alcohol for at least 5 hours before the face-to-face session and that they will not take drugs (i.e., marijuana) during the same day of the experiment. Tobacco or medicines consumption was not limited, since it could end up generating the opposite expected effect (i.e., withdrawal response). In the same way, female participants were asked to sign up for the face-to-face session in a week that they did not have their menstruation in order to avoid possible hormonal changes that would affect HRV. 100% of the sample reported not having taken any of the substances mentioned above and only 2 participants had menstruation during the face-to-face session, reporting no mood change from their baseline state.

or a triangle), to favor memorizing the specific goal associated to each context and, consequently, the combination between the goal, the geometric figure and the context. The diamond in the family meal scene was related to the distal goal of ‘enjoy the meal’, which subsequently activated the proximal goal to fixate on faces expressing positive emotions. The triangle in the family meal scene was related to the distal goal of ‘resolving a family conflict’, which subsequently activated the proximal goal to fixate on faces expressing negative emotions. The diamond in the work interview scene was related to the distal goal of ‘feeling calm and relaxed during the interview’, which subsequently activated the proximal goal to fixate on faces expressing positive emotions. Finally, the triangle in the work interview scene was related to the distal goal of ‘not get nervous and resolve doubts during the interview’, which subsequently activated the proximal goal to fixate on faces expressing negative emotions.

Figure 15. Combinations of context image, geometric figures and emotional goals used in the attention training.

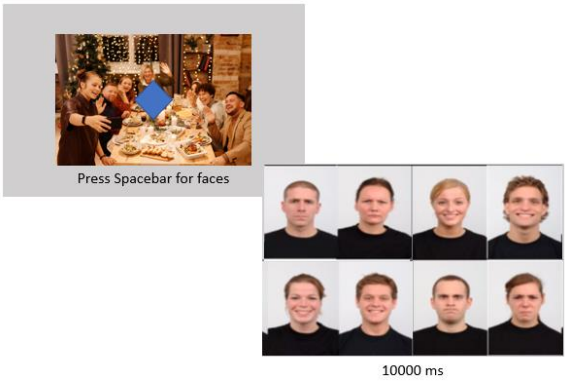
Context	Goal	Context Image
Family Food: To feel cheerful and happy during the meal, it is best to notice those family members who have positive expressions and are having a good time.		
To solve arguments between family members and thus not feel bad or sad about it, it is best to pay attention to those who have negative or angry emotions.		
Work interview: To feel calm and secure during the interview, it is best to notice those who have positive expressions.		
In order not to get nervous or disturb myself during the interview, it is best that I try to resolve possible doubts from those interviewers with negative expressions.		

Unlike Godara et al. (2020, 2021), motivational contexts were generated according to RFT theory (Higgins, 1997, 1998, 2012), in order to create contexts with specific motivational characteristics. In this case, the family meal context was categorized as a promotion context, while the work interview context was categorized as a prevention

context. By doing so, specific motivational goals were generated with the aim to represent the characteristic emotional continuums of each motivational SF. The family meal scene was a promotion context whose goals were expressed within an emotional continuum of cheerfulness-dejection, while the work interview scene was a prevention context whose goals were expressed in an emotional continuum of quiescence-agitation (Higgins, 1997, 1998). In fact, music used during the training follows this differentiation between motivational contexts, in such a way that participants listened to music inducing happiness or sadness in the family meal context (promotion) trials, depending on the specific proximal goal for each trial, while, in the work interview context (prevention) trials, they listened to music inducing tension/anxiety or calmness/relaxation, depending on the specific proximal goal for each trial.

Each trial started with a context image along with a geometric figure (diamond or triangle) in the middle of the screen, representing the context and the goal that the participant had to activate. Participants could see that combination as long as they needed in order to think about the optimal goal and emotional component associated with the trial combination, before continuing with the trial. At the same time, a phrase appeared in the below area of the screen asking them to press the spacebar to see the emotional faces when they were prepared. Once pressed, 8 emotional faces were presented, balanced both according to gender and valence for 10,000 milliseconds (two positive women, two negative women, two positive men and two negative men; see Figure 16 for a visual depiction of trial).

Figure 16. Visual depiction of a trial of the attention flexibility training.



When faces appeared, participants had to direct and maintain their attention (gaze) in the faces with the adaptive emotional component to the corresponding goal and context of the trial, in such a way that they listened to music or not depending on their attentional performance and the active motivational context, as follows:

- Family meal + diamond (goal: to feel happiness): if participants directed their attention to positive faces, they listened to the happy music, getting reinforcement, but if they stopped looking at it or looked at the negative faces, they did not hear anything.
- Family meal + triangle (goal: to not feel sad): if participants directed their attention to negative faces, they did not listen to sad music, but if they stopped looking at it or looked at the positive faces, they listened to sad music, getting a punishment.
- Job interview + triangle (goal: to feel calmed): if participants directed their attention to positive faces, they listened to relaxing music, getting reinforcement, but if they stopped looking at it or looked at the negative, they did not hear any music.

- Job interview + diamond (goal: to not feel anxious): if participants directed their attention to negative faces, they did not listen to anxious music, but if they stopped looking at it or looked at the positive, they listened to the anxious music, getting a punishment.

Therefore, the onset or cessation of music depended on participants' flexibility in adjusting attention to emotional goals within each motivational context. This music was contingent on the participants' attentional pattern, receiving online direct musical reinforcement or punishment as the eye-tracker detected the occurrence of visual fixations in the corresponding types of faces.

In the control comparison condition, participants completed the exact same tasks, with the same stimuli, design, trials' sequence and durations, but without receiving gaze-contingent musical feedback. It comprised a yoked control group. Thus, although participants received the same amount of music during the same time, music did not play contingently on participants' attentional pattern. Music playing in each trial was simply preprogrammed, based on the duration and number of pauses of each song for each trial in a first pilot test with 11 participants with comparable emotional characteristics who initially completed the active training version.

Thus, attention in the training condition can be considered a top-down regulation process that generates situational control in participants through music reinforcement, while in the control condition, participants were totally passive to music presentation and cannot be categorized as a reinforcement. Emotional faces in both conditions were maintained for 10 s in each trial. Participants in both groups performed 64 training trials, in such a way that the number of repetitions and switch, either for emotional goals or

motivational contexts, was the same (i.e., trials were presented in a pseudorandom manner, so that all the participants had the same trial order presentation comprising an equal number of conditions of repetition and switching for all possible context + goal combinations).

8.2.2.7. Affective Attention Flexibility (close transfer)

In order to evaluate close transfer, the variation of attention flexibility task (AF task; Godara, et al., 2020) validated in the Study 2 of this Dissertation was used. This task evaluates affective attentional flexibility between emotional goals (i.e., positive, negative) and motivational contexts (i.e., promotion, prevention). As in the training procedure, the evaluation AF task was based on the learning of certain combinations between context images and geometric figures (square or circle) that were associated with specific emotional goals that required to direct and maintain attention (gaze) to a particular type of emotional information in each trial. In this case, the contexts were a "Party with friends" and a "Presentation at the University". In the same way as in AF Training, contexts were expressed following the RFT principles (Higgins, 1997, 1998, 2012), in such a way that "Party with friends" was categorized as a promotion context (expressed following the emotional continuum of cheerfulness-dejection), while "Presentation at University" was categorized as a context of prevention (expressed following the emotional continuum of quiescence-agitation; see Figure 17 for a visual depiction of the AF Task combinations). The square in the context of “Party with Friends” was associated with the goal of “enjoy the party”, requiring participants to focus on positive information, while the circle was associated with the goal “resolve a conflict with friends” so participants had to focus on negative information. The circle in the context of

“Presentation at University” was associated with the goal of “be calm and relax during the presentation”, requiring participants to focus on positive information, while the square was associated with the goal “not get nervous and resolver questions that may arise”, so participants had to focus on negative information. It was decided to use different geometric figures between the AF Task (square and circle) and the AF Training (rhombus and triangle), so that participants would do different association processes in each task.

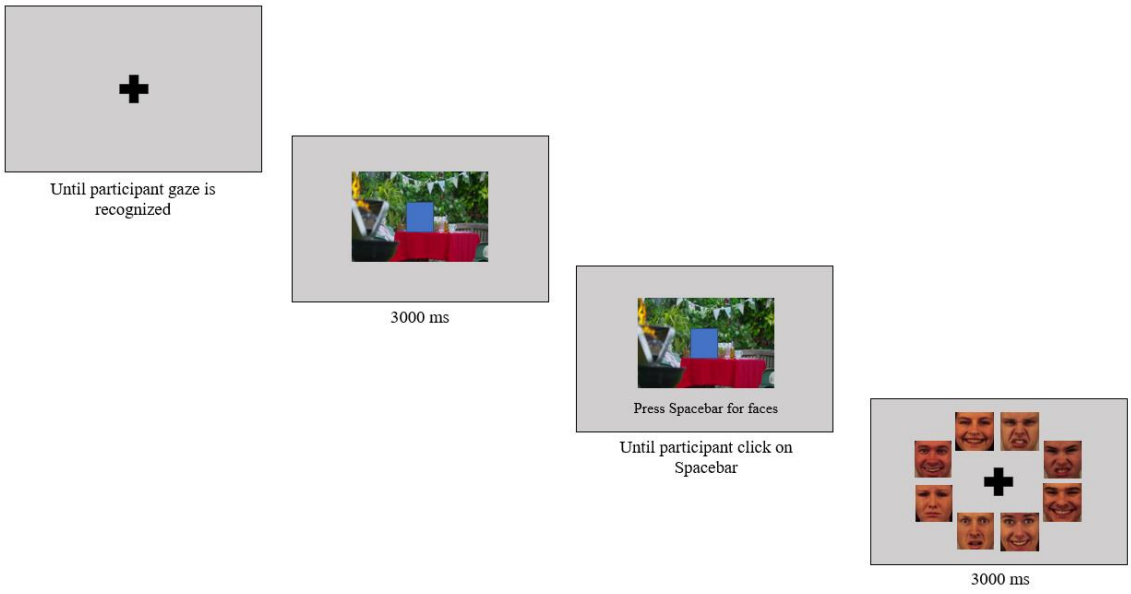
Figure 17. Combinations for AF task.

Context	Goal	Context Image
"Party with Friends" To enjoy the party, it is best to look at those of my friends who seem to be having a good time. To resolve a conflict/problem with my friends and not feel bad about it, it is best to pay attention to those who seem sad or upset.	 (Promotion Goal to Positive Information) (Promotion Goal to Negative Information)	
Cheerfulness ⟷ Dejection		
"Presentation at the University" To be calm and feel safe during my presentation, it is best to look at those of my colleagues who have more positive expressions. In order not to get nervous, it is best to quickly resolve questions that may arise during my presentation, looking at those of my colleagues who have more negative expressions.	 (Prevention Goal to Positive Information) (Prevention Goal to Negative Information)	
Quiescence ⟷ Agitation		

Each trial started with a fixation cross in the middle of the screen that had to be fixated by participants for 200 ms in order to continue with the trial. Then, a context image with a geometric figure appeared for 3000 ms, indicating which context and goal

has to be activated for that specific trial. After that, a sentence in the bottom of the screen appeared ("Press spacebar for faces"), indicating participants that they could continue with the task when they were ready[9]. Once they pressed the spacebar, 8 emotional faces (balanced according to gender, valence and position) appeared on the screen during 3000 ms, and participants had to direct and maintain their attention (gaze) in the appropriate type of emotional information (either positive or negative faces depending on context and goal combination) as quickly as they could (Figure 18).

Figure 18. Sequence in the attention flexibility task.



Two sets of 64 AF Task trials were completed, one before and another one after completing the flexibility training. Trials in both sets were presented in a pseudo-randomized manner, so that there was the same number of trials repeating and switching both contexts and emotional goal combinations in both assessments. In this task, "Time

[9] In order to know that participants during the AF task (pre and post) were able to recall the emotional goals associated with the geometric figures and contexts, there was a check-knowledge process before and after each of the tasks. Of the entire sample, no participant failed to remember the emotional goals in the flexibility task, both pre and post.

to First Fixation on relevant emotion" was the attentional index extracted from the eye-tracker to assess the efficiency with which participants switched between motivational contexts and emotional goals. A series of data cleaning steps were followed. First, all trials with first fixation times lower than 100 ms and greater than 1000 ms were eliminated since they are non-representative. Similarly, those participants who did not have at least 50% of valid trials to compute each type of attentional cost index were left out from the analyses. From resulting available data, attentional cost indices were generated for both purely emotional indices (attention either towards positive or negative information) and contextual indices (attention either towards the promotion or prevention context), as performed in the Study 3 of the Dissertation. This was done through the subtraction from the first fixation times in trials in which there was a given change (e.g., switch from negative to positive information) of the first fixation times in trials where there was a repetition of that condition (e.g., repeat attention to positive information). Higher values indicate higher levels of attention flexibility. This method has been used in a similar way in other RT-based flexibility studies (Genet et al., 2013; Grol & De Raedt, 2020; Malooly et al., 2013) and the previous studies of the Dissertation:

"Specific Index of Affective Switch towards Positive Information" (SIASP): this index was created by subtracting first fixation times in those trials in which there was a required shift from negative towards positive emotional faces (regardless of the type of context) from first fixation times requiring to repeat an attention pattern towards positive information (regardless of the type of context), in relation to the previous trial.

"Specific Index of Affective Switch towards Negative Information" (SIASN): SIASN was created by subtracting first fixation times in those trials in which there was a

required shift from positive towards negative emotional faces (regardless of the type of context) from first fixation times requiring to repeat an attention pattern towards negative information (regardless of the type of context), in relation to the previous trial.

"Specific Index of Contextual Switch towards Promotion Context" (SICSProm): SICSProm was created by subtracting first fixation times in those trials in which there was a required shift from prevention towards the promotion context (regardless of the type of goal emotion) from first fixation times requiring to repeat an attention pattern towards promotion context (regardless of the type of goal emotion), in relation to the previous trial.

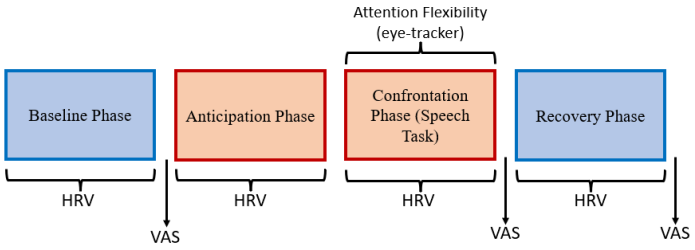
"Specific Index of Contextual Switch towards Prevention Context" (SICSPrev): SICSPrev was created by subtracting first fixation times in those trials in which there was a required shift from promotion towards the prevention context (regardless of the type of goal emotion) from first fixation times requiring to repeat an attention pattern towards prevention context (regardless of the type of goal emotion), in relation to the previous trial.

8.2.2.8. Speech Task (far transfer)

The Speech Task validated in the Study 1 of the Dissertation was used, which includes different phases (see Figure 19) to assess stress reactivity and recovery processes both using subjective (Visual Analogue Scales) and psychophysiological (HRV) indicators. The VAS assessed current levels of happiness, sadness, nervousness and relaxation in a scale from 0 - not at all- to 9 -very much-, and were applied at the end of baseline (pre-stress), immediately after completing the speech task (during-stress) and

after a recovery phase (post-stress). HRV was assessed continuously through the entire duration of the social stressor, differentiating 4 stress phases, as detailed below.

Figure 19. Sequential phases of Speech Task.



The first step consisted of the evaluation of HRV resting-state levels ("Baseline Phase") just after completing attentional training and the post-AF Task, before starting the stress procedure. For this, a vanilla baseline was performed before starting the stress induction, based on requesting participants to complete a very simple cognitive task (counting green squares) for 5 minutes (Jennings et al., 1992) while their HRV was recorded. Previous studies have shown that this task does not influence HRV levels due to its low levels of cognitive cost, but that at the same time it implies a more natural situation to index resting-state HRV than using procedures of relaxation (e.g., Jennings et al., 1992). At the end of this baseline assessment, participants were then asked to complete the first VAS. Next, a variation of the speech task (Sanchez, Romero, et al., 2017), as validated in the Study 1 of the Dissertation, was performed in order to assess the transfer of the attention training in processes of reactivity to and recovery from social stress (far transfer). In this case, participants were asked to give a 5-minute talk about the topic "why do you consider yourself…?", referred to five self-relevant positive adjectives

(e.g., intelligent), as done in Study 1[10]. In addition, they were told that their speech would be evaluated by a jury made up of 4 members specialized in verbal language, who would assess the talk through a webcam based on three criteria: security, clarity and conviction. This jury would present emotional feedback to them directly and online in the form of avatars providing feedback on their evaluation. The jury feedback was false and was preprogrammed in such a way that it showed different balances among negative and positive emotional faces. The feedback was balanced according to valence and location of faces. The presentation order was: Balanced (50% positive – 50% negative), Positive (75% positive – 25% negative), Balanced (50 % positive – 50% negative), Negative (25% positive – 75% negative) and Balanced (50% positive – 50% negative) (Figure 20). False feedback comprised a total of 4 faces, positive (smiling) and negative (disgusted), with 2 male and 2 female avatars, created with FaceGen Modeller software (Singular Inversions, Toronto, ON, Canada).

The task consisted of 5 trials (in each trial, participants had to speak about a different adjective), each lasting 1 minute, which began with 30 s of a gray screen with a circle in the middle. This gray screen appeared with the justification that the jury had enough information to evaluate the ongoing speech. Feedback then appeared on the screen for another 30 s. This methodology was implemented for every of the five adjectives/trials performed in the task.

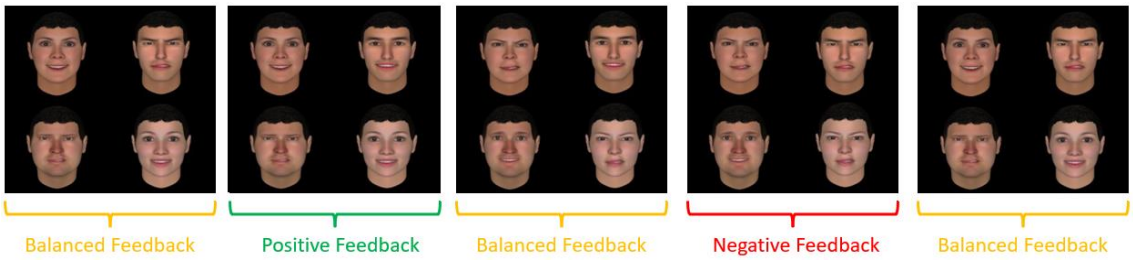
The speech task can be divided in two specific phases: (a) "Stressor Anticipation Phase", which is composed by the whole explanation to participants about the task (e.g.,

[10] The adjectives used in the speech task were obtained from the Self-Attribute Task done in the previous session where they completed the diagnostic interview. The 5 highest-rated positive adjectives per participant were chosen with the aim that participants felt identified with the topics of the task.

the existence of a jury, the specific adjectives which they had to talk about, the criteria of the speech…) and (b) the "Stressor Confrontation Phase", that comprises the 5 minutes of the actual participant's speech. HRV was monitored through each of these phases to index changes reflecting patterns of stress reactivity. A new series of VASs was completed at end of each of these 5-minute phases.

The "Proportion of Total Time of Fixation on Positive over Negative Faces" was the eye-tracking based index used in this task, as in Study 1. It indicates to what extent participants maintained their attention on positive faces with respect to the total time of fixation on emotional information, both positive and negative [i.e., Proportion of Total Fixation Time on Positive = Total Fixation Time on Positive/(Total Fixation Time on Positive + Total Fixation Time on Negative)].

Figure 20. Order of false feedback during the Speech Task.



Finally, after the speech task was over, participants were asked to relax for 5 minutes, in order to assess participant's ability to recover from the social stressor (Recovery Phase). Once these 5 minutes were over, they were asked for the last time to complete a final set of VASs. A final HRV measure was established for this 5-minute recovery period.

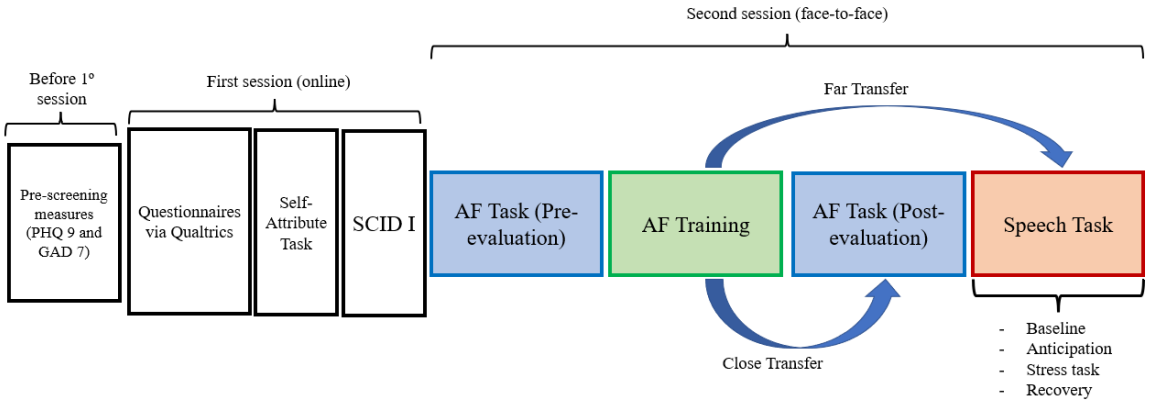
2.3. Procedure

Before the first session, participants were asked to complete PHQ 9 and GAD 7 as prescreening measures (for a detailed explanation, see the "Questionnaires" subsection). After this, those participants who met the cut-off criteria were invited to participate in the experiment and had to attend to two different sessions. Before first session, participants completed via Qualtrics some questionnaires as well as the informed consent. The first session consisted of an online meeting where participants performed a "Self-Attribute Task"[11] followed by the administration of the affective modules of SCID I using DSM IV diagnostic criteria (First et al., 1996). After establishing clinical and subclinical statuses and the type of emotional problems present, participants were randomly assigned, based on clinical status group, to undergo the active or control training in the following experimental session. This second experimental session consisted of a face-to-face session in a faraday cabin. Participants first performed a pre-training baseline measure of the affective attention flexibility task (Godara et al., 2020), followed by the training task (i.e., active or control) together with a post-training assessment of the same affective attention flexibility task (close transfer). Once this part was finished, participants were explained how to correctly put the H10 band, in order to assess their HRV during the stressor. When it was ensured that participants had put on the band correctly and that POLAR V800 correctly measured HR, the speech task (far transfer) was performed, including its baseline, anticipation, stress task and recovery

[11] In this task, participants had to evaluate from 1 (not at all) to 4 (a lot), to what extent they felt identified with 20 positive adjectives. These adjectives were later used in the Speech Task, with the aim that participants did the task using adjectives that really described them. This task was run using E-Prime Go. These adjectives were validated before the experiment by a sample of participants independent of the main study in order to ensure the validity of the adjectives used (Supplement 2).

phases (see Figure 21 for study procedure scheme). Finally, participants were debriefed on the real purpose of the study, and they received a validated brief positive mood induction (i.e., eating chocolate; Sanchez, Romero, et al., 2017) as a reinforcement and were thanked for their participation in the study.

Figure 21. Schematic design of the study procedure.



8.3. Results

8.3.1. Attention flexibility (close transfer)

In order to assess pre-post changes in attention flexibility indices, repeated measures ANOVAs were performed with Time (pre, post) and Type of Emotion (positive, negative) or Type of Context (promotion, prevention), depending on the specific analysis, as withing-group measures factors, and Training Condition (Training vs Control) and "Clinical Status" (subclinical vs clinical) as between-group factors.

Ten participants were removed from these analyses because they did not meet the established inclusion criteria (see the AF Task subsection in the Method for details in the Data Cleaning procedure). Thus, the analyzed sample comprised 46 participants. Regarding differences between the training conditions in demographics or pre-training measures (Training Condition = 21; Control Condition = 25), no significant differences

were found for age, t = -.13, p = .9, sex proportion, $\chi 2$ = .2, p = .66, or any questionnaire used in the study, all $t´s$ < 1.9, $p´s$ > .07. Table 15 shows the cognitive cost indices for each clinical status group in each training condition.

Table 15. Pre and Post Attention Flexibility Indices.

		SIASP		SIASN		SICSProm		SICSPrev	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
	Subclinical	9.38	37.80	-37.93	-8.77	-37.85	-17.30	47.99	-11.60
		(105.27)	(135.88)	(112.96)	(100.50)	(112.3)	(110.01)	(129.99)	(102.34)
Training	Clinical	22.28	-15.94	-20.70	56.58	29.76	47.70	22.94	57.15
Condition		(72.98)	(64.17)	(85.12)	(105.89)	(96.80)	(83.47)	(55.13)	(121.21)
	Total	13.68	19.88	-32.19	13.01	-15.31	4.36	39.64	11.31
		(94.02)	(117.94)	(102.65)	(104.53)	(109.89)	(104.61)	(109.74)	(110.99)
	Subclinical	21.11	11.17	-19.30	31.26	31.38	27.71	-18.61	49.69
		(86.82)	(67.53)	(123.98)	(121.31)	(122.71)	(124.21)	(98.16)	(124.14)
Control	Clinical	71.90	-7.43	14.07	30.29	-4.86	23.15	113.82	70.87
Condition		(90.24)	(61.03)	(125.42)	(69.97)	(115.80)	(116.66)	(98.80)	(102.04)
	Total	45.49	2.24	-3.28	30.79	13.99	25.52	44.96	59.86
		(90.40)	(63.85)	(123.23)	(97.99)	(118.39)	(118.14)	(117.69)	(112.23)

*Note*s. SIASP = Specific Index of Affective Switch towards Positive Information; SIASN = Specific Index of Affective Switch towards Negative Information; SICSProm = Specific Index of Contextual Switch towards Promotion Context; SICSPrev = Specific Index of Contextual Switch towards Prevention Context.

8.3.1.1. Training effects in Affective Attention Flexibility Indices

A 2x2x2x2 repeated-measure ANOVA with Time (Time 1: pre and Time 2: post) and Type of Emotion (Positive and Negative) as within-group factors and Training Condition (Training Condition and Control Condition) and Clinical Status (Subclinical and Clinical) as between-group factors was performed with the Affective Attention

Flexibility indices (SIASP and SIASN) as outcome. Post hoc comparisons were done in order to interpret resulting significant interactions.

A significant interaction of Time by Type of Emotion was found, $F(1,42) = 4.79$, $p < .03$, $\eta_p^2 = .1$. Post-hoc comparisons showed that participants in general were more flexible switching attention from negative to positive than from positive to negative information in the pre-training evaluation ($p = .03$) but this difference was no longer significant in the post-training evaluation ($p = .34$). This suggests that flexibility processes were in general balanced after practice. Moreover, there was not a significant difference in flexibility levels in the post- compared to the post-training neither for both positive ($p = .1$) or negative information ($p = .1$). No other main effects or interactions were significant, all F's < 1.45; all p's > .23, all $\eta_p^2 < .03$.

8.3.1.2. Training effects in Contextual Attention Flexibility Indices

A 2x2x2x2 repeated-measure ANOVA with Time (Time 1: pre and Time 2: post) and Type of Context (Promotion and Prevention) as within-group factors and Training Condition (Training Condition and Control Condition) and Clinical Status (Subclinical and Clinical) as between-group factors was performed with the Contextual Flexibility indices (SICSProm and SICSPrev) as outcome.

There were not significant main effects or interactions, all F´s < 3.68, all p's > .06, all $\eta_p^2 < .08$.

8.3.2. Speech Task Indices (far transfer effects)

In order to evaluate specific hypotheses regarding differences due to training in dependent variables measured during the phases of the Speech Task (i.e., self-reported mood as measured by VASs, HRV as measured by RMSSD, Affective Attention

Flexibility as measured by the Proportion of fixation times in positive over negative feedback across the sections of the speech), repeated-measure ANOVAs with the corresponding Time as within-group factors and "Training Condition" (Training vs Control) and "Clinical Status" (subclinical vs clinical) as a between-group factors were performed.

8.3.2.1. Self-reported mood changes in response to stress

Two participants were excluded from these analyses due to problems during the experimental procedure (i.e., one participant not showing up for the experimental session and another participant not wanting to participate in the speech task due to the high levels of nervousness generated). Each participant belonged to different experimental conditions, so total sample of these analyses is composed by 54 participants (Training Condition = 28; Control Condition = 26). Table 16 shows means and standard deviation of the VAS measures across the sections of the speech task.

Table 16. Means and standard deviations (in brackets) of VAS self-reported moods.

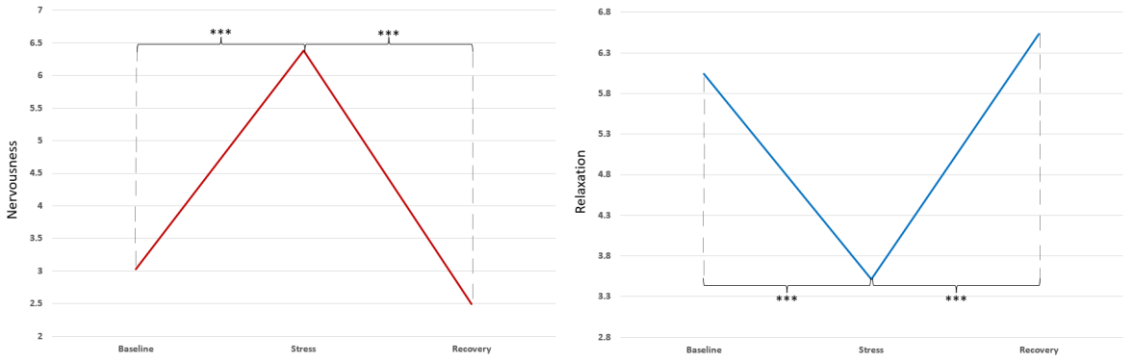
		Nervousness			Relaxation			Happiness			Sadness		
		Baseline	Stress	Recovery	Baseline	Stress	Recovery	Baseline	Stress	Recovery	Baseline	Stress	Recovery
Training Condition	Subclinical	3.2	6.73	2.13	6.07	2.27	6.8	5.93	5.2	5.8	1.53	2.53	1.93
		(1.70)	(1.71)	(1.64)	(1.91)	(1.53)	(1.42)	(1.39)	(1.82)	(1.66)	(1.46)	(2.33)	(1.91)
	Clinical	2.46	6.15	2.08	6.08	4.15	6.69	5.77	4.08	4.77	2.15	2.31	1.85
		(1.98)	(2,54)	(1.85)	(1.6)	(2.37)	(2.02)	(1.23)	(1.5)	(1.83)	(1.77)	(2.06)	(1.95)
	Total	2.86	6.46	2.11	6.07	3.14	6.75	5.86	4.68	5.32	1.82	2.43	1.89
		(1.86)	(2.12)	(1.71)	(1.74)	(2.15)	(1.69)	(1.3)	(1.74)	(1.79)	(1.61)	(2.17)	(1.89)
Control Condition	Subclinical	2.54	6.54	2.62	6.23	3.85	6.08	5.2	4.77	5.38	1.77	2.23	1.92
		(1.61)	(2.07)	(1.76)	(2.17)	(2.64)	(2.06)	(1.82)	(2.17)	(1.71)	(1.74)	(1.88)	(1.85)
	Clinical	3.92	6.08	3.15	5.77	3.77	6.54	3.92	3.85	4.31	4.08	4	3.69
		(2.29)	(2.78)	(2.61)	(2.13)	(2.86)	(1.98)	(1.44)	(1.99)	(1.44)	(2.22)	(2.2)	(1.93)
	Total	3.23	6.31	2.88	6.0	3.81	6.31	4.62	4.31	4.85	2.92	3.12	2.81
		(2.06)	(2.41)	(2.2)	(2.12)	(2.7)	(1.99)	(1.58)	(2.09)	(1.64)	(2.28)	(2.2)	(2.06)

A series of 3x2x2 repeated-measure ANOVAs with Time (Time 1: baseline; Time 2: stress task; Time 3: recovery) as within-group factor and Training Condition (Training Condition and Control Condition) and Clinical Status (Subclinical and Clinical) as between-group factors were performed for each mood state VAS (Nervousness, Relaxation, Happiness, Sadness) as dependent variables.

According to nervousness and relaxation, only a significant main effect of Time was found, $F(2,49) = 75.1$, $p < .001$, $\eta_p^2 = .75$ and $F(2,49) = 38.03$, $p < .001$, $\eta_p^2 = .61$, respectively, indicating general changes in the levels of these moods across the experimental procedure. Post-hoc comparations showed an increase in nervousness and a decrease of relaxation from the baseline (Time 1) to the stress phase (Time 2), both p's < .001, followed by a decrease in nervousness and an increase in relaxation from the stress

to the recovery phase (Time 3), both p´s < .001. There were no differences between the baseline and recovery phases neither in in nervousness, p = .16, or relaxation, p = .46 (Figure 22). Thus, results indicate that the social stress task produced the expected pattern of mood effects and its validity as a momentary social stressor, yet no differences in these changes due to training and/or clinical status were supported.

Figure 22. Levels of nervousness and relaxation during the experimental procedure.

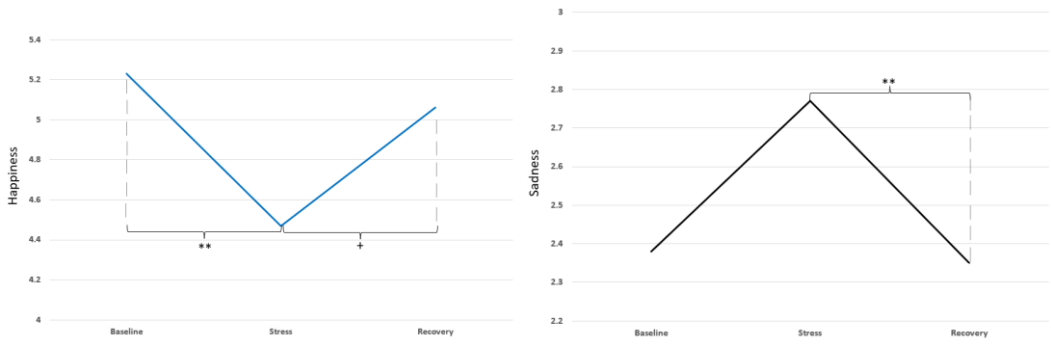


Notes. ***: p < .001

According to happiness and sadness, a main significant effect of Time was also found for both emotions, $F(2,49) = 4.56$, $p = .01$, $\eta_p^2 = .16$ and $F(2,49) = 4.42$, $p = .02$, $\eta_p^2 = .15$, respectively, indicating that participants' levels of happiness and sadness changed across the phases of the stress procedure. Post-hoc comparisons showed a significant decrease from the baseline to the stress phase in the levels of happiness, p = .01, but not for the levels of sadness, p = .34. Moreover, there was a recovery trend from the stress to the recovery phase in the general levels of happiness, p = .05, and a significant decrease in the levels of sadness, p = .01. No differences between the baseline and recovery phases in happiness were supported, p = .95 or sadness, p > .99, respectively (Figure 23). A main significant effect of Clinical Status for both happiness, $F(1,50) = 6.55$, $p = .01$, $\eta_p^2 = .12$, and sadness, $F(1,50) = 4.55$, $p = .04$, $\eta_p^2 = .08$, was also found,

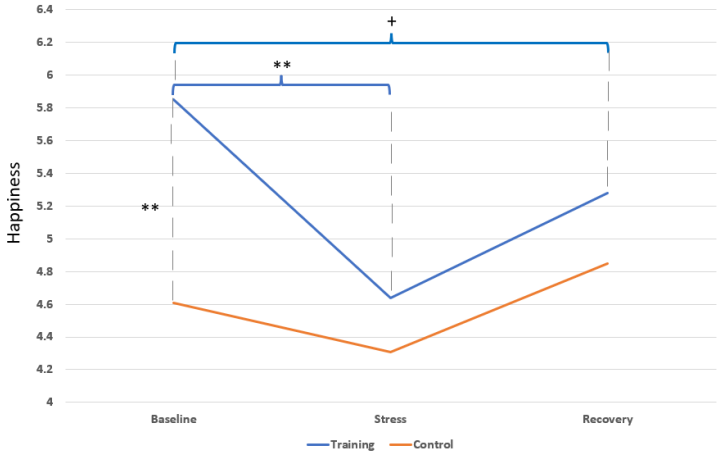
indicating that subclinical participants felt happier, p = .01, and less sad, p = .04, than clinical participants during all the phases of the experimental stress procedure. Moreover, an interaction between Time and Training Condition was found for happiness, $F(2,49) = 3.34$, $p = .04$, $\eta_p^2 = .12$. Post-hoc between-group comparisons showed that participants in the training condition felt happier than participants in the control condition during baseline (i.e., after having completed the flexibility training), p = .002, while the rest of the comparations were not significant, all p´s > .34. As for post-hoc within-group comparisons, participants in the control condition did not change their levels of happiness during all the experimental procedure, all p´s > .39. However, participants in the training condition showed decreases in happiness from the baseline to the stress phase, p = .003, and there was not an increase of happiness from the stress to the recovery phase, p = .18. (Figure 24). In sum, participants in the training condition showed higher happiness levels during baseline, as a result of the training, although when facing the stressful situation, those happiness levels decreased and did not later recover.

Figure 23. Main effect of happiness and sadness during social stressor.



Notes. **: p ≤ .01; +: p < .1

Figure 24. Interaction between Time and Training Condition during the experimental procedure in levels of happiness.



Notes. **: $p \leq .01$; +: $p < .1$

8.3.2.2. Affective Attention Deployment

The final sample included in these analyses was the same as in VAS analyses (Training Condition = 28; Control Condition = 26). Table 17 shows the mean and standard deviations (in brackets) of affective attention deployment (i.e., proportion of total fixation time to positive over negative feedback) during speech task.

Table 17. Mean and standard deviation of Proportion of Total Fixation Time to Positive over Negative Feedback.

	Proportion of Total Fixation Time				
	Balanced Feedback	Positive Feedback	Balanced Feedback	Negative Feedback	Balanced Feedback
Training Condition	.56 (.15)	.8 (.15)	.48 (.18)	.23 (.17)	.56 (.17)
Control Condition	.52 (.19)	.67 (.22)	.56 (.18)	.24 (.17)	.53 (.18)

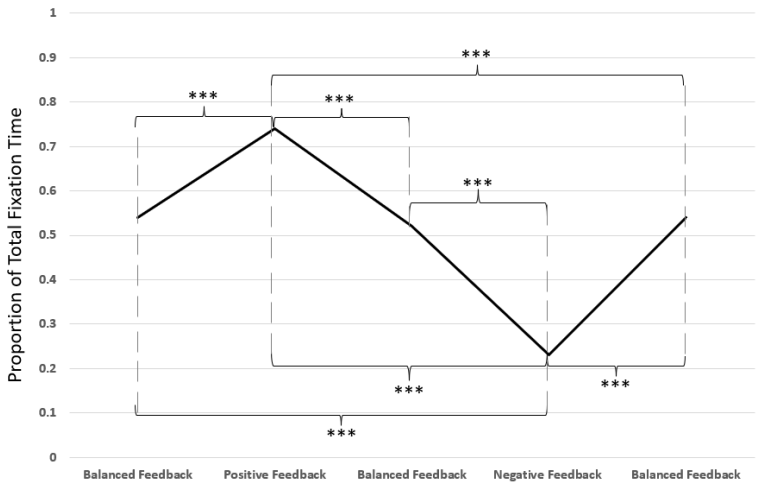
A 5x2x2 repeated-measure ANOVA with Time (Time 1: Balanced Feedback; Time 2: Positive Feedback; Time 3: Balanced Feedback; Time 4: Negative Feedback; Time 5: Balanced Feedback) as within-group factor and Training Condition (Training Condition, Control Condition) and Clinical Status (Subclinical and Clinical) as between-group factors was performed with the Proportion of Total Fixation Time to Positive over Negative Feedback as dependent variable.

There was a significant main effect of Time $F(4,47) = 43.78$, $p < .001$, $\eta_p^2 = .79$. Post-hoc comparisons indicated an attention flexibility pattern, in such a way that participants maintained their attention proportionally depending on the emotional component of each feedback (i.e., a pattern of contextual-based Affective Attention Flexibility, as also shown in Study 1). When the feedback was mainly positive (Time 2), participants attended more time to positive than negative faces compared with balanced feedback (Time 1, 3 and 5), all p´s < .001, and with negative feedback (Time 4), p < .001. The oppositive pattern happened when feedback was mainly negative, indicating that participants attended more time to negative than positive faces during negative feedback (Time 4) compared with positive feedback (Time 2), p < .001, and with balanced feedback (Time 1, 3 and 5), all p's < .001. There were no significant differences in the proportion of fixation times between the three balanced feedbacks, all p´s > .99 (Figure 25). Beyond this general effect, an interaction between Time and Training Condition was also found $F(4,47) = 3.06$, $p = .02$, $\eta_p^2 = .21$. Post-hoc comparations showed that, as for between-group differences, there was a significant difference in the proportion of fixation time during the positive feedback part (Time 2): more specifically, participants in the training condition spent significantly more time attending to positive over negative faces

compared with participants in the control condition, $p = .01$. The rest of between-group comparisons were not significant, all p's > .1, (see Figure 26A). As for within-group differences, participants in the training condition showed the trained affective flexible attention pattern, in such a way that they maintained their attention proportionally to balanced, positive, and negative feedback depending on the type of feedback, so there were differences between the first balanced feedback (Time 1) and the positive feedback (Time 2), $p < .001$, between the positive feedback (Time 2) and the following balanced feedback (Time 3), $p < .001$, between the feedback balanced (Time 3) and the negative feedback (Time 4), $p < .001$, and finally between the negative feedback (Time 4) and the last balanced feedback (Time 5), $p < .001$ (see Figure 26B). In contrast, participants in the control condition did not show the same pattern, in such a way that there were differences between the first balanced feedback (Time 1) and the positive feedback (Time 2), $p = .01$, between the feedback balanced (Time 3) and the negative feedback (Time 4), $p < .001$, and finally between the negative feedback (Time 4) and the last balanced feedback (Time 5), $p < .001$, but there was not significant differences between the positive feedback (Time 2) and the following balanced feedback (Time 3), $p = .41$ (Figure 26B). Thus, results indicated that attention is influenced by context-dependent information, in such a way that the participants guided and maintained their attention to emotional information depending on the type of feedback presented. In line with this, the gaze-contingent training helped participants in the training condition to be more flexible and to direct their attention depending on the emotional component of each feedback, maximizing positive processing when required. However, although participants in the control condition showed some certain level of affective attention flexibility, they did not

maximize attention to positive faces at the positive feedback section in the same proportion as participants in the training condition.

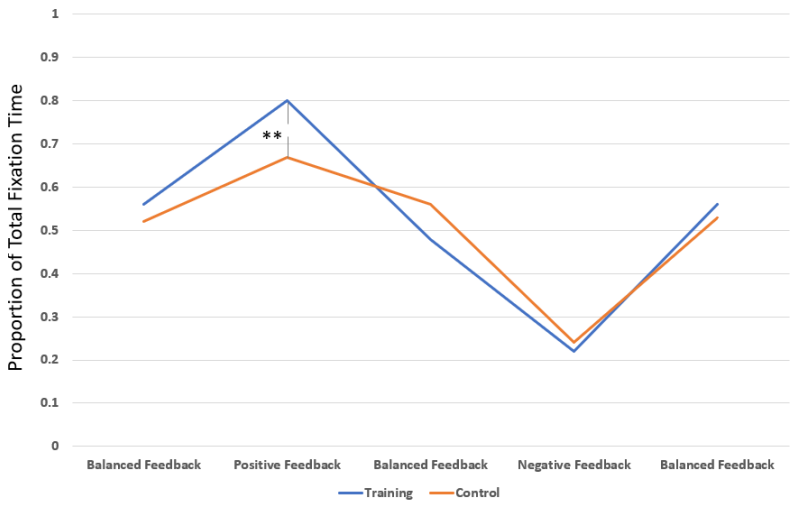
Figure 25. Main Time effect of proportion of total fixation time.



Notes. ***: p < .001

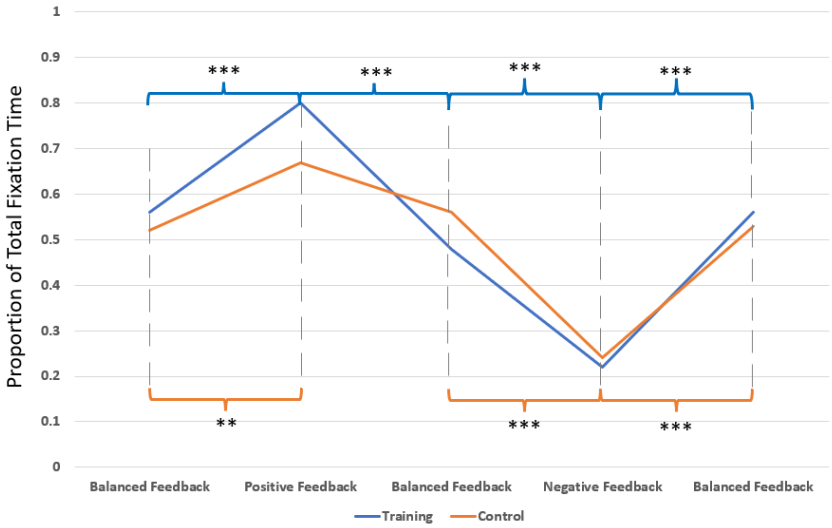
Figure 26. Between and within-group differences in proportion of total fixation time.

26A) Between-group differences in proportion of total fixation time.



Notes. **: p = .01

26B) Within-group differences in proportion of total fixation time.



Notes. ***: p < .001; **: p = .01

8.3.2.3. Heart Rate Variability changes in Response to Stress

Nine participants were excluded from the HRV analyzes. Two participants were excluded due to problems during experimental procedure (i.e., one participant not showing up for the experimental session and another one not wanting to participate in the speech task due to high levels of nervousness generated) and 7 participants were excluded due to invalid HRV records with many artifacts. Thus, the final sample was composed by 47 participants (Training Condition = 24; Control Condition = 23). Table 18 shows the means and standard deviation of HRV (i.e., RMSSD) measures in each experimental phase of the stress task.

Table 18. Mean and standard deviations of RMSSD levels in each experimental phase of the stress task.

		RMSSD (HRV)			
		Baseline	Anticipation	Stress Task	Recovery
Training Condition	Subclinical	46.11 (25.23)	38.91 (17.97)	33.77 (12.53)	48.37 (26.71)
	Clinical	42.23 (12.1)	38.53 (12.16)	38.51 (13.8)	49.84 (15.54)
	Total	44.33 (19.99)	38.74 (15.25)	35.94 (13.05)	49.04 (21.86)
Control Condition	Subclinical	47.94 (19.56)	35.57 (13.73)	35.2 (13.5)	58.07 (25.88)
	Clinical	40.14 (23.76)	35.32 (19.63)	35.17 (17.4)	37.57 (19.4)
	Total	43.87 (21.73)	35.44 (16.69)	35.18 (15.31)	47.37 (24.54)

A 4x2x2 repeated-measure ANOVA with Time (Time 1: Baseline; Time 2: Anticipation; Time 3: Stress Task; Time 4: Recovery) as within-group factor and Training Condition (Training Condition, Control Condition) and Clinical Status (Subclinical and Clinical) as between-group factors were performed with RMSSD as dependent variable. In these RMSSD analyses, Greenhouse-Geisser correction was applied due to not meeting the assumption of sphericity.

A main significant effect of Time was found, $F(1.98, 85.21) = 26.08$, $p < .001$, $\eta_p^2 = .38$, indicating that there were changes in HRV across the experimental phases. Post-hoc comparisons showed that, in general, RMSSD levels decreased, in comparison to the baseline phase, both during the anticipation, $p < .001$ and during the stress task phases, $p < .001$. Then, participants were able to recover properly from the social stressor, since the RMSSD levels during the recovery phase were significantly higher than in anticipation phase, $p < .001$, and in the stressor phase, $p < .001$. Near-to-significant differences were observed between baseline and recovery, $p < .06$ (see Figure 27), indicating that the

RMSSD recovery levels were even greater at the end of the study, compared to the pre-stressor baseline. No differences were found between anticipation and stress task phases, p > .99. Results suggest that the social stress task used in the study is valid to generate psychophysiological changes during the occurrence of these momentary stressor event. Moreover, there was a significant interaction between Time and Clinical Status, $F(1.98, 85.21) = 5.16$, $p < .008$, $\eta_p^2 = .11$, indicating that there was different stress reactivity patterns depending on clinical status. Post-hoc comparation showed no between-group differences in any phase, all p's > .16. As for within-group differences, results showed that subclinical participants had the expected reactivity pattern, lowering their RMSSD levels during the anticipation, p < .001, and confrontation with the stressor, p < .001, in comparison to baseline levels, but were able to recover from it and even increased HRV above basal levels (compared with the anticipation phase, p < .001, with the stress task phase, p < .001, and with baseline phase, p = .05). No differences were found between anticipation and stress phase, p = .37. In contrast, clinical participants did no show changes in RMSSD during any experimental phase, all p´s > .1 (Figure 28). These results suggest that one of the differentiating characteristics within the status of emotional problems was the reactivity pattern in response to the stressor, in such a way that subclinical participants get stressed, but they were able to recover properly, while clinical participants showed a blunted reactivity pattern. In addition, there was a significant three-way interaction between Time, Clinical Status and Training Condition[12], $F(1.98, 85.21)$

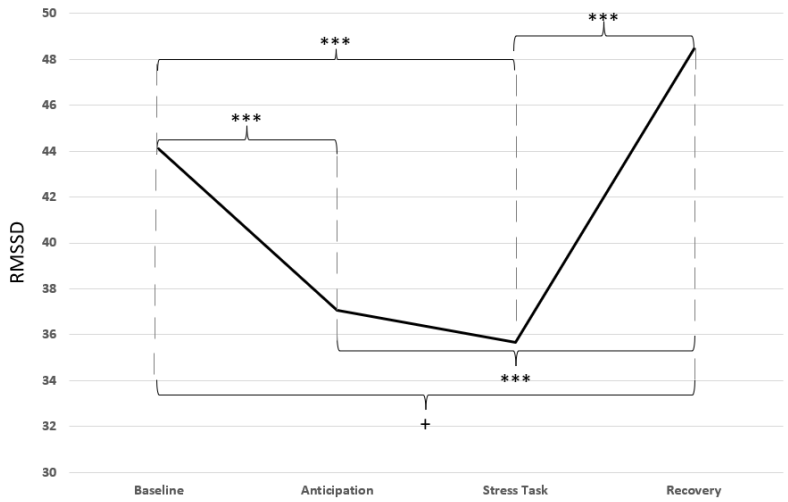
[12] Due to the three-way interaction, if we divided the sample according to the type of training and clinical status at the same time (Subclinical participants + Training Condition = 13; Subclinical participants + Control Condition = 11; Clinical participants + Training Condition = 11; Clinical participants + Control Condition = 12), there was no significant interaction differences in age, F = .23, p = .63, sex proportion, $\chi 2 = 2.37$, $p = .5$, PHQ 9, F = .38, p = .54, GAD 7, F = 2.6, p = .11, the depression subscale (F = .6, p = .44) and stress subscale of DASS 21 (F = 2.81, p = .1). There was a significant difference in anxiety

= 4.31, $p < .02$, $\eta_p^2 = .09$, in such a way that HRV reactivity patterns were not only influenced by clinical status but also by the type of training received. Post-hoc comparison showed that, as for between-group comparations, in the control condition, subclinical participants had higher levels of RMSSD than clinical participants during recovery, p = .03. The rest of the between-group comparations were not significant, all p's > .2. As for within-group comparations, subclinical participants in both conditions showed the expected stress pattern, decreasing their levels of RMSSD from the baseline to the anticipation phase in both conditions (training condition, p = .02, and control condition, p < .001) and an increase of RMSSD from the stress task to the recovery phase (training condition, p = .005, and control condition, p < .001). In contrast, clinical participants in the control condition showed the blunted reactivity pattern, where there were no significant differences (no HRV changes) across any of the experimental phases, p > .31. However, clinical participants in the training conditions showed a semiflexible reactivity pattern, in such a way that, although baseline HRV levels were not significantly different from those ones during the anticipation, p = .9 or the stress task phases, p > .99, there was a stress recovery response, since HRV levels in the recovery phase were significant higher in comparison to the anticipation phase, p = .04, and near-to-significant in comparison to the stress task phase, p = .08 (see Figure 29). Overall, results showed that participants who had a clinical status of emotional problems and received training in affective attention flexibility showed an improvement in their pattern of psychophysiological stress recovery (i.e., just like participants with subclinical status),

subscales of DASS 21 (F = 5.82, p = .02), but these differences were only significant between different clinical and subclinical groups (e.g., between subclinical and clinical participants in control condition, p < .001), not between participants in the same clinical status in different conditions (all p´s > .08).

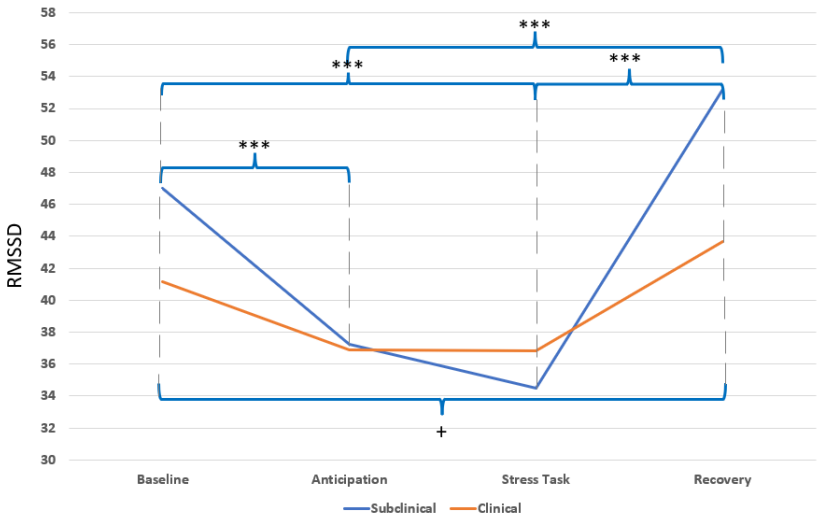
contrasting with the blunted HRV levels observed for clinical participants in the control condition.

Figure 27. Main effect of time on RMSSD.



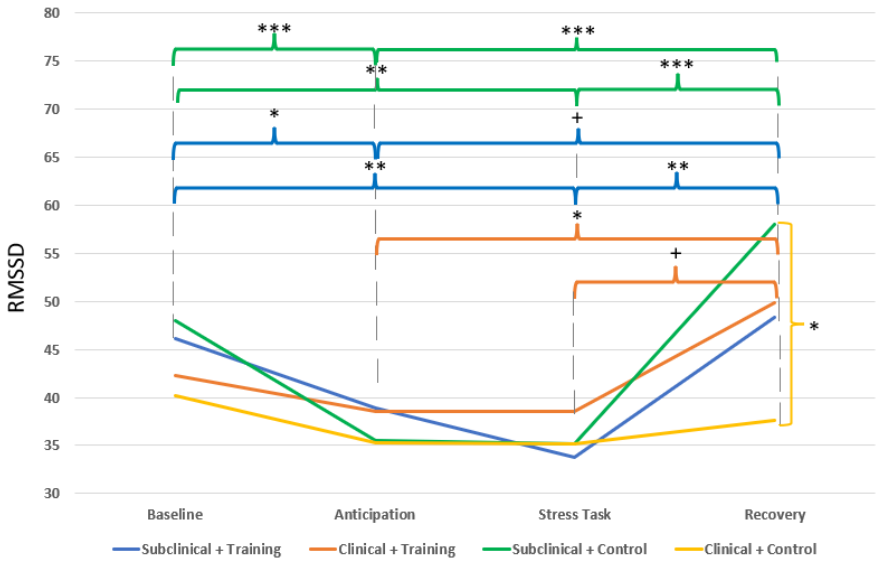
Notes. ***: p < .001; +: p < .1.

Figure 28. Stress reactivity pattern depending on clinical status.



Notes. ***: p < .001; +: p < .1.

Figure 29. Stress reactivity pattern depending on clinical status and training condition.



Notes. ***: $p < .001$; **: $p \leq .01$; *: $p < .05$; +: $p < .1$.

8.4. Discussion

The main aim of this final study was experimentally manipulating (training) participants' attention in order to generate context-dependent affective attention flexibility patterns. For this purpose, specific visual fixations on positive or negative information depending on context and goals was reinforced through emotional music that fit with each context-goal combination (e.g., happy music when the goal was enjoying a party with friends), using a variation of the training task developed by Godara et al., (2021). The results indicated that, although a clear improvement in the affective attention flexibility levels of the participants was not observed in pre-post changes in the AF task (close transfer), when testing improvements in flexibility in a social stress task (far transfer), the training generated certain benefits in different psychological indicators. First, participants in the training compared to the control condition showed higher levels in happy mood during the baseline assessment, after

having completed the training, and before starting the stress induction, although this was followed by a decrease of happy mood during the confrontation with and the recovery from the stressor. Moreover, participants in the training condition showed enhanced fixation times processing positive over negative information when the feedback was mainly positive, increasing their levels of affective attention flexibility in the processing of positive information. Finally, specifically clinical participants in the training condition showed a psychophysiological flexible pattern, being characterized by an increase in HRV during the recovery phase, a pattern that was absent in those clinical participants undergoing the control condition.

In contrast to the results found in other affective flexibility training studies (Godara, Sanchez-Lopez, Baeken, et al., 2021), in this study we did not find the expected effect of active training in pre-post changes in the affective attention flexibility close transfer task. One possibility to explain these incongruent results might be that, although both studies used musical reinforcement to train flexibility, this study was based on the presentation of pleasant music and the elimination of unpleasant music depending on the type of goals as the main type of reinforcement. This was different to the procedure of Godara et al. (2021), which was based on pleasant music or white noise, with no specific musical reinforcement associated with each specific type of context and goal combination. For future studies, it would be necessary to evaluate the advantages and disadvantages of each type of experimental design, in order to establish what type of training generates the best psychological improvement in other types of assessments of attention flexibility. Another possible explanation of these mixed results refers to the experimental design itself. Although this study followed a pre-post design,

characteristic for the evaluation of treatment effectiveness, other studies have focused on the importance of evaluating cognitive processes after a stressor (Quinn & Joormann, 2015; Wen & Yoon, 2019), in order to see how stressful situations modify levels of cognitive control and flexibility processing, and consequently, the regulation of stress itself (e.g., levels in executive functions after a stressor predicted levels of depressive symptoms, while pre-stressor levels did not; Quinn & Joormann, 2015). For this reason, perhaps using a measure of the AAF task assessed after the stress-inducing task, and before the recovery phase, would have been better suited to index relevant patters of inter-situational affective attention flexibility and the benefits of the training in this form of flexibility.

As for transfer effects during the stress task, the training showed certain psychological advantages in comparison to the control condition. First of all, during baseline (after completing the training), trainees felt happier than control participants. These results are in line with other studies that relate affective flexibility with lower negative affect and higher positive affect in daily life (through the mediating role of rumination; Yaroslavsky et al., 2019) and higher well-being levels during daily life (Pe, Koval, et al., 2013). However, the levels of happiness during the confrontation of the stressor and the subsequent recovery phase were not maintained by the trainees. Therefore, although a training-based mood improvement was observed in the stages prior to the stressor, it is necessary to evaluate the reasons for its decline and lack of maintenance during stress.

As for the improvement in affective attention flexibility during the speech task as the result of active training (i.e., maximizing attention to positive feedback when it

turned clearly positive) , these results are in line with those ones from Godara, Sanchez-Lopez, Baeken, et al. (2021), who found an increase in positive flexibility as a result of AAF training. Nevertheless, although Godara, Sanchez-Lopez, Baeken, et al. (2021) also found an increase in negative attention flexibility when feedback turned clearly negative, the training in this study did not find that other effect (i.e., greater fixation on negative information when feedback was mostly negative). This could be due to the fact that individuals with subclinical to clinical status of emotional problems in the current study already showed high levels of fixation on negative information (Armstrong & Olatunji, 2012; Clauss et al., 2022). However, inflexible fixations on positive information when required would be a defining characteristic of these problems (e.g., Blanco et al., 2019; Godara et al., 2020). Therefore, taking into account the characteristic pattern of attentional processing of emotional information of individuals with emotional disorders, being flexible in a context where maximized fixation in positive information is adaptive and a key point when it comes to favor correct emotional processing and emotion regulation.

According to the studied psychophysiological processes, the results indicated that the speech task was an optimal valid momentary social stressor to induce HRV-based processes of stress reactivity and recovery and to evaluate the different cognitive-affective processes that can be implicated. Participants, in general, showed a stress profile both at the subjective (e.g., significant increase in nervousness levels and significant decrease in relaxation levels) and the objective level (e.g., levels of RMSSD significantly decreased during the phases of anticipation and confrontation of the stressor and participants were then able to recover, increase RMSSD levels, after the

task finished). These results are in line with other previous studies where these same HRV responses to momentary stressors have been observed (Grol & De Raedt, 2021; Kim et al., 2018; Weber et al., 2010; Zandara et al., 2018). Moreover, the results of the study showed that while the subclinical participants showed a psychophysiological flexible pattern, those participants with a clinical status who did not undergo active training had a blunted reactivity during the entire stress task procedure, in such a way that their baseline, reactivity and recovery HRV levels did not change and were low across the entire procedure. These results are in line with studies that have evaluated the relation between resting-state HRV and emotional disorders, finding that people with depression and anxiety disorders, in comparison to healthy controls, show lower levels of resting-state HRV and blunted HRV reactivity (Friedman, 2007; Hamilton & Alloy, 2016; Kemp et al., 2010, 2012; Rottenberg, 2007; Wang et al., 2013). In contrast to that blunted pattern in the control condition, clinical participants in the training condition showed a flexible pattern characterized by a psychophysiological recovery (e.g., lower HRV levels during the anticipation and confrontation phases in comparison to the recovery phase). These results are novel, as no previous research has shown changes in HRV as a result of programs of cognitive training. Consequently, the results suggest that the training generated an improvement in the parasympathetic-sympathetic balance in order to establish normative levels of HRV, especially during the process of recovering from the stressor (Thayer et al., 2009). At the same time, these results show the connectivity between changes at the cognitive level (i.e., attention) and how these changes can positively affect variables at other levels of functioning. Similarly, vagal control has been conceptualized as a flexibility process (Thayer et al., 2009), so results

suggest a certain level of relationship and congruency between them (i.e., attention and psychophysiological flexibility).

Overall, the study reflects certain key points to highlight. First, in general, results highlight the importance of attention as a key cognitive mechanism in the processing of affective information and its relevance in emotional dynamics such as emotion or stress regulation (Gross & Thompson, 2007; Joormann & Vanderlind, 2014). Compared to a stable conceptualization of affective attention, which can be seen reflected in studies assessing negative attention biases (Armstrong & Olatunji, 2012; Blanco et al., 2019; Chen et al., 2012), the current results suggest that attention could serve as a flexible cognitive process (Godara et al., 2020), which is influenced by contextual factors. Therefore, the context in which an action is implemented is essential when determining the efficiency of attentional functioning subserving that action/behavior. Although there has been a tendency to interpret preferential attention to positive as adaptive and preferential attention to negative information as maladaptive (e.g., ABM programs focused on directing attention from negative to positive/neutral material in individuals with emotional problems; e.g., Sanchez et al., 2016), establishing behaviors as inherently (mal)adaptive without taking into account the context can make it difficult to understand its consequences at a psychological level. Results also indicated that attention processes can be manipulated with the aim of producing changes in affective, psychophysiological and behavioral variables. In fact, the training generated changes in processes in different levels, including affective (e.g., increased levels of happiness during the baseline), behavioral (e.g., greater flexible fixation on

positive over negative feedback when required) and psychophysiological improvements (e.g., HRV-flexibility reflecting stress recovery in clinical participants).

Despite the relevance of these findings and their implications, the study has a number of limitations. First, the sample was mainly composed of women and require further replication in other studies with better sex balances. Also, it is possible that the statistical power to detect significant effects might be limited due to the low number of participants analyzed, compared to other training studies in affective flexibility (Godara et al., 2021). Another limitation of the study is based on the task used to evaluate affective attention flexibility. In this sense, although this is the process of close transfer that was intended to be evaluated, the task itself does not seem to differentiate between other related cognitive control processes of inhibition and shifting. Other studies evaluating similar processes show the same problem (Genet et al., 2013; Malooly et al., 2013), but affective flexibility seems to be a significant predictor independently even though analysis include general cognitive flexibility as a covariable (Genet & Siemer, 2011). Finally, this study refers to a single-session training, which would limit its capacity to generate consistent and sustained effects. Future studies should focus on determining the ideal number of training sessions that generate the greatest benefit from this type of training. Likewise, compared to the current laboratory study, future research should aim to evaluate and intervene affective attention flexibility in a daily basis (e.g., through ESM methodology). This way, daily-life state measurements of context-based flexibility could be established and intervened, which would be much more ecological than the measures and interventions developed in laboratory settings. Carrying out this procedure in the evaluation of affective attention flexibility might be very beneficial.

Instead of generating relevant experimental contexts, just like we did in this study, it would be the individuals themselves, in his daily life, who would identify the relevant contexts in which to evaluate or train these cognitive processes. In the same way, the dynamics between emotional, stress or cognitive processes could be evaluated through ESM in order to establish how they interact with each other and contribute to individual differences in stress resilience and mental health.

8.5. Conclusion

In this study, a training in affective attention flexibility was carried out through musical reinforcement in a sample with (sub)clinical emotional problems of depression and anxiety. The results show that the training, although it did not generate a direct improvement in inter-situational affective attention flexibility tasks, it did generate several improvements in a stress task (far transfer), at emotional, cognitive and psychophysiological levels. These results promise to advance new venues of affective attention flexibility training that can be applied through multiple sessions and across ecologically relevant contexts to maximize their effects and potential to treat attentional and regulatory dysfunctions that are present in emotional disorders.

8.6. Supplement Material of Study 4

8.6.1. Supplement 1 Study 4

In order to ensure that the songs used generated the expected emotions, a sample of 35 undergraduates (29 females; 6 males) with an average age of 20.6 years, rated the emotional valence generated by each of the songs preselected from a pool of music with effects in inducing happiness, sadness, calmness and nervousness in a scale from 1 (not at all) to 9 (very much). Table 19 shows the resulting means and standard deviations of each song's emotional valence.

Table 19. Mean and standard deviation for each emotional song.

		Mean	Standard Deviation
	Happiness	**7.46**	**1.370**
Another Day of Sun (happy)	Sadness	1.34	.591
	Relax	4.26	1.804
	Nervousness	2.94	1.679
	Happiness	2.11	1.23
Blood Starve Beast (nervousness)	Sadness	2.4	1.376
	Relax	1.54	.919
	Nervousness	**7.26**	**1.559**
	Happiness	2.14	1.287
Into the Dark (sadness)	**Sadness**	**6.2**	**1.762**
	Relax	6.37	2.315
	Nervousness	1.8	1.324
	Happiness	3.86	1.958
Natural Light (relax)	Sadness	4.2	2.26
	Relax	**7.54**	**1.597**
	Nervousness	1.46	.657

8.6.2. Supplement 2 Study 4

In order to ensure that the adjectives in the self-attribute task were positive, a sample of 50 undergraduates (females: 45; males: 5) with a mean age of 22.42 years old, totally independent of the main study, evaluated the valence, activation and frequency of use of the 20 adjectives included in the task (Table 20).

- Valence: To what extent is the characteristic to which this adjective refers negative or positive for you? 1 (totally negative) to 9 (totally positive).
- Arousal: To what extent does the characteristic referred to by the adjective generate calm or excitement in you? 1 (totally calm) to 9 (totally excited).
- Use frequency: How often do you use this adjective? 1 (never) to 9 (constantly).

Table 20. Mean and standard deviations for each adjective.

		Mean	Standard Deviation
Industrious	Valence	7.98	.892
	Arousal	5.56	1.798
	Frequency	6	1.654
Efficient	Valence	8.28	.809
	Arousal	5.18	2.067
	Frequency	4.92	1.614
Cheerful	Valence	8.32	.819
	Arousal	5.52	1.951
	Frequency	6.7	1.432
Organized	Valence	7.96	.807
	Arousal	4.16	2.151
	Frequency	7.02	1.622
Emotional	Valence	5.96	1.177
	Arousal	5.32	1.984
	Frequency	6.76	1.89
Warm	Valence	7.5	1.147
	Arousal	3.98	2.104
	Frequency	5.94	1.942
Outgoing	Valence	6.76	1.222
	Arousal	6.8	1.37
	Frequency	5.82	2.017
Polished	Valence	5.24	1.287
	Arousal	4.48	1,297
	Frequency	2.8	1.525
Idealistic	Valence	5.86	1.309
	Arousal	5.48	1.328
	Frequency	3.42	2.021
Talkative	Valence	5.58	1.486
	Arousal	6.7	1.093
	Frequency	5.7	1.669
Pleasant	Valence	8.08	.9
	Arousal	5.78	1.92
	Frequency	6.7	1.632
Unconventional	Valence	5.98	1.66
	Arousal	6.62	1.398
	Frequency	4.9	1.843
Individualistic	Valence	7.34	1.303
	Arousal	4.76	2.036
	Frequency	6.68	1.347
Good-looking	Valence	7.6	1.385
	Arousal	6.02	1.911
	Frequency	6.06	1.557
Reflective	Valence	7.3	1.216
	Arousal	4.2	2.286
	Frequency	5.32	1.953
Thorough	Valence	7.46	1.054
	Arousal	3.26	1.676
	Frequency	5.86	1.498
Kind	Valence	8.32	.891
	Arousal	3.16	1.856
	Frequency	6.64	1.396
Charming	Valence	7.66	1.349
	Arousal	4.16	2.014
	Frequency	4.6	2.050
Clever	Valence	8.28	.701
	Arousal	5.5	2.121
	Frequency	7	1.325
Silent	Valence	7.02	1.27
	Arousal	2	1.385
	Frequency	6.54	1.644

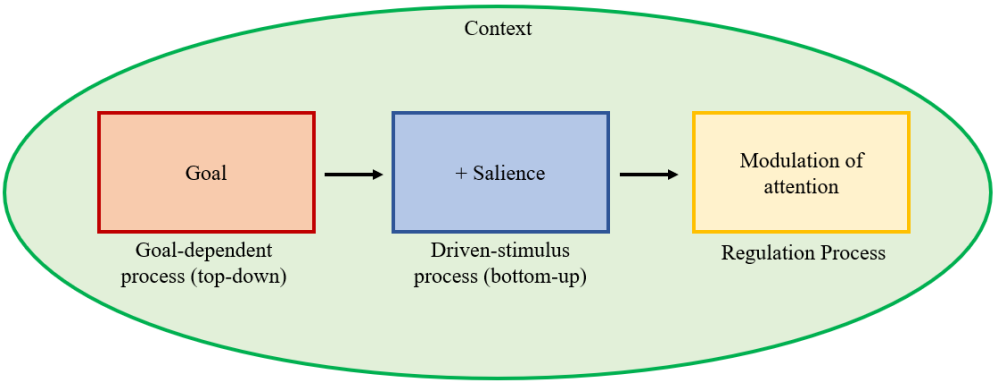
Chapter 9. General Discussion and Conclusion

9.1. Overview

Through extensive consideration of current theoretical models and empirical evidence, a series of experiments were conducted in the present Dissertation. This body of work was aimed to test a series of hypotheses regarding the nature of contextual and affective attention flexibility, its modulation through motivational variables, and its role in improving the regulation of stress, and issue that is characteristic of emotional problems, such as depression and anxiety. As a main conclusion, results overall support the claim that attention flexibility is a key cognitive mechanism that help to explain individual differences in information processing and emotion and stress regulation. Thus, not only a preferential attention toward specific emotional components (i.e., attention biases toward negative or positive information) have a relevant role for emotional functioning and its regulation. Beyond that general static view of attention, understanding and assessing attention as a flexible process can also provide relevant information about the mechanisms implicated in the onset, maintenance, and relapse of emotional disorders. In this Dissertation we aimed to evaluate the processes that can potentially influence flexible attentional deployment, such as contextual and motivational factors. The first refers to the characteristics of the environment in which the functional component of attention is evaluated and comprises considering how different contexts provide room for distinctive types of adaptive attention patterns, therefore, changes in the attentional processes that adapt to the contextual demands. The second motivational dimensions refer to integrating the study of specific goals based of what individuals may want to achieve

in each type of context. These goal-dependent processes were found to modulate attention in such a way that individuals directed their attention to larger extents towards the contextual emotional components more related to fulfilling specific goals. Overall, results support the idea that contextual and motivational factors interact with each other, giving rise to modulatory processes that influence attentional behavior, thus generating a more flexible mode of processing emotional information, not only based on preferentially attending certain components (e.g., positive information) in a stable manner over time (i.e., across every type of context and a state of motivation; see Figure 30).

Figure 30. Schematic design about the influence of contextual and motivational factors on attention.



9.2. Affective Attention Flexibility: a new conceptualization of attention mechanisms

In last decades, most of research has focused on attention bias, conceptualized as a tendency of individual to direct and maintain attention toward a specific emotional component (e.g., Armstrong & Olatunji, 2012). Yet, extant evidence, as the one collected in this Dissertation, indicates that, although selective attention biases are relevant in

processes of information processing and emotion regulation, they need to be reconceptualized. Some authors have previously focused on affective flexibility process, defined as the individual's ability to process emotional information in order to regulate the emotions that may appear (Malooly et al., 2013). In fact, this has been related to higher levels of resilience at the trait level (Genet & Siemer, 2011), higher levels of reappraisal (Malooly et al., 2013), lower levels of rumination (Genet et al., 2013) and lower emotional symptoms (Wen et al., 2019; Wen & Yoon, 2019). The present project went beyond these initial formulations of affective flexibility and, extending from previous recent literature on this issue (Godara et al., 2020; Godara, Sanchez-Lopez, Baeken, et al., 2021), considered a further conceptualization of affective attention flexibility that included contextual and motivational modulatory factors. This way, attention, instead of being understood as a stable process over time, can be conceptualized as a dynamic process, whose functional value would depend on the environment in which it is used and the specific goals with which the individual identifies at each moment. This new concept of attention flexibility arises as a consequence of the importance of context in cognitive processes, more specifically in selective attention, and is defined as the ability of individual to selectively process different emotional information depending on contextual characteristic with the aim to adapt and regulate the generated emotions.

In the studies of the present Dissertation, we assessed the flexible components of attention, from multiple perspectives. First, we focused on evaluating the modulating role of the context in selective attention when facing with emotional changes within the same context (i.e., intra-situational flexibility). For this purpose, a momentary stress inducer (i.e., speech task; Sanchez, Romero, et al., 2017) was adapted to evaluate attentional

changes in the face of intra-situational changes (i.e., dynamically changing positive and negative social feedback), as well as changes in emotional and physiological mechanisms of stress regulation. Study 1 provides evidence that supports an intra-situational flexible component of attention, in such a way that attention, conceptualized as proportion of total fixation time on positive over negative information, changed depending on the proportion of positive and negative feedback. Participants had a higher fixation proportion of processing of positive information when the feedback was mainly positive, a higher fixation proportion of processing of negative information when the feedback was negative and a balanced fixation proportion of processing when the emotional feedback was balanced. This general pattern was also found in Study 4. Therefore, individuals were able to flexibly use their attention selectively, depending on the changes in social feedback presented in each section of the task. The non-existence of attentional flexibility would have been shown through a pattern of non-change of fixation proportions across contextual intra-changes, understanding that preferential attention to positive or negative information would be stable processes. This specific pattern of flexibility was supported in Study 1 for a subgroup of individuals characterized by amotivational profiles (i.e., low levels of multiple motivational dimensions). The main results support the idea that a maximization of selective attention toward positive information may not be inherently adaptive, but it depends on contextual features, in the same way that a preferential attention to negative information should be expected (i.e., not necessarily maladaptive) at conditions where social feedback was mainly negative. In fact, there are studies that support a facilitation of detection of threatening stimuli in healthy individuals when the situation demands it (Öhman, Flykt, et al., 2001; Öhman, Lundqvist, et al., 2001).

Consequently, it can be concluded that not the general individual attentional patterns per se, but the adjustment between the context and such attention deployment patterns, might give rise to effective forms of contextual adaptation and (potentially) adaptive behaviors. Rottenberg (2007) highlighted this idea around the ability of individuals to detect and adequately responding to contextual changes. The Emotion Context Insensibility (ECI; Rottenberg et al., 2002, 2005) proposes that the presence of emotional symptoms would be explained due to problems identifying environmental changes, leading to diminished emotional reactivity. In this case, the healthy sample tested in Study 1 was on average sensible and adapted their attention to contextual changes, further showing normative processes of emotion and stress regulation, as assessed through self-reports of mood and HRV indicators of stress reactivity and subsequent stress recovery.

Another important conclusion of this Dissertation is that not only contextual factors, but also its interaction with motivational variables, are important to explain patterns of attention flexibility. With the aim of disentangling how goal-dependent processes guide attention through distinctive contexts (i.e., inter-situational flexibility), in Study 2 we evaluated the ability of individuals to switch attention between different goals within and across contexts. We adapted a previous attention flexibility task (Godara et al., 2020), in which each context (i.e., party with friends and presentation at university) were combined with two different cues (each one represented by a blue square or blue circle), which comprised the activation a distal goal (e.g., enjoy the party, feel calm during the presentation) linked to a proximal goal (e.g., (re)direct attention to positive information). In contrast with Godara et al. (2020), in this project, a distinction was made between contexts, conceptualizing the context "party with friends" as a motivationally

promotion context, since it was expressed in terms of achieving/solving cheerfulness-dejection emotions, and the context "presentation at the university" as a prevention context, since it was expressed in terms of achieving/solving quiescence-agitation emotions (Higgins, 1997). With this methodology, it was possible to assess selective attention patterns in different motivational context (i.e., promotion vs prevention), during goal-switch (i.e., repetition vs switch) associated with specific affective goal-relevant information (i.e., positive vs negative). In Study 2, results indicate that the ability to switch between different goals (independently of the affective component) were modulated by the type of context and the level of predominance motivational SF. This means that high promotion SF participants were more flexible, characterized by no significant differences in goal-repetition vs goal-switching, in the promotion context but not in the prevention context and high prevention SF participants showed the opposite pattern, being flexible in the prevention but not in the promotion SF. The existence of a differential value of the context and associated goals in the performance of the task implies that the use of certain cognitive processes (i.e., selective attention) is not equal across every context, thus highlighting the key role of contextual and motivational factors in regulating them. This idea has been highlighted by other researchers both regarding cognition (Godara et al., 2020; Öhman, Flykt, et al., 2001) and emotion regulation (Aldao et al., 2015; Aldao & Nolen-Hoeksema, 2012a; Bonanno & Burton, 2013; Coifman & Bonanno, 2010; Sanchez-Lopez, 2021). The main idea derived from Study 2 results is that different contextual goals can influence the focus of attention, making it a dynamic process of cognitive processing. This importance of contextual and motivational factors associated to changes in selective attention was also found in other studies (Godara et al.,

2020), where, although focusing on levels of depressive symptomatology, differences were found in selective attentional patterns based on context and goals-switches, as a function of individual differences in depressive symptoms. Specifically, dysphoric participants were more flexible switching attention towards negative information and non-dysphoric participants were more flexible switching attention towards positive information. The key aspect of this research and empirical evidence provided in this Dissertation is that attention should not be conceptualized as a stable process, but consider different contexts and goals associated with relevant emotional components, to generate precise ways to measure selective information processing in a more naturalistic way. Overall, results from Studies 1 and 2 suggest that attention can be modulated by contextual and motivational aspects, implicating that attention is sensitive to both intra- and inter-situational changes, giving a relevant value to the flexible component of attention. Therefore, next steps in the Dissertation were focused on evaluating the influence that different forms of attention flexibility had in emotional (Studies 3 & 4) and psychophysiological functioning (Study 4), using both ecological evaluations in daily life and controlled laboratory conditions of stress induction.

Study 3 shows that the way in which individuals switch attention between affective goals (either towards positive or negative information) have an influence in daily life emotional functioning. That is, the ease in identifying relevant affective information associated with the achievement of a goal (e.g., easier attentional switch towards positive goals or more difficult towards negative goals) later influenced the type of emotions experienced during daily life functioning. This relation between attention and emotional functioning is connected to the predictions of conceptual models of information

processing in which the role of attention as a mechanism of emotion regulation emphasized (Gross & Thompson, 2007). The flexible component of affective attention has been linked to better psychological functioning, including higher levels of trait resilience (Genet & Siemer, 2011), lower use of rumination (Malooly et al., 2013) and lower level of emotional symptoms (Wen et al., 2019; Wen & Yoon, 2019). Results from Study 3 add new relevant insights in this issue, showing that different attention flexibility patterns are related with the experience of specific types of emotions. Higher flexibility switching attention toward positive information predicted lower levels of sadness in daily life, while higher flexibility switching attention toward negative information predicted higher levels of tiredness. This implicates that the way individuals selectively switch and process goal-dependent information can have an influence on emotional functioning. These results are supported by literature that evaluate different approximations of cognitive flexibility (e.g., attentional disengagement abilities, updating capacities and interference in working memory) in daily life emotional functioning. For example, longer delays in disengaging gaze from sad information, higher interference in working memory of negative information and lower levels of updating emotional information has been previously related with lower levels of positive affect and higher levels of negative affect in daily life (Pe, Koval, et al., 2013; Pe, Raes, & Kuppens, 2013; Pe, Raes, Koval, et al., 2013; Yaroslavsky et al., 2019). Therefore, the way in which we process emotional information, within a contextual and motivational framework, seems to have an effect in our emotional functioning.

Further, Results from Study 3 highlights that specific forms of attention flexibility may not be always optimal or generate adaptive emotional functioning (e.g., higher

flexibility in switching attention in prevention contexts predicted lower calmness and trend higher nervousness). This contradicts that original conceptual view that any form of flexibility would reflect an inherently adaptive mechanism (see for instance a critical analysis of this proposal in Sanchez-Lopez, 2021). In fact, there are several previous studies with results contrary to this type of general assumption. Higher levels of flexibility towards negative information were associated with impaired emotional functioning (i.e., higher levels of tiredness; Study 3) and lower levels of HRV (Grol & De Raedt, 2020). Similarly, other studies have found that greater inflexibility towards positive information was related to lower levels of rumination (Genet et al., 2013). Consequently, rather than assuming an adaptive component of flexibility, is the collected evidence prompts the necessity of identifying those specific flexibility patterns that can be related to forms of adaptive functioning (Study 3) in order to promote them through training programs (Study 4).

Study 4 was designed to train balanced forms of contextual and affective attention flexibility in individual with high emotional symptom levels, who show lack of flexibility in switching attention toward positive information (Godara et al., 2020). Study 3 showed that, indeed, this particular form of flexibility is predictive of lower levels of sad mood during daily life functioning. When aiming to design training procedures to maximize different forms of flexibility, the use of reinforcers of adaptive attentional behaviors emerged as a promising way of intervention. In fact, other approaches focused on the modification of attentional patterns have used contingent reinforcement like color identification (Sanchez et al., 2016) or music (Godara, Sanchez-Lopez, Baeken, et al., 2021; Lazarov et al., 2017) being successful in modifying negative attention biases.

Music reinforcement has been proven a valid method to modify attention patterns (Godara et al., 2019; Godara, Sanchez-Lopez, & De Raedt, 2021). In this case, the methodology is based on reinforcement with music when individuals direct attention to the most adaptive emotional component (Lazarov et al., 2017) or when there is an adjustment between the context, the goal and the goal-relevant adaptive emotional component (Godara, Sanchez-Lopez, Baeken, et al., 2021). Following a variation of this letter study, in Study 4, it was developed a new contingent music reinforcement training with the aim of improving a balanced attention flexibility in individuals with different levels of emotional problems (i.e., sub- to clinical levels of depression and/or anxiety). In this case, while participants in the control condition were passive subjects, listening to music independently of their attentional deployment, participants in the training condition were active subjects, in such a way that they listened to music depending on where they looked. When participants direct and maintain their attention toward the goal-relevant emotional component, they listened to happy or calm music or stop listening sad and anxious music depending on the context and the associated goal. The results in Study 4 showed that participants in the training condition showed significantly higher times fixating on positive information when feedback was mainly positive in comparison to participants in the control condition. In the same way, participants in the training condition showed the expected flexible pattern across the task, implying significant changes in the attentional pattern of processing of positive and negative information with each change of feedback, while the participants in the control group did not show that type of flexibility when confronted with all the feedback changes. These results suggest that training with contingent music favored the flexible component of attention when confronting intra-

situational changes, both at the between-group and within-group level, implicating that the participants in the training condition adjusted to a greater extent to the changes within the context, directing their attention depending on the emotional charge of the feedback, and switching to and maximizing positive processing when required (i.e., a flexibility pattern typically affected in individuals with high emotional symptom levels; Godara et al., 2020; and which was absent in the control group). Consequently, the sensitivity to the characteristics of the context was increased (Rottenberg et al., 2002, 2005). In contrast, no significant training effect were shown when the feedback changed to mainly negative, probably due to the fact that individuals with emotional problems were already flexible toward negative information and are characterized by a preferential processing of this type of information (Armstrong & Olatunji, 2012; Godara et al., 2020).

These results lead to a series of conclusions. First, it can be established that selective attention is a key mechanism to understand individual differences in information processing subserving emotion regulation processes. Our results are consistent in showing how selective attention is influenced by contextual and motivational factors, which would modulate its functioning in favor of the fulfillment of specific goals, leading to changes at the between and within-subject level (Study 1, 2 & 4). Therefore, a flexible attention pattern is characterized by the adjustment between context, the goal and the attention pattern (Study 1, 2 & 4), while inflexible patterns would be conceptualized as insensitivity to contextual information, leading to a reduced modulation of attention. In fact, the degree of adjustment of processing as a function of contextual demands and goals is a mechanism capable of partly explaining the emotional functioning of individuals, although, instead of establishing inherently adaptive forms of attention flexibility, it is

necessary to first establish which flexibility patterns are associated with more adaptive functioning (Study 3). Such flexible adaptive attention pattern should be trained with the aim to promote beneficial forms of attention flexibility from a dynamic perspective. In consequence, goal-dependent process would increase the salience of relevant stimuli, promoting driven-stimuli processes, but taking into account the context where it happens (Study 4).

Although there is increasing evidence that affirms the existence of flexible components of attention and that their training is possible, it is possible to go further in terms of advancing new knowledge with practical implications. As part of future projects, the inclusion of flexibility measures in ESM methodologies are sought in order to evaluate these mechanisms in a day-to-day basis. As an initial step in this project, in order to establish controlled measures of attention flexibility, laboratory research has been carried out, but making use of advances in new technologies, cognitive tasks capable of measuring these flexibility processes could be included into daily remote assessments, taking into account the contexts where the participant is and his/her perception of contextual demands and goals, thus clarifying the contextual and motivational factors that modulate flexibility in attentional processing and resulting emotional functioning at each moment.

9.3. Motivational SF modulation on attention deployment

Motivation, understood through the activation of different self-regulatory systems, was identified as a relevant factor to understand the cognitive and emotional functioning of individuals. All these processes can change the way we focus on achieving our goals or even how we interpret/appraise contextual demands leading to different forms of

attention flexibility. Therefore, in this project we aimed to evaluate motivation not only as a component associated with the achievement of goals (Study 3), but also as an explanatory mechanism of the modulation of attention flexibility patterns and the emotional consequences associated with them (Study 1 & 2). Our results indicated that higher tendencies to habitually activate promotion and prevention SF were related to specific forms of affective attention flexibility intra-situationally (Study 1), and specific forms of contextual attention flexibility inter-situationally (Study2). These forms of contextual attention flexibility linked to specific types of motivational SFs were further found to not always be inherently adaptive (i.e., higher flexibility to prevention contexts predicting lower levels of calmness and trend higher levels of nervousness in daily life). These main findings lead to emphasize a series of ideas, as commented below.

First, according to the RFT (Higgins, 1997, 1998), the activation of one motivational SFs precludes the activation of the other, thus providing an exclusive character associated with the presence of a SF. This causes that, from this model, an individual could only focus on the possible positive results or on the avoidance of possible negative results at specific moments. This makes it easier to understand how the individual can switch between systems depending on the context and the outcome they are looking for, but at the same time it limits the understanding of the different relationships between motivational SFs and how these new patterns can influence other processes, since different results suggest that there are individuals who are predominantly capable of taking both needs into account. From a correlational point of view, Study 1 showed that there was a positive relationship between both SF levels, giving rise to the idea that a certain part of individuals is capable of activating both SF, while there are

others that would not. This idea is supported by a three-way interaction according to attention deployment during the speech task in Study 1. This would mean that there would not only be two possibilities (e.g., preferential activation of the promotion SF or the prevention SF), but there would be various possibilities (e.g., low activation of both motivational SF, high activation of both motivational SF, activation of only one of them), giving rise to multiple motivational patterns capable of modulating attention flexibility in different ways. In this sense, and congruent with this proposal, whereas participants higher in any or both motivational self-focuses were characterized by flexible attention patterns across the task used in Study 1, a subgroup of individuals characterized by low motivational levels in both dimensions were clearly inflexible in their selective attention toward positive and negative information despite contextual changes in the emotional feedback provided across the task in Study 1.

The second idea is related to the effect of momentary vs chronic failures of each motivational SFs. In order to adapt the model with a more clinical perspective, certain authors have tried to associate each motivational SFs not only with an emotional consequence (e.g., cheerfulness-dejection or quiescence-agitation emotional continuum) but also with a predominantly associated emotional problem (e.g., depression and anxiety problems, for promotion and prevention SFs, respectively). In this case, momentary promotion/prevention failures would not be harmful, but would promote an adjustment in order to achieve the specific goal. However, chronic failures in achieving goals related to each self-focus would produce changes in the activation of motivational SF, in such a way that chronic hypoactivation of the promotion SF would only be associated with depressive symptoms, while chronic hyperactivation of a prevention SF would only be

related to anxiety symptoms. The comorbidity between both symptoms would be due to an initial chronic hypoactivation of the promotion SF that would lead to a hyperactivation of the prevention SF, giving rise to an emotional imbalance (Klenk et al., 2011). Based on the results presented in this Dissertation, although not focused on a chronic failure approach, our first approximation on the relationship between different motivational SFs, emotion regulation strategies and types of emotional symptomatology levels partially support this type of vulnerability models. In Study 1, correlation analyses between these variables (presented in the Supplement) were conducted, partly supporting the idea of specific associations between specific symptom profiles and specific components of the RFT. RFT affirm that each motivational SF is associated with a specific goal pursuit strategy, in such a way that promotion would be related with an approach perspective, being more sensitive to possible positive results, while prevention SF would be related with an avoidance approach, being more sensitive to possible negative results. This idea is supported by Study 1, where a specific relation between promotion SF and behavioral activation levels and between prevention SF and behavioral inhibition levels were found, implicating that each motivational SF are associated with a specific goal pursuit strategies (Higgins, 1997, 1998), which would be adaptive depending on the characteristic of each motivation SF. Moreover, the results also showed that each predominant activation of a motivational SF was related to certain emotion regulation strategies. While promotion SF was only related with putatively adaptive emotion regulation strategies (e.g., reappraisal, refocused on plan), prevention SF was only associated with putatively maladaptive emotion regulation strategies (e.g., rumination and worry). Consequently, in order to generate a more complete clinical model integrating motivational SFs, results suggest the

need to include emotion regulation components, since each motivational SF seems to predispose the use of different emotion regulation strategies. These strategies could be decisive when it comes to managing failure to achieve a specific goal, the consequent emotions associated with success/failure or even the type of affects resulting from the activation of motivational SFs. For example, probable greater activation of the prevention SF might derive in higher levels of worry, perpetuating that SF until goal success; whereas probable greater activation of the promotion SF might produce higher use of plan refocusing when facing goal failure, in order to regulate it and achieve the goal. Low emotion regulation capacities might lead to emotional problems, such as depression, related with low promotion SF and anxiety, related with high prevention SF (Klenk et al., 2011). In fact, Study 1 results partly support this assumption, relating lower levels of promotion SF with greater depressive symptoms, indicating a specific association. However, although a positive relation was found between prevention SF levels and anxiety symptoms, a further significant positive association of prevention SF levels was also found with depressive symptoms, indicating that in general, the prevention SF would not be specifically related to anxiety. Therefore, the results of Study 1 partly support certain relationships hypothesized by other authors (e.g., relationship of each motivational system with a specific sensitivity to reinforcers), but at the same time, it makes explicit the need to include other components of emotion regulation (e.g., inclusion of associated emotion regulation strategies that are preferentially used) and suggests the non-specificity associated with the prevention SF, which, when chronicled, might serve as a common vulnerability mechanism for both types of emotional problems, while this would not be the case for low levels in the promotion system.

The third idea is related to the predominant vs contextual components of motivation highlighted by the theory. This model states that, although there is a predominant activation of one system over the other (e.g., individuals who generally keep the promotion or prevention system activated), certain contexts can produce a momentary activation of the other motivational SF, giving rise to a different regulation and consequently, a different emotional result, implying that these motivational components can be understood as trait or as dynamic variables. In this project, attempts have been made to use different methodologies to assess this phenomenon from as many perspectives as possible. In this case, the predominant levels of different motivational SF were assessed through self-reports in order to evaluate how they can modulate different regulatory processes associated with stressful events. Studies 1, 2 and 3 were focused on this idea. One of the aspects in which predominant motivational SF influence flexible regulation is psychophysiology. In fact, predominant promotion SF modulated HRV changes across a momentary stress induction task (i.e., speech task), in such a way that high promotion participants showed the expected adaptive pattern characterized by HRV decrease when anticipating and facing the stressor and HRV increase during recovery, while low promotion participants did not show significant differences between any experimental phase. Results suggest a differential pattern of psychophysiological reactivity and recovery depending on predominant promotion SF. Although this is the first study that relate motivational SF and HRV, other indirect approximations associated with depressive symptoms and HRV changes during stressors support Study 1 results (Hamilton & Alloy, 2016). In this case, it is suggested that individuals with lower levels of promotion SF are not focused on attaining possible positive results, leading to

dysphoric mood (Klenk et al., 2011) and consequently, certain levels of insensitivity to context changes (Rottenberg & Hindash, 2015). Prevention SF were not associated with differential HRV pattern, although variables associated like higher levels of anxiety levels (Chalmers et al., 2014) or worry (Ottaviani et al., 2016) has been related. Maybe rather than a predominant activation of prevention SF, momentary activation of this SF is needed to evaluate how prevention SF influence psychophysiological variables. Further, motivational SFs not only influence HRV, but also attention flexibility. Study 1 supports this assumption, indicating that different motivational SF pattern modulated the fixation time proportions attending to positive over negative information during the stress task, in such a way that under certain circumstances, high promotion participants maintained longer fixations on positive information after receiving positive feedback while high prevention participant maintained longer fixations on negative when the feedback was mainly negative. However, those individuals with lower levels of both motivational SF did not show significant changes in fixation proportion under intra-situational changes. Just as the predisposition towards certain motivational SFs modulates attention when confronting intra-situational changes, it also does so when faced with inter-situational changes. In Study 2, the cognitive cost associated with goal switch depended on the predominant motivational SF and motivational context. This results support studies where faster appraisals of stimuli between different emotional continuum depend on the predominant motivational SF (i.e., higher promotion participants were faster appraising cheerfulness-dejection stimuli, while higher prevention participants were faster according to quiescence-agitation stimuli; Shah & Higgins, 2001). Once the effect of the predominant activation of motivational SF on attention was evaluated (Study 2), next

steps were focused on evaluating its effect on emotional functioning (Study 3), more specifically, how the flexibility switch capacities between different motivational contexts favors a series of emotions in daily life. In this case, because each context was expressed as a function of motivational SF specific emotions (i.e., cheerfulness-dejection vs quiescence-agitation), attention flexibility indices associated with switching between contexts were created, regardless of the affective goal. Higher flexibility toward prevention context was related to lower levels of relaxation and higher levels of nervousness, indicating that the capacity to switch toward the prevention context can influence the frequency of certain emotions. Results are in line with the very definition of the construct, in such a way that the context of prevention, which is expressed in terms of quiescence-agitation emotional continuum, favors emotions within that continuum (Shah & Higgins, 2001).

As a summary, these findings highlight a clear influence of the predominant activation of motivational SFs on different psychological processes (e.g., attention flexibility and HRV changes across stress phases). A predominant activation of a given SF would produce a predisposition to activate cognitive schemes focused on certain specific goals (e.g., focusing on seeking positive outcomes vs avoiding negative outcomes), leading to an interpretation of reality delimited by those schemes. In consequence, this predisposition would help to flexibly regulate intra-situational changes modulating those regulatory processes at the same time that would modulate the goal-switching efficiency in those contexts that are in agreement with the motivational SF predominantly activated. This indicates that when there is an adjustment between the context, the goal and the activation of certain motivational SF, regulatory processes (i.e.,

specific forms of attention flexibility) would be faster. Consequently, it is necessary to continue investigating the role of these motivational SFs, which, although related to certain types of emotional problems, would provide information in previous stages, being able to establish predictive patterns capable of explaining vulnerability for the development of emotional problems at the same time that informing the development of different intervention programs for different forms of inflexibility. To achieve this, it is necessary to establish the temporal relationships between the different motivational, attentional, and regulatory mechanisms and their predictive value on mental health (e.g., through longitudinal studies). Similarly, although the predominant activation of certain motivational SF offers valuable information, there are no naturalistic studies evaluating the activation of these motivational systems when confronted with ecological contextual changes, for example, through ESM. Taking previous information into account (Aldao, 2013; Aldao et al., 2015; Sanchez-Lopez, 2021), it is very likely that different contextual factors (e.g., perception of the stressor) modulate the activation of the different motivational SF, thus giving rise to the use of different emotion regulation strategies and behaviors (e.g., approach vs. avoidance) and consequently, to generate different types of emotional outcomes. Therefore, although the empirical evidence collected in this Dissertation is a very promising start for this research lines, new research in motivation through self-regulatory systems seems to be an aspect to take into account when it to better establish the relationships between different regulatory processes, as well as their influence in the development of emotional problems.

9.4. Emotion functioning, HRV and emotion regulation

Finally, subjective self-reports and objectives psychophysiological variables were used to evaluate changes in in the reactivity and recovery from stress (Study 1 & 4). Building from research derived from different models of psychophysiology (Porges, 2007; Thayer et al., 2009), heart rate variability has identified as an emotion regulation indicator in such a way that it would not only provide and index of the sympathetic-parasympathetic balance but also an indirect index of the neural balance (prefrontal vs limbic areas) related to emotion and stress regulation. Although many research has been based on the study of differences in HRV baseline levels and different emotional problems, finding lower HRV baseline levels in both depression (Kemp et al., 2010, 2012) and anxiety disorders (Chalmers et al., 2014; Friedman, 2007), a more dynamic perspective in the change of HRV across different experimental phases (baseline, anticipation, confrontation, recovery), was used in this Dissertation to study whether the participants show an adaptive pattern characterized by decreases in HRV during the stressor and an increase in it during the recovery period and what factors modulate it. This adaptive pattern of changes in HRV levels across stress phases reflects the activation of certain mechanisms that favor the regulation of the stressor. However, in emotional disorders this pattern of change is not observed, rather there would be no differences between experimental phases in HRV levels, implying the non-activation of specific mechanisms (Hamilton & Alloy, 2016; Kim et al., 2018; Weber et al., 2010). In order to evaluate this HRV patterns, and implicated mechanisms, a momentary stress induction task was used (i.e., speech task). In general, the stress inductor was able to generate the expected subjective and objective patterns of stress reactivity and recovery. In fact, this

method has been used by other different authors as a momentary inductor of stress (Grol & De Raedt, 2021; Sanchez, Romero, et al., 2017; Weber et al., 2010; Zandara et al., 2018). The expected pattern was characterized by a decrease in relaxation and HRV levels and an increase in levels of nervousness when facing the stressor and a return to baseline levels during recovery, implicating that, in general, the task was experienced as a significant stressor at both an emotional and a psychophysiological level. Results in Study 1 & 4 support this self-report and psychophysiological pattern.

Importantly, this adaptive pattern was modulated by individual differences in several variables. As it has been shown before, the pattern of change associated with HRV was modulated by the predominant activation of the promotion SF in such a way that those individuals with lower levels of promotion showed a blunted pattern of reactivity, while those ones with high promotion levels were able to react and recover from the task (Study 1). Furthermore, the active training in attention flexibility conducted in Study 4 transferred to the facilitation of this type of pattern in individuals with clinical levels of emotional problems (whereas those individual in the control condition were characterized by a blunted HRV reactivity pattern). Therefore, in line with research pointing out an association between psychophysiology and cognition (Colzato et al., 2018; Grol & De Raedt, 2020), this project shows that modifying the flexible component of attention facilitate possible changes in HRV when regulating stressors, through a contingent music reinforcement intervention. While the clinical participants showed a maladaptive pattern characterized by no HRV change between experimental phases, the subclinical participants did (Hamilton & Alloy, 2016). These results support a differential pattern based on the level of emotional maladaptation, as well as indicate that HRV can be

considered a transdiagnostic mechanism of emotional vulnerability (Beauchaine & Thayer, 2015). Likewise, not all clinical participants had the same HRV pattern, but there were differences depending on the training condition. While the participants in the control group maintained the maladaptive pattern, those in the training group improved their levels of recovery at the end of the task. In this case, the individuals who received musical reinforcement based on their attentional performance seem to have shown a differentiated pattern of adaptation to the stressor. Therefore, the results suggest that HRV is a mechanism to consider when aiming to intervene attention inflexibility and stress regulation in individuals with emotional problems. In fact, it suggests a close relationship between attention flexibility and autonomous functioning. Therefore, promoting adaptive forms of attention flexibly can cause that different mechanisms of regulation of stressors (e.g., strategies adapted to the context, psychophysiology reactivity and recovery, emotional functioning) can adjust to the characteristics of the context in order to provide better adaptability to the environment. Bearing in mind that other studies have used similar training methodologies with beneficial results (Godara, Sanchez-Lopez, Baeken, et al., 2021; Lazarov et al., 2017), future research should focus on evaluating not only the possibility of changing attentional pattern and its consequences on HRV and other indices of stress regulation, but also implement this training as a multi-session intervention that can facilitate transfer to improve depression and anxiety symptom levels.

9.5. Final Conclusion

As a final conclusion, results from this Dissertation support the claim that instead of understanding selective attention as a rather stable process, it is necessary to conceptualize it from a dynamic perspective, in such a way that it can be modulated by

contextual and motivational factors. In fact, the analysis of motivational regulatory systems (motivational SFs) can favor the identification of certain attention flexibility patterns with different roles in emotional or psychophysiological mechanisms aimed to regulate stress and meet specific adaptive goals. The results from this Dissertation not only support the existence of flexible components of attention and their modulation by motivational SFs depending on the context, but also their role as differential predictors of emotional functioning and its causal influence in autonomous mechanisms of stress regulation. All this generated knowledge can be used to generate a framework of understanding of emotion and stress regulation based on the role of selective attention, not only as an unconscious filter of information, but also as a conscious regulatory process with which to favor the flexible processing of different types of information, leading to the activation of context-dependent processes. The evidence from this project represents a new adding, extending from the previous research focused on cognitive-affective mechanisms of emotional disorders, that may help to better understand how emotions and their regulation can be understood from multiple perspectives and through an interactive vision of multiple processes that jointly contribute to mental health and adaptiveness.

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