CER-Paris Descartes

(Comité d’Éthique de la Recherche)

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### Nom du protocole :

Etude sur le possible effet régulateur de la motivation sur le processus/traitement attentionnel de stimuli émotionnel négatifs.

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### Résumé (en Français) :

## Scientific Project (in English) :

### Background: Theoretical Framework

Not only do our emotions greatly influence our everyday decision-making, they are also known to play a key role in many neuropsychiatric disorders and growing research points towards emotion dysregulation as the main mechanism. Indeed, difficulties regulating one’s emotions have been suggested to be at the core of anxiety and mood disorders. The capacity to efficiently regulate emotions, in contrast, has been linked to better psychological and physical outcomes.

Yet research in this field is complicated as questions about the nature of emotions continue to divide the scientific community. Its definition varies widely according to the theoretical framework but the consensus in Affective Neuroscience recognises an emotion as a cognitive, subjective and/or physiological state(s) arising from a system-level neural activity in response to a highly significant and relevant stimulus. In this context, emotion regulation can be seen as an explicit or implicit process aiming to initiate, terminate, or modulate the trajectory of an emotion. One of the most commonly studied regulatory techniques is selective attention in which a subject either shifts his/her visual-spatial attention away from the emotion-inducing stimulus to inhibit its effects or towards the stimulus to enhance them. This can be highly beneficial as the brain continuously monitors distractors to ensure optimal performance and emotionally salient stimuli are particularly effective in interferingwith the ongoing cognitive processing. Indeed, **emotional items benefice from enhanced sensory representations** by **receiving prioritised attention impacting the attention dedicated to non-emotional stimuli**. Thus, being able to utilise selective attention by either discarding irrelevant emotional distractors or focusing on relevant emotional targets might lead to better decision-making.

Despite growing recognition of the importance of emotion regulation, little is known about other higher-order cognitive function that might influence its impact on decision-making. One such omitted function is motivation which can be defined as an internal state encouraging individuals to obtain desirable outcomes like rewards and to avoid undesirable outcomes such as punishments. To the best of our knowledge, there has been no quantitative study evaluating the possible effect of motivation on emotion regulation. Yet it may seem very intuitive that variations in motivation may influence the regulation of the ongoing emotion especially if the emotions are not in line with the ongoing goal. For example, it may be more advantageous for a runner in a city to inhibit his fear when mistaking a stick for a snack; yet this could be deleterious for a hiker on a mountain. Thus, the goal-oriented nature of motivation may impact the cost-benefit trade-off.

Furthermore, alterations in motivation such as apathy and anhedonia are debilitating symptoms commonly found in a range of neuropsychiatric disorders and often co-altered with emotion dysregulation. Unrevealing the interaction between motivation and emotion regulation, and the specific symptomatic comorbidities might be key to explaining the underlying mechanisms of mental illnesses, especially anxiety and mood disorders

### Research Aim and Hypotheses

Project Aim

Our study aims to investigate how motivation influences the regulation of emotional attention. In particular, we want to address the lack of literature on the possible upregulating and downregulating effects of monetary incentives on the attentional regulation of emotionally negative stimuli.

Hypotheses

The motivational value of monetary incentives improves emotion regulation on at least one emotional expression level which is either invert (as measured by physiological techniques) and/or overt (as measured by behavioural recordings).

### Material and Method

Stimuli Set

One of the most commonly used stimuli to investigate attentional processing of emotions are faces due to their ecological validity and ease of use. In consequence, we adopt fearful faces of both males and females as emotionally negative stimuli and neutral faces of both males and females as neutral stimuli. We utilise the Chicago Face Database (CFD), which provides use with standardised and very high quality images. The normalising data allowed us to exclude individuals that were rated as looking too unusual, too afraid or too surprised even in a neutral facial expression (i.e. ratings being three standard deviations from the mean).

In summary, our stimuli set is composed of four different emotional faces categories (i.e. fearful male, neutral male, fearful female, neutral female.

Experimental Protocol Encompassing Two Behavioural Tasks

To implement the motivational incentives into the experimental design, participants are presented with low (i.e. 5 cents) or (i.e. high 2 euros) monetary incentives at the beginning of each tasks’ trials. The sums awarded are conditional on the performance of X randomly selected trials. Thus, if the participants were correct, they will receive the sum that was allocated to this specific trial. If they were not, they would not receive anything. With a baseline of X euros, the participants could receive a bonus between X and X and thus, a total ranging between X and X.

First, we employ the methodological insights gained from the study of cognitive conflict while implementing emotional stimuli in the commonly used paradigm—the Rapid Serial Visual Presentation (RSVP). In this task, the close presentation in time (i.e. 200-400 milliseconds) of a first salient stimulus (i.e. critical distractor) to a second stimulus (i.e. target) often affects its detection because of an attentional blink. This means that the emotionally salient stimulus (i.e. fearful face) can act as either a critical distractor or a target according to its relative position in the stimuli stream. Particularly, if a fearful face is presented as a critical distractor it may impair the detection of a neutral face which acts as a target in the second position. This emotional attentional blink, which has been robustly found in other studies, will be detrimental for the performance. In contrast, if the fearful face acts as a target with a previously presented neutral distractor, it will enhance its detection due to its e**nhanced sensory representations** and be beneficial for the performance. This would allow us to investigate whether the effect of incentives on the detection rate might allow overcoming the detrimental effect of the emotional distractor or enhancing the beneficial effect of the emotional target. Finally, if both the target and the distractor are of the same emotional value (i.e. both fearful faces), then performance will probably not be impacted positively or negatively.

We invented the second task to adopt a similar structure to the previously described RSVP task. In this new recognition task, a search display of twenty faces positioned on an invisible grid is shortly presented (i.e. two seconds) to the participants. The goal of the participant is to determinate if the array was mainly composed of female or male faces. Thus, on each trial, there is a target gender and a distractor gender. However, according to the condition, different proportions of emotional faces categories (i.e. fearful male, neutral male, fearful female, neutral female) compose the array.

The total percentage of one gender over the other is always maintained such as the discrimination is possible (e.g. 60% fearful males, 60% neutral males, 40% fearful females and 40% neutral females). If the proportion of fearful faces in the target gender increases in contrast to the distractor gender and the proportion of neutral faces in the target gender decreases in contrast to the distractor gender (e.g. 80% fearful males, 40% neutral males, 20% fearful females and 60% neutral females), it will impact performance positively as focusing on emotionally salient stimuli will provide more evidence towards the correct discrimination than neutral faces.

Behavioural Recordings

The measure of interest is the performance and the reaction time in each of the two behavioural tasks.

Furthermore, we want to have an insight into the subjective emotional state of the participants. The golden standard of self-report called “experience sampling” consists of repeatedly asking subjects to rate their current subjective emotional state.

Psychophysiological Recordings

An eye-tracker device will be used to measure participants’ pupil diameters while they are performing the behavioural tasks. It is well known in the literature that pupil dilation is sensitive to emotional component and likely reflects emotional arousal. It is important to point out that cognitive demand and effort can also lead to pupil dilation. Nonetheless, a recent study found that pupillary response might comprise two temporal components reflecting cognitive emotion regulation effort and emotion regulation success [5].

Skin conductance also represents a well-established autonomic indicator of the emotionally aroused state with both enhanced and reduced patterns during regulation compared to controls [5]. However, the temporal resolution is relatively poor.

### Expected Results

In the RSVP and Visual Search tasks, when the emotionally salient stimuli act as distractors and have an emotion-disturbing (ED) effect on attention, we expect a bigger relative increase in performance between the low incentives condition versus the high incentives condition for ED compared to emotionally-neutral (EN) stimuli even if the average performance is still higher for the EN. In this case, motivation would lead to the salience downregulation of the emotionally distracting stimuli. Conversely, when the emotionally salient stimuli act as targets and have an emotion-enhancing (EH) effect on attention, we expect a higher average and bigger relative increase between the low incentives condition versus the high incentives condition for EH compare to EN. In this case, motivation would lead to the salience upregulation of the emotionally enhancing stimuli.

These effects would be exacerbated by higher incentives compared to lower incentives.