

2022

Scientific and Technical REPORT

„How does the blue sky become grey? Examining the sensitivity of neurotics for processing the negative stimuli in evaluative conditioning”

AFFLEARN - PN-III-P4-ID-PCE-2020-1964
(January 2022 – December 2022)

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Scientific and technical report for the AFFLEARN project (PN-III-P4-ID-PCE-2020-1964)

I. General description of the project

Funding Program and Institution:	Fundamental and frontier research, CNCS – UEFISCDI
Project ID and contract number:	PN-III-P4-ID-PCE-2020-1964; PCE 138/ 2021
Type of project:	Exploratory Research Projects (PN III PCE 2020)
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Period:	Jan 2021 - Dec 2023

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II. General and specific objectives for the AFFLEARN project

1. General objective

In this project, we focus on how neuroticism shapes learning in an evaluative conditioning paradigm. Previous research on neuroticism and stimuli processing, concluded in a fundamental theoretical perspective that describes neurotic people to be generally focused on the negative stimuli (e.g., Eysenck, 1967; Gray, 1981). However, this "traditional" approach to high neuroticism manifestations has become questionable due to a recent outcome demonstrated through the EC effect. Vogel et al. (2019) showed that highly neurotic individuals present a substantial EC effect on both the positive and the negative conditions compared to low neurotic people, indicating that neurotic individuals pay more attention to the valence feature when processing an object. Given the equivocal results, more studies need to be carried out to support one of the two perspectives.

Hence, the primary purpose of the current project is to examine highly neurotic individuals' sensitivity towards negative stimuli processing in an evaluative conditioning paradigm. To accomplish this objective, we implemented two experimental studies, while a third one is scheduled for 2023.

O1. Testing whether neuroticism impacts the evaluative conditioning effect in a design that includes ambivalent USs and classical positive and negative USs (work in 2021, excepting for some dissemination part that also took place in 2022)

The first study's objective is to test whether neuroticism impacts the evaluative conditioning effect in a design that includes ambivalent USs and classical positive and negative USs. This research design represents an originality element in the literature. By introducing this novelty element, we intend to clarify to what extent highly neurotic people tend to focus on negative aspects. To be more specific, in the evaluative conditioning design, we simultaneously paired the CSs with a mixed image that contains both positive and negative USs. We expected to gather support for the negativity bias hypothesis, and therefore to clarify the specific perspective that can be used to explain this learning process for highly neurotic individuals. In our initiative, we also relied on data gathered from a feasibility study that was previously conducted. In that study, the results supported our hypothesis.

Remarks on the publication and dissemination process

As we presented in the *Scientific and Technical Report* from 2021, we carried out two experiments for accomplishing the aforementioned scientific goal. At that time, the experiments were embedded within one manuscript in preparation with title "The Moderating Role of Neuroticism on Evaluative Conditioning Effect: Ambivalence and Reinforcement Manipulation". Meanwhile, after pertinent discussions with the team members, we concluded to change the title to a more specific one as "Does the Relation between Neuroticism and Evaluative Conditioning depend on Ambivalence? Insights from ambiguous and uncertain learning situations".

The manuscript was submitted to *Social Psychological and Personality Science* (Q1, WoS) (<https://journals.sagepub.com/author-instructions/SPP>). On the 2nd of September 2022, we received the editorial decision of "Revise and Resubmit – Major Revision". Now, the manuscript is in preparation for resubmission to the same journal. The deadline is the 31st of December 2022. The major comments we received concern (1) the revision of the analysis from Linear Mixed Models Effects to Linear Mixed Effects Regression by using the US valence as a categorical factor and (2) the interpretation the results according to the new revealed tendency. That is, the conclusion of our two experiments consists in a general disliking of novel CSs paired with positive, negative, neutral, or ambiguous USs. We did not identify a significant negative direction in the evaluation of the CSs paired with ambiguous USs relative to the CSs paired with positive or negative USs (excepting the neutral ones that were more positively evaluated; in Experiment 1), but we identified that highly neurotic people generally gave lower ratings to the CSs independent of the US valence. Therefore, we did not able to conclude that people who score high on neuroticism give more weight to negative aspects of co-occurred stimuli, as our first hypothesis stated, nor emphasize the Vogel et al.'s (2019) direction

that highly neurotic people are sensitive to both positive and negative valence. We simply state that people who score high on neuroticism evaluated the novel co-occurred stimuli with positive, negative, neutral, and ambivalent more negatively, mimicking the plenty of literature evidence with regard to highly dispositional negativity as proneness to manifest higher stressor reactivity even if the situations are positive, pleasant, without real stressors (and not real negative or threatening) (Shackman et al., 2016 for a review).

The results of these two experiments were disseminated this year within two symposiums:

1. Bunghez, C., & Sava, F. A. (2022, July 13-15). Does the relation between Neuroticism on Evaluative Conditioning depend on ambivalence? In Sava F. A. (Chair), *Personality and learning: On the relation between neuroticism and conditioning* [Symposium]. European Conference of Personality (ECP20), Madrid, Spain.
2. Bunghez, C., & Sava, F. A. (2022, August 29-31). Does the relation between Neuroticism on Evaluative Conditioning depend on ambivalence? In Sava F. A. (Chair), *Personality and learning: On the relation between neuroticism and conditioning* [Post-Conference Symposium]. European Social Cognition Network Transfer of Knowledge Conference (ESCON), Milano, Italy.

[O2. Investigating the potential cognitive mechanisms responsible for the evaluative conditioning effect by building upon the expected results of the first study \(O2 is scheduled for 2022\)](#)

Building on the findings expected for the first study, the second study's objective is to underline the potential cognitive mechanisms that may be responsible for the evaluative conditioning effect. More clearly, our aim is to investigate why and how neuroticism impacts how people attach a specific valence to newly encountered objects.

For instance, we will consider the attentional bias to verify if individuals scoring high on neuroticism spend more time processing the negative features of the ambiguous stimulus, as captured by an eye-tracking device.

We also intend to investigate an affect bias based on the assumption that people scoring high on neuroticism tend to appraise the CS stimuli that were paired with ambiguous USs as less pleasant, because, in the absence of definitive clue about how to see the ambiguous US, they will rely on affect as information. This will imply judging the stimuli in congruence with the mood (supposedly more negative) or negatively interpreting the task (situation) as demanding or stressful.

A memory bias will also be considered as a viable explanation. This suggests that highly neurotic individuals might manifest a negativity biased recall. For instance, they will misattribute how the CSs were paired (both with positive and negative images), recalling that they were paired only with negative USs.

Each of these mechanisms (attention, affect, situation, and memory) will be sequentially introduced in the design to investigate how they interact and which of them explains the most variance in the observed effect. More details about the hypotheses, design and results are presented in the *Activity 2*.

03. Testing the generalizability of this negative bias effect based on the evaluative conditioning procedure in a direction that is also relevant for seeing neuroticism as a risk factor for emotional disorders (03 is scheduled for 2023)

The flexibility of the EC procedure allows us to test hypotheses that exceed the fundamental question of whether people high in neuroticism tend to focus more strongly on valenced stimuli in general or only on negative stimuli.

Hence, the third objective of this project is to test the generalizability of the negative bias effect based on the evaluative conditioning procedure in a direction that is also relevant for the vulnerability account, while portraying neuroticism as a risk factor for emotional disorders.

In our approach, we will rely on a recent theoretical contribution of our partners from the Twinning grant (De Houwer et al., 2019). This conceptual framework creates common ground between similar phenomena that usually are studied in isolation, such as evaluative conditioning, attribute conditioning, spontaneous trait inference and the halo effect. Being placed at the confluence of social psychology and learning psychology, this framework manages to reduce the fragmentation caused by using different terms that describe similar learning mechanisms.

They pointed out an untested assumption that evaluative conditioning procedures could lead to changes in liking and changes in the perception of other stimulus features (e.g., a neutral CS is perceived as more intelligent and trustworthy after being paired with the positive US). Examining changes in beliefs about the features of stimuli (e.g., whether a person is intelligent or aggressive) is also interesting from a clinical perspective.

According to mainstream theories on psychopathology (Beck, 1976), maladaptive reactions (e.g., depression) do not result from an adverse event but from the way people interpret such an event. Inferences like these share an uncertainty feature.

We are talking about assumptions people make, not about proven facts. Therefore, we expect that propositions that emerge during or after the evaluative conditioning phase are highly relevant to examine the link between neuroticism and negative inferences as a source for the emergence of vulnerability.

2. Conclusion

To conclude this point, all three studies contain significant elements of originality in the context of the current state of the art in the field. The first study will provide evidence in favour of a

learning negativity bias in people scoring high on neuroticism by appealing to ambiguous stimuli (situations). The second study provide clues on the cognitive mechanisms that are responsible for the effect. The third study will address whether the bias in the valance appraisal will also relate to the way people perceive the object of the appraisal on other features.

Hence, these studies will help getting a whole picture by providing an explanatory mechanism of why emotionally vulnerable people are considered at risk for mental health issues.

III. Scientific and technical report in extenso - O2

1. Specific objectives for this phase

Building upon the findings of previous research and the studies done within this project in phase O1, this study aimed to go a step forward and investigate neuroticism and the cognitive mechanisms of evaluative conditioning using ambivalent stimuli. During the past year, we addressed this second objective for which we provide below the activity breakdown and all the descriptive details.

Objective 2: This study aims to investigate whether people with higher levels of neuroticism are more prone to negative evaluative learning bias in an ambivalent context due to potential mediating factors such as attention, memory, and situation perception.

Degree of accomplishment: 90% (pending manuscript)

2. Planned activities and results for this phase

The first activity was planned for the first half of 2022 and consisted of the design setup and implementation of the experiment. The second activity consists of the data analysis and dissemination of the results and was planned for the second half of 2022. For this phase, we planned to disseminate the conclusions resulting from the study in a scientific article that is submitted, accepted, or published in a Web of Science Journal.

3. Summary of the current phase

We conducted the first activity including setting up the design, pre-registering the study on AsPredicted.org platform, and obtaining ethical approval. Data collection started in June and ended in mid-July.

After gathering the participants, at the end of July we started the second activity by putting together and processing the data. We performed various statistical analyses to test our main mediation hypothesis, but also other exploratory directions. Based on the results of our analysis and considering the limitations of the study, the research team decided to do a second experiment in 2023 replicating this one with some design changes to improve the stimuli and conditioning procedure.

With regards to the manuscript, we acknowledge the great value added if we were to include a second experiment, therefore we deferred the dissemination for next year to be able to submit a final article comprising both studies.

4. Scientific and technical description

Activity 1 (January 2022 – June 2022)
Setting up the design and implementing the study.

Participants

The targeted sample is non-clinical, and to participate in this eye-tracking experiment, subjects confirmed by signing the consent form, that they are over 18 years and that they don't have a medical eye condition (i.e., strabismus, nystagmus, ptosis), nor do they wear bi/trifocal or progressive glasses. A total of 290 participants completed this study (200 females, Mage = 27.66, SDage = 10.35); however, 81 observations were eliminated based on two exclusion criteria: evaluation variability (N=6) and valence awareness (N=75), remaining a final sample of N=213.

Design & Materials

This conditioning experiment is a 2x3 within-subject design measuring CS evaluations in 2 timestamps: pre and post conditioning, and 3 US valence conditions: 2 positive, 2 negative and 4 ambivalent, that consist of both negative and positive elements.

For the 8 CS we used abstract images with computer-generated, grey-scale fractals that were also used in previous studies (Bunghez et al, in review); while for each of the 8 US we used 2 pictures of people or animals from the International Affective Picture System, IAPS (Lang et al, 2005) that were similar in the degree of arousal and dominance. Merging 2 pictures of either positive and/or negative valence resulted in the 3 experiment conditions, considering that for ambivalent stimuli we used one positive and one negative picture, a technique also used in previous research (Glaser et al, 2018, Bunghez et al., in press). To prevent an inflated effect due to subjects fixating only on one side of the US, we switched the position of the 2 pictures of opposite valence for half of the ambivalent US. Additionally, to mitigate the risk of a particular CS to have a stronger impact, we rotated the CS-US pairings among participants by preparing 8 groups, to ensure a scenario for all CS-US possible combinations.

To test the mediation model, we assessed the memory bias through a valence awareness task, and measured attention through 3 eye metrics including duration of visits, number of visits and number of saccades within an area of interest (AOI), defined for each side of the ambivalent US.

Additionally, we appraised the participants' situation perception of the experiment context using descriptors extracted from Situation 5 taxonomy. We selected 13 adjectives representative for cognitive load, psychological and physical load that were kept after the first 2 CFA studies conducted by the authors (Ziegler et al, 2019).

Neuroticism was measured using the 48-item subscale of NEO-PI-R that includes 6 facets: anxiety, anger, depression, self-consciousness, impulsiveness, and vulnerability (McCrae & Costa, 1992) which we wanted to also test separately in relation to EC. Additionally, we also measured intolerance to uncertainty using a 12-item instrument, a concept linked to worry and anxiety (Carleton et al, 2007). Both instruments were evaluated on a 5-point Likert scale, a higher score indicating higher neuroticism and higher intolerance to uncertainty respectively.

Procedure

Participants filled in an online form answering the neuroticism subscale, the intolerance to uncertainty questionnaire, and a few demographic questions, after which they were invited individually to participate in the eye tracking experiment using Tobii Pro Fusion. After an initial calibration of the device to fit the optimum parameters in terms of screen distance, eye angle, accuracy, and precision, participants had to complete a few tasks, mostly by responding on a numerical keyboard. First, we measured the pre-conditioning CS evaluations, instructing participants to answer by pressing a number from 1 to 9 where 1 is strong dislike, 5 is neutral and 9 is strong like. Upon rating all 8 CS, the conditioning phase began by randomly allocating the subject to one of the 8 groups of stimuli pairing combinations. There are 8 stimuli pairings in a group that were repeated randomly 8 times resulting in 64 trials. Both stimuli were presented simultaneously for 3500ms, CS on the left and the US on the right side of the screen. Participants were instructed to look at the images on both sides of the screen, after which they disappeared automatically, and a fixation cross appeared in the middle of the screen. They were asked to recenter their gaze to the middle of the screen for the next stimuli pairing to appear, which increases the consistency of gaze starting point in each trial and fair chances for both stimuli. Once the conditioning phase ended, we measured, in the same manner, the participants' post-conditioning evaluations of the 8 CS, followed by the valence awareness task where subjects were asked to remember the stimuli pairings and press the respective key if the CS was paired with a 1-positive, 2-negative, or 3-mixed image, and 4-if they don't remember. Ultimately, we measured the participants' situation perception bias by presenting each of the 13 selected situation descriptors and asking them to answer on a 5-point Likert scale depending on how well they felt the adjective described the experiment context.

Activity 2 (July 2022 – December 2022)

Analysing, reporting the results, and writing the manuscript.

Results

The main purpose of the analysis was to test the impact of neuroticism and the mediation effects of the attentional bias, the memory bias, and the situation perception bias in an evaluative conditioning paradigm using ambivalent stimuli. Before testing the mediation models, we calculated the conditioning effect on the monovalent stimuli controlling for the pre-evaluations of the CS paired with positive and negative US; and obtained a significant moderate effect. For the ambivalent stimuli we calculated the CS change in liking and tested correlations with all other relevant variables including total and facet-level neuroticism, all 3 attention-metrics and the computed variable for the memory bias. Out of all facets of neuroticism we found a stronger correlation between anxiety and change in liking, which is why we carried on with the mediation models using this specific facet of neuroticism. We tested three simple mediation hypotheses, one for each of the biases, however the results did not support our model. For the attentional bias we found a significant but small effect between anxiety and attention, however, we did not find a significant effect of attention on the change in liking. In terms of the memory bias, our results did not show an effect of anxiety on memory, but we did find a small significant effect of memory on the change in liking. With regard to the situation perception bias, our mediation model showed no significant effect between the variables. As an exploratory analysis, we also tested a serial model with two mediators: attention and memory, but again, the results did not show a significant relationship.

One of the limitations of the study concerns the design, complexity and position of the stimuli that could affect the accuracy of attention measures. Even though we counterbalanced the valence-position relation within the 4 ambivalent stimuli, by having two US with positive elements on the right and two on the left. The general trend across participants was to look more/longer at the images on the left as they were closer to the center of the screen which was the starting gaze point for each pairing. This design could have artificially inflated the attention metrics for the images on the left, therefore, a future eye-tracking study should focus on implementing a different stimuli setup to account for the duality of valence in the ambivalent US and provide impartial conditions for attentional biases to manifest.

5. Dissemination

The activities and conclusions resulting from this second objective are to be disseminated next year in a scientific manuscript that will contain both this experiment and an additional experiment that is required to correct some of the limitations of the O2-related implemented study. To publish, we targeted the journal *Social Psychological and Personality Science* or a similar Q1 (preferably) or Q2 WoS journal.

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