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*A study of approach-avoidance patterns in children in
response to emotional stimuli*

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1. Introduction

Approach-avoidance patterns are present regardless of our age. How can we refuse a second piece of cheesecake when we love it or ride a thrill ride with our child when it scares us? Some situations instigate psychophysiological responses and the formation of emotional memory images within very short time frames (Hudson & Johnson, 2021). That why, our ability to learn, unlearn, and relearn can be hindered by the images that feed these patterns. The ability to approach a positive stimulus (e.g., a pleasant food) and retreat from a negative stimulus (e.g., fleeing from danger) is of considerable importance in the survival of the individual (Payen, 2012). However, it is sometimes necessary to resist these natural tendencies in order to resolve difficult situations (e.g., approaching a fire for a firefighter) or to stay away from temptation (e.g., staying away from a pack of candy). Researchers have studied these approach-avoidance tendencies in adults faced with stimuli with positive or negative emotional valence (e.g., Alexopoulos & Ric, 2007; Krieglmeier & Deutsch, 2010), but they remain little explored in children. We therefore consider it important to better understand these tendencies in children, and to compare them with those of young adults. The online-VAAST word paradigm (Aubé et al., 2019) has been shown to be more effective than other methods of exploring approach-avoidance patterns (e.g., motor or visual paradigms). We used it with both of our populations.

2. Objective and assumptions

Our goal is to analyze approach and avoidance patterns with emotional stimuli in children and adults using the word version of the *Visual Approach/Avoidance by the Self Task* (VAAST) tool (Rougier et al., 2018). Based on previous studies, we would expect to observe an approach pattern for positive words and an avoidance pattern for negative words in all subjects, but a significantly stronger pattern for children than for adults.

3. Methodology

3.1 Population

Sixty participants (34 children and 26 adults) took part in this online research project. Of these, 11 children and 4 adults could not be included in the study because they did not complete the activity. The remaining 45 participants were divided into two subgroups: 22 young adults (4 males and 18 females) 20-30 years old (mean age = 26.95 years; SD = 3.5) and 23 children (11 girls and 12 boys) 8-11 years old (mean age = 9.64 years; SD = 0.9). None of the children included in the sample had a diagnosed psycho-emotional disorder.

3.2 Materials

The online VAAST (words) task (Aubé et al., 2019)

The online VAAST (words) task investigates the approach-avoidance tendencies of individuals when faced with emotionally valenced words. Unlike paradigms that focus on motor aspects (e.g., the arm using a joystick), it visually gives the individual the impression of moving towards or away from emotionally-charged items (e.g., through image depth effects) in a street setting. Likewise, it shows greater effects than those found via a non-sensorimotor version (e.g., with a virtual character) (Rougier et al., 2018).

In this task, participants are asked to categorize words written in black according to their valence (positive or negative) on a computer screen as quickly as possible. The appearance of each word is preceded by an O symbol followed by a cross on which the subject must focus before pressing the H (start) key. The subjects must then move towards or away from the items according to their emotional valence by pressing the corresponding keys on the computer keyboard (Y and N keys). The word is zoomed in or out by about 13% and the background changes (e.g., a three-dimensional image of the street that is closer to or farther away than the original situation).

The activity consists of two test blocks whose order changes from one individual to another. In one block, participants perform the task in a congruent situation (e.g., moving toward positive items and away from negative items). In the other block, they are placed in an incongruent situation (e.g., moving away from the positive words and approaching the negative words). Each block consists of 40 words (20 positive and 20 negative words) presented randomly and only once. Before each test block, the participants perform a training phase in which they react to 5 positive words and 5 negative words that are not presented in the main experiment. The software records the proportion of correct answers and the reaction time of each participant (in ms) for each item. If there is an approach-avoidance tendency in individuals, reaction times will be shorter in congruent situations than in incongruent situations.

Words with positive or negative emotional valence

We selected 10 positive words and 10 negative words of between 5 and 7 letters, based on the items rated by 9-year-olds in the study by Syssau and Monnier (2009), having an SFI (Standard Frequency Index, Manulex, Lété, et al., 2006) greater than 50 (occurring more than once every 100,000 words) and with no semantic disparity between valences. Chi-square statistical analysis showed no effect between semantic categories and valence ($X^2(4) = 2.400$, $p = .663$, *ns*) for these 20 words.

3.3 Procedure

Each participant conducted this study at home on their personal computer via the *Psytoolkit* platform (Stoet, 2010, 2017). The protocol was followed in three stages in the same way for each person: reading of the instructions (Stage 1), performance of the task in a congruent or incongruent situation (training blocks and then test blocks, Stage 2), performance of the task in the opposite situation to Stage 2 (training blocks and then test blocks, Stage 3). At the end of each training and testing session, participants were rewarded with colored stars and encouraging messages to keep them motivated.

4. Results

The data collected were analyzed using a generalized linear mixed measures model of median reaction times (in ms) for each emotional valence carried by the words (positive or negative) and for each type of movement (approach or avoidance). We excluded incorrect responses from children (16.4% of tests) and adults (10.1% of tests). The aim was to test whether there

were patterns of approach-avoidance to emotional stimuli (e.g., positive or negative words) in children and adults, and whether these patterns were similar regardless of age.

4.1 Approach-avoidance tendency in adults

The overall analysis shows that adults were faster when reacting to positive words (885 ms) than negative words (949 ms), $F(1, 21) = 11.669, p = .003, \eta^2p = 0.357$. However, there was no significant impact of movement type alone (approach: 897 ms, avoidance: 937 ms), $F(1, 21) = 2.554, p = .125, ns$. Furthermore, participants were faster at approaching positive words (832 ms) and moving away from negative words (857 ms) than approaching negative words (1042 ms) and moving away from positive words (938 ms), $F(1, 21) = 15.820, p = .001, \eta^2p = 0.430$.

4.2 Approach-avoidance tendency in children

The overall analysis shows that children were faster when reacting to positive words (1389 ms) than negative words (1745 ms), $F(1, 22) = 18.595, p = .000, \eta^2p = 0.458$. There was no significant impact of movement type (approach: 1510 ms, avoidance: 1623 ms), $F(1, 22) = 0.054, p = .142, ns$. However, participants were faster at approaching positive words (1162 ms) and moving away from negative words (1632 ms) than approaching negative words (1857 ms) and moving away from positive words (1615 ms), $F(1, 22) = 16.298, p = .001, \eta^2p = 0.426$.

4.3 Comparison of approach-avoidance patterns in adults and children

If we compare the approach-avoidance patterns between the two age groups, we observe that children take 1.6 times longer than adults (1389 ms vs. 885 ms) to react to positive words and 1.8 times longer to react to negative words (1745 ms and 949 ms). Interestingly, the effect of the difference in item valence was 5.5 times greater in children (356 ms) than in adults (64 ms).

Moreover, in congruent situations, the children were 1.4 times slower than the adults to approach positive words (1162 ms vs. 832 ms) and they took almost twice as long to move away from negative words (1632 ms vs. 857 ms). In incongruent situations, the children had reaction times almost 1.8 times longer than the adults to approach negative words (1857 ms vs. 1042 ms) and 1.7 times longer to move away from positive words (1615 ms vs. 938 ms).

5. Discussion

Our first hypothesis postulated the presence of a pattern of approaching positive words and avoiding negative words using the VAAST (words) tool (Aube et al., 2019). This hypothesis is validated. Children, like adults, have shorter reaction times in congruent situations than in incongruent situations. Similarly, they tend to react more quickly to positive words than to negative ones. These data corroborate previous work on this topic (e.g., Alexopoulos & Ric, 2007; Huijding et al., 2009; Klein et al., 2010; Rougier et al., 2018).

Our second hypothesis posited that approach-avoidance tendencies would be more marked in children than in adults. This hypothesis is also validated. Children do indeed have globally longer reaction times than their elders, whether the situation is congruent or incongruent, as well as reaction time differences between the two valences 5.5 times greater than adults regarding positive words. In other words, individuals seem to be more reactive to positive words than to negative words when they are children. This effect is still present in adults but is less than in childhood. There seems to be a marked attraction for positive emotional stimuli and especially positive words in children. However, the emotionally charged words used in this research are part of the familiar linguistic landscape of children, including in school textbooks. We can therefore question the influence of the emotional valence carried by these words on the child's learning at school. Approach-avoidance patterns can be seen as facilitating to learning in some cases (e.g., the presence of a positive situation) or as deleterious in other cases (e.g., the presence of a negative situation). Split-second unlearning, the process whereby the learner (adult or child) is able to let go of their approach-avoidance behavior (Hudson & Johnson, 2021), could be a fruitful course to optimise learning at school.

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