The effect of avoidance behavior on the extinction of a conditioned fear-response.

Is the opportunity to perform an avoidance response, following an avoidance cue, necessary for the return of fear during extinction learning?

Abstract:

Fear conditioning in humans has been researched extensively. When the fearful stimulus is no longer presented, extinction of fear occurs. However, giving people the option to avoid the fearful stimulus during extinction has a negative effect on the fear extinction. Whether this effect is due to the presentation of a visual cue, or due to a behavioral response to this cue is still not clear. This paper aimed to illuminate on this subject, by depriving some participants of executing the avoidance response during extinction. The data showed that people who were not able to perform the avoidance response responded with higher shock expectancies in some cases, which are used to measure fear. We concluded that overall, people who were not able to conduct an avoidance response were more fearful and showed less extinction than people who could avoid.

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Most people experience some kind of fear during the course of their life. These fears can be very specific and differ over a variety of objects (Myers et al. 1984). The extent of the impact of the fear on someone's life does differ in maybe an even greater amount, ranging from a little elevated heart rate while watching a scary movie, to being unable to get out of the house due to an irrational fear that something bad will happen. Fear can be described as an immediate emotional reaction to current danger, often characterized by strong tendencie to escape or avoid the situation and an increase in activity in the sympathetic branch of the autonomic nervous system (Barlow, Brown & Craske, 1994; Craske et al., 2010).

There are a lot of factors that determine the onset of a fear response and eventually that fear response turning into a disorder, which is called a phobia. For long, it was thought that most specific phobias where always related to an earlier traumatic event, although we now know that this is not always the case (Barlow, 2002; Craske et al., 2006; Öst,1985; Rachman, 2002). However, this suggests that fear can be acquired during a lifetime, in a way that resembles learning (when you have once been bitten by a dog, you may learn that such situation may cause you harm and thus fear and avoid dogs). A lot of people with specific phobias can even recall the very moment their fear begun. Munjack (1984; Mineka & Zinbarg, 2006) found while studying people with specific driving phobias, that 50% of the people who could remember the onset of their phobia, reported that it was some sort of traumatic experience such as a car accident. So, while there are more ways to acquire a fear, there is some evidence that it could be a learned response, which is a way that could be replicated in a laboratorial setting.

A long time ago, Pavlov (1927) found out that presenting two paired events to a subject, of which one would evoke a natural response, resulted in a link between the conditioned stimulus and the natural, unconditioned response. When the conditioned stimulus (CS) and the unconditioned stimulus (US) where no longer paired, the association would fade away. Further research done by various scientists showed that people who experience a strong fear in a dangerous situation (which is rational), may unintentionally associate this emotional response with other available situational stimuli. This could result in a situation where one of those situational stimuli becomes a conditioned stimulus and provokes a fear response, similar to Pavlovian Conditioning, even if the danger is not actually present (Bouton, 2005; Bouton et al., 2001; Martin, 1983; Mineka & Zinbarg, 2006; Razran, 1961).

It is clear that it is possible to acquire fear through CS-US association and that this can be replicated in a laboratory setting, very much like the classical conditioning we know, which means that it takes some time to acquire the association and that it eventually fades

away when the US and the CS are no longer paired (extinction). Research on this topic is done by various scientists like Rescorla (1972, 2003) and Lovibond et. al. (2000). They investigated the process of extinction and added another, neutral, stimulus to a fear conditioning test. They showed that the added stimulus disrupted the fear extinction, once again highlighting the role of context in fear learning.

Some kinds of fear fade out over time, like in the laboratory setting. Specific phobias however require exposure-based exercises (Barlow, Moscovitch & Micco, 2004; Craske et al., 2006). This means that patients get gradually exposed to the source of their fear. There are cases where patients have such a strong response to their fear stimuli that they are unable to be (directly) exposed to it. Sometimes, this response can be extreme in such an extent, that the use of tranquilizers, along with the exposure therapy is the only option. The use of such drugs can be seen as safety behavior, as patients are kept save from the extreme response they normally experience. The effect of such safety behavior on the treatment of people with panic disorders and social phobias has been studied several times (Wells et al., 1995; Salkovskis, Clark, Hackmann, Wells & Gelder, 1999). They found smaller treatment gains by patients that were allowed to express safety behavior. In correct terminology, the expressed safety behavior had a negative effect on the extinction of the US-CS association.

Lovibond et al. (2009) conducted a series of experiments to examine the effect of safety behavior on fear extinction. He paired a shock (US) with a neutral stimulus (CS) and gave participants, after acquiring the US-CS association, the possibility to avoid the shock by pressing a button, thus expressing safety behavior. During the fear extinction, none of the groups received shocks, but the group that could perform safety behavior earlier could continue this. This group showed protection from extinction. They responded to the CS with higher shock expectancy ratings and skin conductance response, opposed to the group that couldn't avoid the shock, who showed normal extinction.

Xia and Baas (2014) conducted further research on the effect Lovibond found.. They too used Pavlovian fear conditioning to acquire a US-CS association and compared startle responses between a CS were participants were able to avoid the shock by pressing a button after a visual cue (CSA) and a CS were this was not the case (CSU). The acquiring of this association took place after the fear conditioning. In the following extinction phase, the possibility to avoid still took place in some of the trials. The participants showed less successful extinction learning of CSA in comparison to CSU. They concluded that this was most likely due to return of fear in CSA trials directly following an avoidance trial. So on top

of Lovibonds finding, they made it clear that avoidance behavior during extinction learning has continuing negative effects on successful extinction, due to return of fear.. They also noted the importance of their findings to more clinical situations, specifically exposure therapy and the support that their study gives to earlier clinical findings of decreased effects of exposure therapy while continuing avoidance behavior (Sloan & Tech, 2002; Salkovskis,1999).

Still, there are some questions left, as Xia and Baas discuss in the end of their paper. One of those remaining questions, is whether the avoidance cue or the following avoidance response is followed by an increase in threat expectancy. They suggested a paradigm where participants are shown avoidance cues, but are unable to utilize a subsequent response. This research is conducted on that subject and revolves around the following question:

Is the opportunity to perform an avoidance response, following an avoidance cue, necessary for the return of fear during extinction learning?

This will be measured by replicating the research of Xia and Baas (2014) with an extra group, who won't have the opportunity to perform the subsequent avoidance response, following an avoidance cue during the extinction learning. The potential effect will be analyzed by comparing startle responses and shock expectancy ratings. The groups will both be exposed to the CSA, the CSU and the CSm which won't be followed by a shock. The process of conditioning of the fear and the learning of the avoidance behavior will thus be similar to Xia and Baas (2014), while the extinction phase will differ by making it impossible for half of the participants to respond to the avoidance cue with the learned behavior. The avoidance cue will be visible for both groups, even if they can't respond to it. The startle response to a burst of white noise (the startle probe) will function as a measurement of fear, similar to earlier research (Xia & Baas, 2014).

Furthermore, the participants will fill out questionnaires to assess some of their personality traits, especially those related to fear and anxiety, which can be defined as a negative mood state characterized by bodily symptoms of physical tension and by apprehension about the future (APA, 2000; Barlow, 2002). Their scores will be correlated to the shock expectancy ratings, to see whether personality effects fear conditioning. It is expected that people who are more prone to anxiety and fear give higher shock expectancy ratings opposed to people who are, in general, less fearful and less anxious. This has not been

researched extensively in this setting, although Xia and Baas (2014) showed that anxiety correlated positively with feelings of relieve after the avoidance response.

Methods and Materials

Participants

A total of 32 participants (21 women and 11 men, mean age = 25.72, SD = 7.813) participated in this study. Written informed consent was obtained. All participants were screened on sight problems, hearing problems, other physical or mental problems and the usage of drugs. They were paid €20,- or two course credits after completion of the experiment. The consent, shock administration and physiological measurement procedures were approved by the Facultairy Ethical Committee of the Faculty Social Sciences, University Utrecht.

Stimuli

The experiment began of a background stimulus, a picture of a living room, followed by the background stimulus in a different color, the CS. The colors differed between pink, blue and yellow, as can be seen in figure 1. The avoidance cue was an alarm clock, which was presented on top of the CS, in the corner right below. The US consisted of an electric shock, of which the intensity was defined by a preceding shock work-up, where participants received a shock and could answer how they felt about it on a likert scale ranging from 'not very uncomfortable' to 'very uncomfortable'. The goal was to achieve an intensity that was uncomfortable but not painful. The shock consisted of a 750 ms train of 5 ms pulses. Startle probes were 50 ms white noise bursts of 110 db presented through a headphone.

Figure 1. The background (upper left) and CS stimuli. Color assignment to conditions was varied across conditions. Version 1: CSA=pink, CSU=blue, CSm= yellow. Version 2: CSA= yellow, CSU= pink, CSm= blue.

Questionnaires

The participants filled in a Dutch version of the state part of the State Trait Anxiety Inventory (STAI) (Spielberger, 1972; Van der Ploeg, Defares & Spielberger,1979), a Dutch version of the BIS/BAS (Carver & White, 1994; Franken, 2005) and a Dutch translation of the Novelty and Sensation seeking scale of the TCI (Cloninger, 1994; Duijsens, 2000) along with some questions about their motivation during the experiment, like whether they always reacted with the avoidance response if possible.

Shock expectancy

In every trial, the question concerning shock expectancy was presented to the participant (figure 2). The image was presented at the bottom of the screen and reads (in Dutch) 'how much do you expect a shock?' followed by different colored buttons which corresponded to buttons on the key board and ranged from 'most certainly not' to 'most certainly'.

Figure 2. Scale about shock expectancy.

Design

The experiment consisted of three phases. In the first phase, the acquisition phase, the Pavlovian fear conditioning took place. Two of the CS were coupled with an US (the CSA and the CSU), while one was a safe CS (the CSm). The participants were made aware of this beforehand. The trials consisted of a 3000-12000ms presentation of the background, followed by a 5000-6000ms presentation of the CS, which was eventually followed by the probe. After 500/1500ms the shock expectancy question was displayed for 1175ms. The eventual shock was presented after 750ms. After that, the trial ended. Shocks were given 50% of the time in the CSA and CSU trials. Probes were presented three out of four times for each CS condition.

During the second phase, the avoidance phase, the avoidance cue was added. It was presented 2000ms after the presentation of the CSA, this CS (the cue on top of the CSA) will be called CSAv from now on. If they didn't respond with a button press within 1000ms, they received a shock. In the third phase, the extinction phase, no shocks were given. Half of the participants became unable to produce the avoidance response in the extinction phase, as their mouse was taken. Table 1 shows the experimental design, while figure 3 shows the way in which every trial was constructed.

Table 1. Experimental design.

Phase	Acquisition			Avoidance				Extinction			
Conditioned stimulus	CSA	CSU	CSm	CSAv	CSA	CSU	CSm	CSAv	CSA	CSU	CSm
Trials	12	12	24	24	24	24	24	5	24	24	24
Shocks	6	6	0	12	0	12	0	0	0	0	0
Probe	9	9	18	18	18	18	18	5	19	18	18
No probe	3	3	6	6	6	6	6	0	5	6	6

Note: The shocks in the CSAv trials were only given if participants failed to press the response button within 1 second after the visual cue.

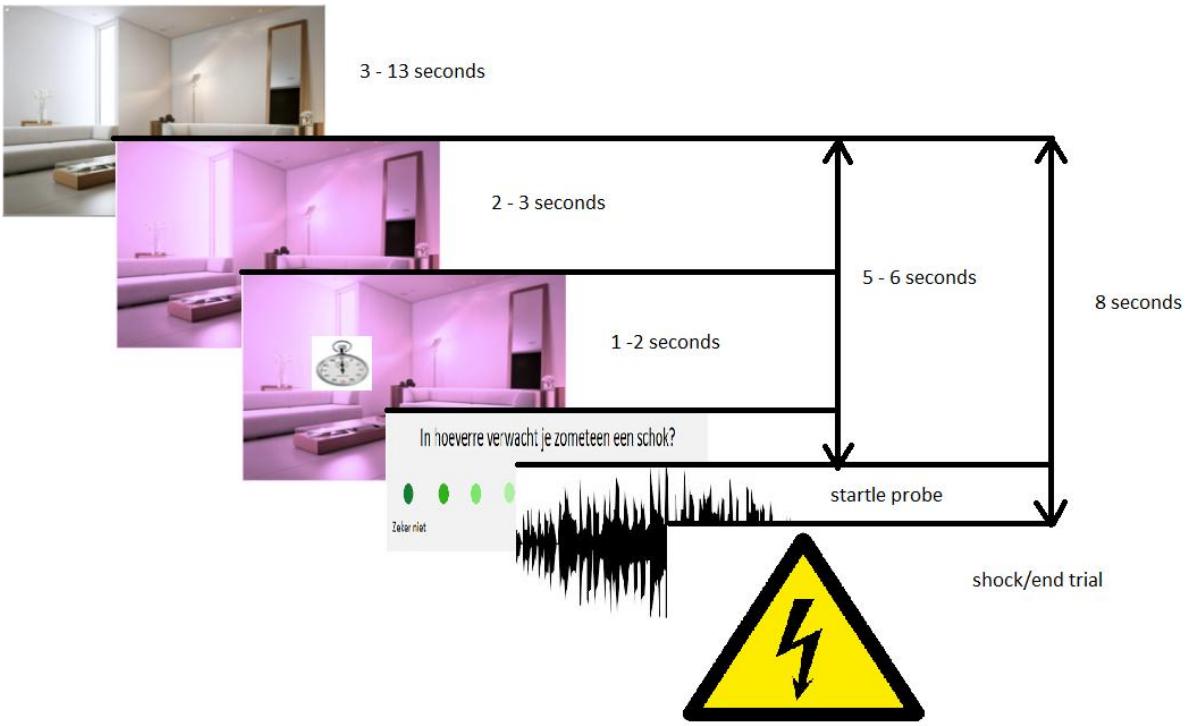


Figure 3. Trial construction

Procedure

Participants started with reading the informed consent and signing it, along with demographic questions and questions about eventual problems with sight, hearing, or other physical and mental disorders and drug use. This was followed by the STAI and TCI, before applying the electrodes for heart rate, skin conductance, startle reflex and the shock pulses, Participants were led through a shock work-up to determine their optimal shock intensity. Following the shock work-up the computer-task started with habituation trials for the startle probes, to ensure that habituation had already took place before the start of the actual experiment. After that, the different CS backgrounds were introduced and they were instructed about the shock expectancy questions. Before the avoidance phase, they received instructions about the avoidance cue and the avoidance response. Before the extinction phase the experimenter came in, asked if everything was still all right and removed the mouse by half of the participants (randomly assigned). After this the electrodes were taken off and the participant received the final two questionnaires, the BIS/BAS and questions about their motivation. The entire session lasted about two hours.

Apparatus

Startle responses and heart rate were measured through EMG electrodes. Startle response electrodes were placed under the right eye. Heart rate electrodes were placed on the breastbone and the left lower ribs of the participants. A CMS/DRL electrode set was put on the forehead. Skin conductance was measured with a GSR1 electrode set, put on the middle phalanx of the index- and middle finger of the left hand. All was measured through a BioSemi amplifier system. The electric shock was administered through a shock electrode on the left wrist. The program Presentation was used for presenting instructions and generating the trials. OpenSesame was used for the questionnaires.

Data Analysis

The EMG data from the startle reflex was processed with Brain Vision Analyzer for Windows. Segments presented 50ms before to 200ms after the startle probe were filtered with a high pass filter of 28 Hz, rectified and smoothed with a low pass filter of 14 Hz. Startle magnitude was defined as the amplitude of the first peak in the segment within a latency of 25-100ms after presentation of the startle probe. Startle data was standardized to control for differences in baseline reactivity in individuals (Xia & Baas, 2014).

The startle data was split in three equal portions, for every phase individually. This was done to smoothen the data and reduce the influence of noise and possible outliers. The data was averaged within every portion, resulting in three moments in time for every CS, for every phase. Those means were used for further analyzing of the data. The same was done for the shock expectancy ratings.

Statistical analysis was done in SPSS 20 for Windows. It consisted of a repeated measures ANOVA with the within factors of the various CS and time and the between factor of condition (mouse versus no mouse). This was done for both the startle data and the shock expectancy data.

Results

Startle data

Main analysis of the startle responses during the acquisition phase showed a main effect for CS, $F(2,62) = 16.945$, $p<0.001$. Contrasts revealed that startle responses on the CSA, $F(1,31) = 22.905$, $p<0.001$ and on the CSU, $F(1,31) = 31.421$, $p<0.001$, were significantly higher than on the CSm. There was also a main effect of time, $F(2,62) = 65.282$, $p<0.001$. Contrasts

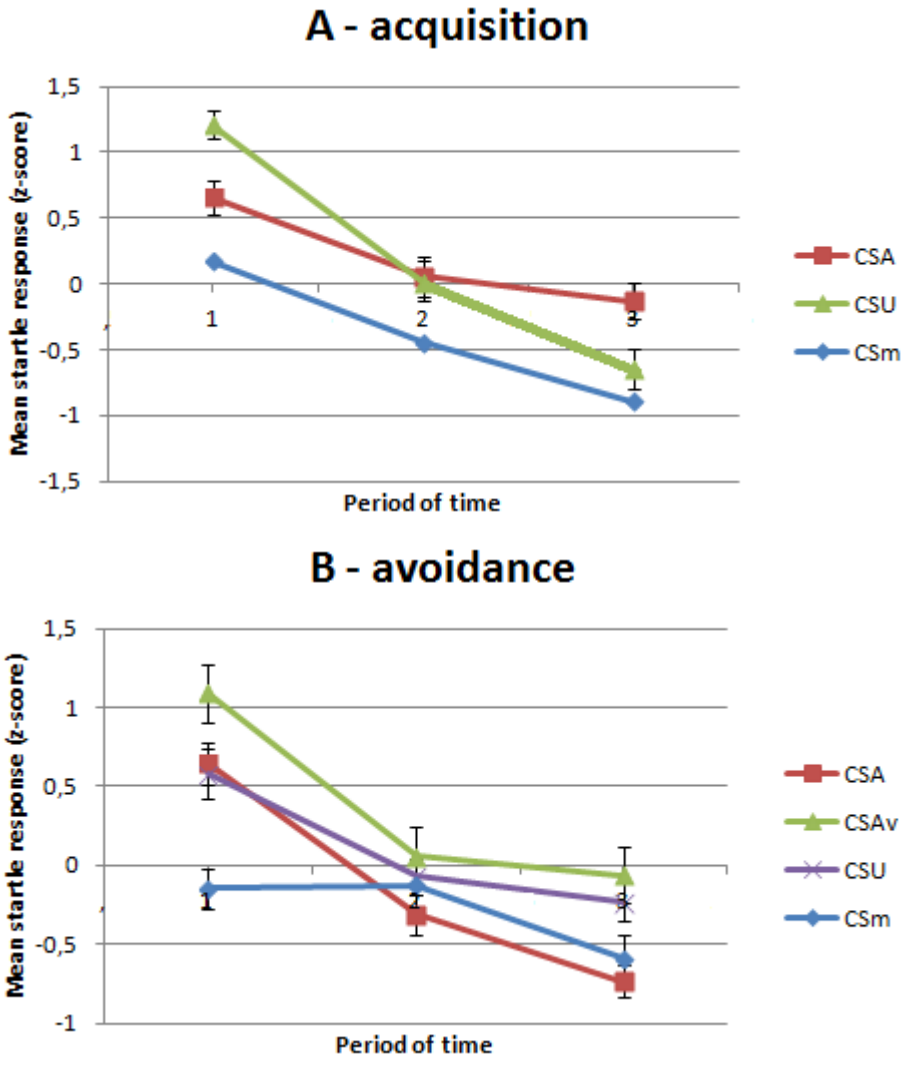
revealed that startle responses in the second period of time, $F(1,31) = 72.752$, $p<0.001$, and in the third period of time, $F(1,31) = 126.943$, $p<0.001$, were significantly higher than in the first period of time. An interaction effect was found between CS*time ($F(4,124) = 4.368$, $p=0.002$). Contrasts were performed comparing the CSA and the CSU to the CSm and the second and third period of time to the first one. These revealed significant interactions when comparing the CSU to the CSm for both the second period of time compared to the first, $F(1,31) = 5.169$, $p=0.03$, and for the third period of time compared to the first, $F(1,31) = 11.44$, $p=0.002$. These results show that fear conditioning has occurred. Figure 4a shows the startle responses over time for the different stimuli.

Main analysis of the startle responses during the avoidance phase showed a main effect for CS, $F(3,93) = 7.054$, $p<0.001$. Contrasts revealed that startle responses on the CSAv, $F(1,31) = 18.709$, $p<0.001$, and on the CSU, $F(1,31) = 8.136$, $p<0.001$, were significantly higher than on the CSm. There was also a main effect of time, $F(2,62) = 35.559$, $p<0.001$. Contrasts revealed that startle responses is the second period of time, $F(1,31) = 32.214$, $p<0.001$ and in the third period of time, $F(1,31) = 62.66$, $p <0.001$ were significantly higher than in the first period of time. Again, an interaction effect was found between CS*time, $F(6,186) = 4.225$, $p=0.001$. Contrasts were performed comparing the different CS to the CSm and the second and third period of time to the first. They revealed significant interactions when comparing the CSA to the CSm for both the second period of time compared to the first one, $F(1,31) = 15.605$, $p<0.001$and for the third period of time compared to the first one, $F(1,31) = 15.454$, $p<0.001$. They also revealed significant interactions when comparing the CSA to the CSm for both the second period of time compared to the first one, $F(1,31) = 15.091$, $p=0.001$ and the third period of time compared to the first one, $F(1,31) = 5,474$, $p=0.26$. They also revealed a significant interaction when comparing the CSU to the CSm for the second period of time compared to the first one $F(1,31) = 4.549$, $p=0.41$. Important findings to note are the absence of a significant difference for the CSA while analyzing the contrasts for the different CS, this effect can be seen in figure 4b. It seems as if the effect of the conditioned responses on the CSA wears of over time. The contrast analysis of the interaction effect shows that there is an interaction effect between time and the CSA while comparing the CSA to the CSm, this also suggests a change in fear responsiveness for the CSA.

In the extinction phase, the CSAv trials were not used while analyzing, as there were too few trials to ensure a right measurement. Main analysis of the startle responses during extinction showed a main effect for CS, $F(2,60) = 3.328$, $p=0.043$. Contrasts revealed that the

startle responses on the CSA were significantly higher than on the CSm, F(1,30) = 7.495, p=0.01. There was also a main effect for time after correction using the Greenhouse-Geisser epsilon of 0.736 (Field. A. 2009), F(1.471,44.132) = 16.69, p<0.001). Contrasts revealed that the startle responses in both the first period of time, F(1,30) = 20.804, p<0.001, and the second period of time, F(1,30) = 7.905, p=0.009 were significantly higher than in the third period of time. No significant interaction effect have been found between any combination of variables. Figure 4c shows how the three CS differ in mean startle response over time. The analysis shows that the desired extinction took place. It also revealed that the CSA differed significantly from the CSm, as this was not the case in the acquisition phase, this can be seen as an effect of the return of fear as known from earlier research. The CSU did not differ significantly from the CSm, this may suggest that the extinction for the CSU happened very fast. Most interesting for this study is the absence of any interaction effect, so the mouse/no mouse conditioning did not have any effect on the startle responses in this analysis.

In addition to the repeated measures ANOVA, an independent samples t-test was used to analyze any possible differences in means between the mouse and the no mouse condition. No significant effect was found between the both means in any of the different stimuli or time periods.



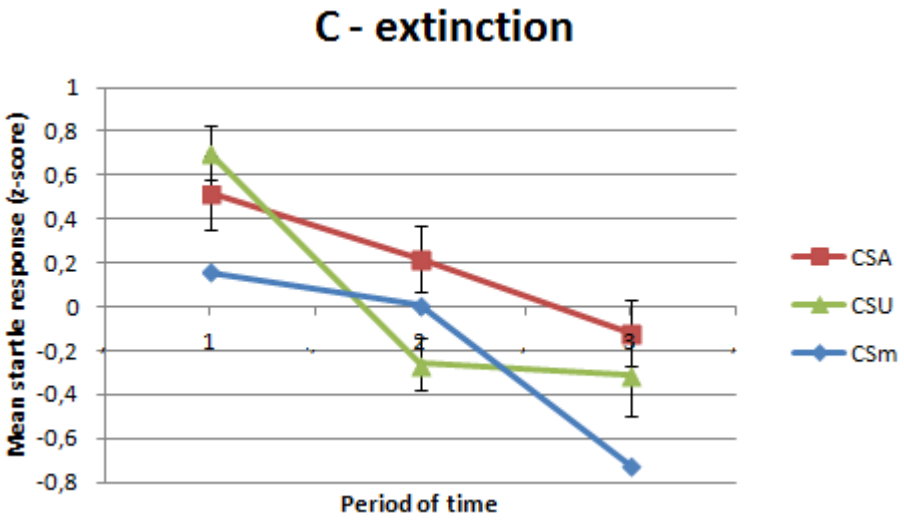


Figure 4. Figures a (acquisition), b (avoidance) and c (extinction) show how the mean startle responses differ over time for each CS, for every phase. Figure d shows how the mean startle responses differ over time for the CSA within the extinction phase.

Shock expectancy data

For the data from the shock expectancy, one participant had to be excluded due to motivational problems, he admitted that he just pushed the same button most of the time and randomly selected another in a few cases.

Main analysis on the shock expectancy responses during extinction showed a main effect of CS after correction using the Greenhouse-Geisser epsilon of .663, $F(1.327, 38.481) = 63.516$, $p<0.001$. Contrasts revealed that the shock expectancy ratings for the both the CSA, $F(1,29) = 64.079$, $p<0.001$ and the CSU, $F(1,29) = 76.837$, $p<0.001$ were higher opposed to the CSm. A main effect of time was also found, $F(2, 58) = 93.949$, $p<0.001$). Contrasts revealed that the shock expectancy for both the first period of time, $F(1,29) = 134.277$, $p<0.001$, and for the second period of time, $F(1,29) = 20.233$, $p<0.001$, were higher opposed to the third period of time. There was also an interaction effect between CS*time found after correction using the Greenhouse-Geisser epsilon of .532, $F(2.128,61.719) = 48.236$, $p<0.001$). Contrasts were performed comparing the different CS to the CSm and the first and second period of time to the third. They revealed significant interactions while comparing the CSA to the CSm for both the first period of time compared to the third one, $F(1,29) = 67.25$, $p<0.001$, and for the second period of time compared to the third one, $F(1,29) = 13.722$, $p=0.001$. Upon that, they revealed significant interactions while comparing the CSU to the CSm for both the first period of time compared to the third one, $F(1,29) = 80.418$, $p<0.001$ and for the second

period of time compared to the third one, F(1,29) = 11.841, p=0.002. Figure 5 shows the difference over time for all three CS. No other significant interaction effects have been found.

Again, a independent samples t-test was performed to further analyze any possible differences between the mouse and the no mouse condition. Three significant differences were found. In the third period of time of the CSA, participants that were unable to use the mouse responded with higher shock expectancies, than those that could use their mouse. As Levene's test of equality of variances was significant, no equality of variances could be assumed. This mean difference, -.982, was significant t(15,662) = -2.917, p=.01. In the third period of time of the CSU, participants that were unable to use the mouse again responded with higher shock expectancies, than those that could use their mouse. Again, Levene's test was significant. This mean difference, -.737, was significant t(16.612) = -2.325, p=0.33. In the first period of time of the CSm, participants that were unable to use the mouse responded with higher shock expectancies, that those that could use their mouse. Again, Levene's test was significant. This mean difference, -1.107, was significant t(15.014) = -2.516, p=.024. Opposed to what was found while analyzing the startle data, significant mean difference were found. The two mean differences in the third period of time indicate that extinction was disrupted when the mouse was taken away, even in a situation where no avoidance cue was present. The mean difference for the CSm in the first period of time shows that, even while aware that they would not receive shocks, participants rated the shock expectancy significantly higher when their mouse was taken away.

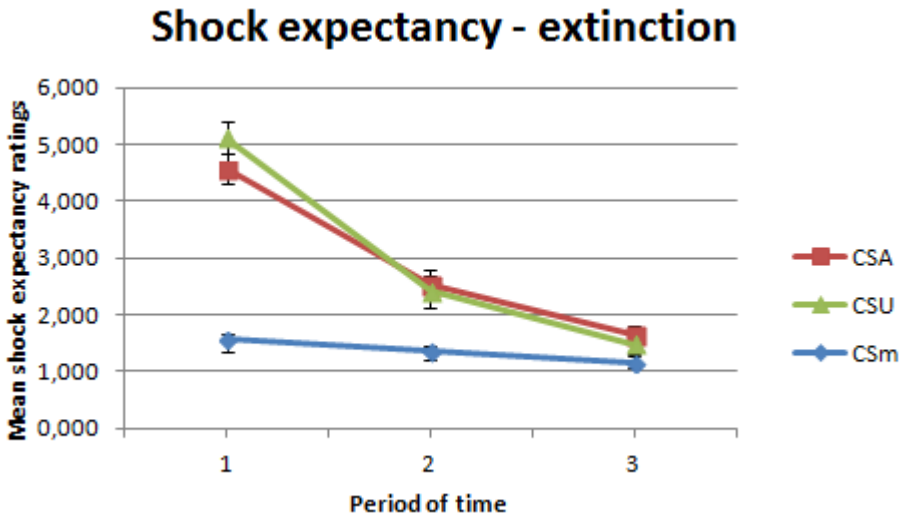


Figure 5. Shows the difference in shock expectancy over time for the different CS.

Questionnaires

Bivariate correlations were used to reveal possible correlations between shock expectancy ratings in the extinction phase and scores on the different questionnaires. To do this, new variables have been computed, the mean of the shock expectancy responses for the CSA trials, for the CSU trials and for the CSm trials. The last variable was the mean of all three CS. As the shock expectancy data was not normally distributed, Spearman's rho was used.

Three significant correlations were found. The mean shock expectancy rating on the CSA trials correlated positively with the Drive scale of the BAS ($r(31) = 0.392$, $p<0.05$). Indicating that participants who were more driven to take action had a tendency to give higher shock expectancy ratings, it is possible that people who score high on this personality trait act extremer in situations like this (likert-scales), this could also explain why the mean shock expectancy responses of all CS also correlated positively with the Drive scale of the BAS ($r(31) = 0.375$, $p<0.05$). The mean shock expectancy responses of all CS correlated negatively with the State Anxiety scale of the STAI ($r(31) = -0.372$, $p<0.05$, while we expected a positive correlation between the STAI score and the shock expectancy responses. This data shows that people who are overall more anxious responded with lower shock expectancies opposed to people who are not that anxious.

Overall, all three correlations are significant, but small. No other significant correlations were found.

Discussion

The aim of this study was to explore whether the effect found by Xia and Baas (2014), the return of fear in extinction learning due to avoidant behavior, is mostly due to the presentation of the avoidance cue, or executing the avoidance response. To examine this difference, the group of participants was split in two conditions, one in which the participants could still use the avoidance response in the extinction phase, while the other group was deprived of utilizing that action. The conditioned fear was measured with both objective measures, startle reflexes, and subjective measures, shock expectancy ratings.

While performing repeated measures ANOVAs, it became clear that the expected fear conditioning had taken place. Main effects of CS and time were found, as is in line with previous studies (Xia and Baas, 2014). However, in the avoidance trials, contrast revealed that the CSA did not differ significantly from the CSm. This effect was not present in the study by Xia and Baas (2014). It seems as if the effect of the fear conditioning, as was present in the acquisition phase, diminishes when the option to avoid was presented. As this contradicts

earlier studies, while almost the same procedure was used, further research may be necessary to see whether this is an incidental effect, or whether adding the avoidance option truly effects fear conditioning. Maybe an increase in participants could illuminate further on this subject.

Analysis of the extinction phase showed that the expected interfering effect of the avoidance behavior, had taken place, as the extinction of the CSU was more successful than that of the CSA, as revealed by the contrast, that only showed a significant difference between the CSA and the CSm and no significant difference between the CSU and the CSm. However, concerning the mean question of this paper, no significant effect of the Condition variable, whether participants could use their mouse during extinction, was found CS. The following t-test on the startle data revealed no significant mean differences between both groups. However, an effect of our crucial manipulation, taking away the opportunity to avoid the shock after presentation of the avoidance cue, came to light while performing a t-test on the shock expectancy data. Participants that were unable to perform the avoidance response gave higher shock expectancy ratings in the third time period of the CSA and the CSU and in the first time period of the CSm. This shows that taking away their mouse evoked more fearful behavior, even in situations that were safe (the CSm) and resulted in less extinction, but only on a subjective level. This answers the main question only partially, as it reads that performing the avoidant behavior is necessary for the return of fear during extinction learning. The analysis showed that the fear is bigger when the avoidant behavior can not be performed, but only in certain specific combinations of time and CS and only while using subjective measures.. This leaves some room for interpretation. It could be the case that the cue alone is responsible for the return of fear and that the following response in fact causes some relieve and a less fearful state. The other option is that, because participants are used to being able to avoid, they get more fearful if this is not possible. In fact, most of the participants reported that they flinched for a brief moment, the first time the cue was shown while they could not respond in the learned way. It seems valid to ask ourselves if we truly examined whether the avoidance cue or the corresponding response is necessary for a return of fear, or only answered the question of how people would react when the opportunity to avoid the shock was taken away. Research on this subject is done by Sloan and Telch (2002), who examined the effect of what they called safety-seeking behavior in patients with claustrophobic fear. They measured their participants before and after the safety-seeking treatment and concluded that the safety-behavior treatment had detrimental effect on habituation to their fear. So the opportunity to avoid between two measurements of fear led to more fear afterwards, similar to our data. Maybe a more suitable paradigm to answer the main question would be one were not

only the option to respond was taken away, but participants were also made aware that no shock would follow in this last phase. The other group could also be made aware of this, but would receive the instruction to still perform the avoidance response. As the startle response is a reflex, participants are still expected to show some kind of fearful response, while it is ensured that they are not responding out of an overall state of fear, caused by taking their mouse.

While analyzing the results of the questionnaires, there were three significant, but small correlations found, although none of them was in line with our expectations. Based on our data, it seems that a higher score on State Anxiety correlates with lower shock expectation scores. As one of the key elements of anxiety is apprehension about the future (APA, 2000; Barlow, 2002), one would expect that a higher score on the STAI correlates with higher shock expectancy ratings. As this is not the case, it seems that anxious people, who normally do worry about (bad) things that may or may not happen in the future, do not expect shocks to happen in the near future. The questionnaires do not assess the main question of our research, but show interesting results to investigate further one. The positive correlations between the Drive scale of the BAS and the shock expectancy ratings overall, but especially on the CSA are maybe a result of their tendency to really take action when presented a choice. Where people with a low drive may respond more conservative to likert-questions, people with a high drive react more extreme to those.

There are some other limitations to the study that came to light while experimenting. Many participants complained about the length and reported that they became more and more exhausted during the experiment, this may of course affect the results. Some of them even reported that they intentionally did not avoid some of the shocks, to 'stay awake' or because they were 'curious about what would happen' if they did not avoid the shock. They also reported a lot of times that they couldn't concentrate on the experiment at the end and were easily distracted. There was an questionnaire conducted to assess those feelings. Participants were asked if they were motivated (with 4 being highly motivated), tired during the experiment (with 4 being very tired) and whether they could concentrate during the experiment (with 4 being very able to concentrate). The mean score on motivation was 3.13 (sd=.793), indicating that they were motivated. The mean score on being tired was also 3.13 (sd=.833), indicating that they were tired. The mean score on being able to concentrate was 2.84 (sd=.808) indicating that they were able to concentrate, but not really well.

Next to that, questions could be raised about the isolation of the avoidance response. After all, people could still perform a button press like response (while not actually pressing a

button). While monitoring their behavior, most of the participants whose mouse was taken, did move their hand to the direction the mouse used to be, the first time the cue was shown. Some continued to express this behavior for the other times it was presented. This indicates that participants continued their avoidance behavior.

Concluding, some interesting effects have been found, but questions can be raised about the meaning of those effects. Only after resolving those issues, implications of these effects in clinical settings can be discussed. This research made clear that the used paradigm may not be perfect to assess the main question of this paper, whether the return of fear the extinction phase, while performing avoidant behavior is due to the presence of the avoidance cue or the response, but the data suggests that taking away the opportunity to avoid results in higher subjective fear. Upon that, the questionnaires show results that are opposite to our expectations and could give more insight in the relationship between fear and anxiety, if analyzed further in future research.

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