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Associative learning in flying phobia

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ABSTRACT

Background and objectives: Modern learning theories suggest that particularly strong associative learning contributes to the etiology and maintenance of anxiety disorders, thus explaining why some individuals develop an anxiety disorder after a frightening (conditioning) event, whereas others do not. However, associative learning has rarely been investigated experimentally in specific phobias. The current study investigated associative learning in patients with flying phobia and healthy controls using a modified version of Olson and Fazio's associative learning paradigm (Olson & Fazio, 2001).
Methods: Under the guise of an attention task, patients with flying phobia ($n = 33$), and healthy controls ($n = 39$) viewed a series of distracters interspersed with pairings of novel objects (counterbalanced conditioned stimuli, CSs) with frightening and pleasant stimuli (unconditioned stimuli, USs).
Results: After the conditioning procedure patients with flying phobia rated both CSs more frightening and showed stronger discrimination between the CSs for valence compared to healthy controls.
Conclusions: Our findings indicate a particularly stronger conditioning effect in flying phobia. These results contribute to the understanding of the etiology of specific phobia and may help to explain why only some individuals develop a flying phobia after an aversive event associated with flying.

1. Introduction

Traditionally, anxiety disorders have been considered to be a learned fear response to a stimulus after a frightening experience with that stimulus (Pavlov, 1927; Watson & Rayner, 1920). However, retrospective investigation into the learning history of fear showed that not all people experiencing fear or trauma in a given situation go on to develop a phobia, and that patients with anxiety disorders and healthy controls report a similar amount and intensity of frightening experiences with typical phobic stimuli (Lautch, 1971; Liddell & Lyons, 1978; Rachman, 1977). With respect to flying phobia, 3 retrospective studies investigating associative learning experiences before the development of the flying phobia have been conducted so far. In interview studies, Wilhelm and Roth (1997) found that participants with flying phobia and healthy controls did not differ in the number of reported conditioning events associated with flying, and Schindler, Vriends, Michael, and Margraf (submitted for publication) found a similar pattern of results: Patients and healthy controls reported an equal number of comparable frightening events associated with flying. In a study with aircrew participants, Aitken, Lister, and Main (1981) showed that not all people who have had fearful events during flying go on to develop phobias. They found that a higher percentage of healthy controls reported having experienced a significant flying accident compared to participants with a flying phobia. In sum, the findings that healthy controls and patients with flying phobia both report aversive experiences during flying and that only patients developed a specific phobia after these incidents demonstrate, that the assumption that associative learning is an appropriate model for the development of specific phobia is doubted today.

In the past decade conditioning models have experienced a renaissance, as associative learning models have become more sophisticated (Field, 2000) and findings that patients with anxiety disorders (social anxiety disorder, post-traumatic stress disorder and panic disorder) show different associative learning effects in comparison to healthy controls have been published (Blechert, Michael, Vriends, Margraf, & Wilhelm, 2007; Grillon & Morgan, 1999; Hermann, Ziegler, Birbaumer, & Flor, 2002; Michael, Blechert, Vriends, Margraf, & Wilhelm, 2007; Orr et al., 2000; Peri, Ben-Shakhar, Orr, & Shalev, 2000). Compared to healthy controls, patients with these anxiety disorders show either stronger discrimination between a CS paired with an aversive stimulus (e.g., electric shock, CS+) and a CS not paired (CS−) (Orr et al., 2000) or

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stronger CRs to both CSs, indicating stimulus generalization (Mineka & Zinbarg, 1996), or weaker inhibition of the fear response in the presence of safety signals (Davis, Falls, & Gewirtz, 2000). These results indicate that patients may have developed the disorder because of their propensity to form particular strong conditioning responses or they might reflect an epiphenomenon contributing to the maintenance of the disorder. Although specific phobias are the most common anxiety disorders (Kessler et al., 2005), to date associative learning has only been investigated in spider phobia.

Schweckendiek et al. (2011) used a novel picture–picture conditioning paradigm and found that patients with spider phobia showed enhanced brain activation to a CS that was paired with phobia-relevant pictures (US) and not to CSs that were paired with non-phobic aversive USs or neutral pictures in the fear network. Regarding verbal ratings (e.g., fear, valence), patients showed higher discrimination between the CSs that were paired with phobic or non-phobic USs and neutral USs compared to healthy controls. These results show a phobia-relevant conditionabilty effect measured by brain activation and a general conditionability effect (independent from phobia-(ir)relevant USs) measured by verbal ratings. Thus indeed a stronger conditioning effect might play a role in specific phobia at least at subjective levels.

In the present study we experimentally investigated associative learning effects in flying phobia, using a modified version of the associative learning paradigm of Olson and Fazio (2001, 2002)[3] for its lifelike design. As in everyday life, in which many associations will be formed between flying and mildly aversive USs (e.g., hard work life, reports of turbulent flights), this paradigm uses mildly aversive USs, namely words and pictures. Further, similar to the associations of flying in real life with pleasant (e.g., holidays, nice view, smiling crew) and frightening (e.g., strange movements in the plane, reports of flying accidents on TV) stimuli, this paradigm uses several pleasant and frightening USs. Finally, the participants view, under the guise of an attention and surveillance task, a series of random images and words (430 trials) interspersed with CS–US pairings (40 trials), making it closer to real life in the sense that associative learning always takes place within a context of many distracting stimuli. In our paradigm, neutral novel cartoon characters served as CSs. Of the 2 counterbalanced CSs 1 CS was paired with 10 different pleasant USs (CSpleas) and the other CS with 10 different frightening USs (CSfear). In a subsequent evaluation task participants rated how anxious they feel when viewing the CSs and their valence. Stronger associative learning was measured by the differentiation between CSfear and CSpleas (Orr et al., 2000) as well as generalization of the CSfear to the CSpleas (Davis et al., 2000). Recent studies have shown that increased contingency awareness in healthy participants is often correlated with stronger associative learning (Pleyers, Corneille, Luminet, & Yzerbyt, 2007). Thus, we also explored if contingency awareness of the CS–US pairings influences conditionability.

2. Method

2.1. Participants

The present sample consisted of 33 patients with flying phobia according to the *Diagnostic and Statistical Manual of Mental Disorders–4th edition* (APA, 1994) and 39 healthy controls. The clinical sample comprised patients who decided to join a fear-of-flying weekend seminar run by one of the authors (B.S.).[4] This seminar included cognitive behavior treatment (including a flight in Europe) and technical information about airplanes and flying.

Table 1
Sociodemographics and DSM-IV diagnoses of the flying phobia group and healthy control group.

Variable	Flying phobia patients $N = 33$	Healthy controls $N = 39$
Sex (men) *N* (%)	13 (39.4)	20 (51.3)
Age in years, *M* (SD)	36.4 (9.3)	36.1 (11.1)
Education, N (%)		
Apprenticeship	17 (51.5)	15 (38.5)
Secondary school	2 (6.1)	7 (17.9)
Comprehensive and technical college	8 (24.2)	8 (20.5)
University	6 (18.2)	9 (23.1)
Current diagnoses, N (%)		
Primary diagnosis		
Flying phobia	33 (100)	0
Secondary diagnosis		
Agoraphobia	7 (21.2)	0
Other specific phobia	2 (6.1)	0
Social phobia	1 (3.0)	0
Generalized anxiety disorder	1 (3.0)	0
Total	11 (33.3)	0
Third diagnosis		
Agoraphobia	1 (3.0)	0
Other specific phobia	1 (3.0)	0
Eating disorder	1 (3.0)	0
Generalized anxiety disorder	1 (3.0)	0
Total	4 (12.1)	0
Past diagnoses, *N* (%)		
Major depression	9 (27.3)	8 (5.1)
Panic disorder with agoraphobia	3 (9.0)	0
Post-traumatic stress disorder	2 (6.0)	0
Panic disorder	1 (3.0)	0
Eating disorder	2 (6.0)	1 (2.6)

All participants of the clinical sample fulfilled the *DSM–IV* criteria of specific phobia (flying). Table 1 presents current primary, co-morbid, and past psychological disorders for all participants. 11 patients with flying phobia had a secondary diagnosis, which was mainly another anxiety disorder ($N = 10$, 30.3%). 4 patients (12%) had a third co-morbid disorder that was also mainly (9% of all, 75% of 4) an anxiety disorder. The author B.S. diagnosed patients and healthy controls using the Mini-DIPS (Margraf, 1994). The DIPS is the German version of the Anxiety Disorders Interview Schedule (DiNardo & Barlow, 1988). The Mini-DIPS is the short form of this structured interview following *DSM–IV* criteria for current (6 months) and lifetime prevalence of the following disorders: Anxiety, affective, somatization, obsessive–compulsive, and eating. Furthermore, it allows the exclusion of patients with schizophrenic psychoses.

The healthy control group consisted of 39 participants who were recruited through announcements at the University of Basel. Exclusion criteria for the healthy control group were fulfilling the *DSM–IV* criteria of any lifetime anxiety disorder, fulfilling the *DSM–IV* criteria of a current psychiatric disorder according to the Mini-DIPS (see Table 1), or being an airline employee. All participants of the clinical and the control sample had flown before. The clinical sample and the control sample were matched with respect to age, sex, and education (see Table 1).

2.2. Procedures and stimuli

On a website about a fear-of-flying weekend seminar in Zürich (Switzerland), interested people filled out a contact form. An email

[3] Olson and Fazio (2001, 2002) call their paradigm evaluative conditioning, because they used negative and positive unconditioned stimuli (USs) to be associated with the conditioned stimuli. As we use mildly aversive frightening USs we prefer to call our paradigm an associative learning paradigm.

[4] B.S. is a trained cognitive behavior psychotherapist registered at the Federation of Swiss Psychologists (FSP).