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"Influence of hypnotic suggestions on empathy and social fear learning as measured by skin conductance response: A pilot study"

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Abstract (English)

The *observational fear-conditioning paradigm* allows investigating socially transmitted learning about fear-related stimuli using skin conductance response (SCR) measures. The aims of this experimental pilot study with a within-subject design and 23 participants included the use of hypnotic suggestions to alter affect sharing – a main ingredient of empathy – in order to assess the role of empathy in social (fear) learning; and showing that hypnotic suggestions can be a useful tool in empathy research. Each participant received hypnotic suggestions for increased and decreased affect sharing (in counterbalanced order) for an observed person in a video who feigned to receive electric shocks in an experimental setting. In the following phase, participants' SCR was measured during an alleged participation in the same experiment as the observed person. In each suggestion condition, the participants completed the observational fear-conditioning paradigm. SCR results did not differ significantly in respect to the suggestion condition. Nevertheless, post-experimental self-report data suggests that cognitive and affective aspects of empathy were successfully manipulated with the respective hypnotic suggestions. The main limitation of this study is the sample size. Overall, the results are mostly encouraging regarding the use of hypnotic suggestions as an empirical tool to manipulate empathy, and it proved applicable in this paradigm.

Abstract (Deutsch)

Das *observational fear conditioning paradigm* erlaubt die Untersuchung sozial vermittelten Lernens angst-assoziierter Stimuli mithilfe der Messung des Hautleitwerts (HLW). Die Ziele dieser experimentellen Pilotstudie mit einem Messwiederholungsdesign und 23 Versuchspersonen beinhaltete die Verwendung hypnotischer Suggestionen, um *affect sharing* zu verändern – eine Hauptzutat von Empathie – und somit die Rolle von Empathie für das soziale (Angst-)Lernen zu untersuchen, und den Nachweis, dass hypnotische Suggestionen für die Empathie-Forschung ein wertvolles Instrument sind. Jede Versuchsperson erhielt hypnotische Suggestionen für ein erhöhtes und vermindertes *affect sharing* (in ausbalancierter Reihenfolge) für die beobachtete Person im Video, die in einem experimentellen Setting simulierte, Elektroshocks zu erhalten. In der folgenden Phase wurde der HLW der Versuchspersonen erhoben während sie angeblich am gleichen Experiment teilnahmen wie die beobachtete Person. Für jede Suggestionsbedingung durchliefen die Versuchspersonen das *observational fear-conditioning paradigm*. HLW-Ergebnisse unterschieden sich nicht signifikant in den Suggestionsbedingungen. Nichtsdestotrotz deuten die Selbsteinschätzungsdaten, die post-hoc erhoben wurden, darauf hin, dass affektive und kognitive Aspekte der Empathie mithilfe der hypnotischen Suggestionen erfolgreich manipuliert wurden. Die Haupteinschränkung dieser Pilotstudie ist die kleine Stichprobe. Insgesamt jedoch ermutigen die Ergebnisse dazu, hypnotische Suggestionen als empirisches Instrument zur Veränderung der Empathie zu benutzen und Hypnose für dieses Paradigma zu verwenden.

Introduction

Learning and the observational fear-conditioning paradigm

When speaking of learning, the distinction between associative and non-associative learning is drawn (Bear, Connors, & Paradiso, 2007). Non-associative learning concerns learning by habituation or sensitization; associative learning is learning by associations as in classical or instrumental conditioning. Classical conditioning usually refers to a form of *direct* learning, in that an aversive stimulus is personally experienced. This type of learning is typically measured with the Pavlovian fear-conditioning protocol, where a neutral stimulus is paired with a potent stimulus and thus becomes the conditioned stimulus – able to evoke the conditioned response. However, much of what we learn as humans is acquired by observing others, especially when it comes to aversive stimuli like pain. This *indirect* type of learning is also called *social (fear) learning* (Haaker, Golkar, Selbing, & Olsson, 2017).

To investigate social learning, Olsson, McMahon, and colleagues (2016) developed the *observational fear-conditioning paradigm*, which has since been used in several studies (see review in Haaker et al., 2017). This paradigm consists of two stages: *the observational-learning stage* and *the direct-expression stage*. During the observational-learning stage, the participant is instructed to watch a person in a video (the demonstrator) who is in fact an actor. The demonstrator is looking at a computer screen where two different neutral stimuli are being presented – specifically, a square in two different colors (see Figure 1).

One of the stimuli (CS^+) is apparently paired with an electric shock to the demonstrator, the other stimulus (CS^-) is never paired with an electric shock. Six CS^+ and six CS^- trials are being presented to the demonstrator. Whenever a shock is given, the demonstrator expresses the alleged pain by pulling their arm away and by a painful facial expression. Following the presentation of the video, it is the turn of the participant in the direct-expression stage. The participant was instructed that they would subsequently take part in the same experiment as the demonstrator. Hopefully, the participant has by now learnt which stimulus is likely paired with an electric shock. The participants need to expect to receive electric shocks themselves in order to learn; and a sign that the participants have learnt is when they expected to receive shocks as reported after the experiment. In reality, during the direct-expression stage, the participant never receives any electric shocks, which ensures that the results represent specifically the effect of *social* learning. During the direct-expression stage social learning is measured by skin conductance response (SCR). An increase in SCR after presentation of the CS^+ square would imply a (social) learning effect.

The parameters of the Pavlovian fear-conditioning protocol are transferable to the observational fear-conditioning protocol in that the originally neutral stimulus (color of CS^+) is paired with the unconditioned stimulus (the demonstrator's expression of pain), thus leading to an unconditioned response (a response of arousal as measured by SCR). In the process of learning, the neutral stimulus becomes the conditioned stimulus (color of CS^+) and evokes the conditioned response (fear).

In the original study by Olsson, McMahon, and colleagues (2016), participants were randomly assigned to three different groups: high empathy, low empathy and no-instruction group. Participants in the high-empathy group were given the information that the demonstrator reported very painful shocks after the experiment. The low-empathy group was told that the demonstrator was only an actor and received hardly noticeable shocks but acted as if they were painful. The no-instruction group was given no empathy-related instructions. The results indicated a weaker fear response and thus a weaker learning effect in the low-empathy group. The authors argue that their results provide a clue that empathy possibly plays a moderator role in social fear-learning. However, their design actually manipulated the *contextual* appraisal (de Vignemont & Singer, 2006): The demonstrator was either an actor or an authentic experimental participant – both provide different contexts concerning the necessity of learning. This knowledge can apparently influence the role of a painful facial expression in learning about threats. However, empathy was not likely the true independent variable of their study, leaving the question of its role yet open for deliberation.

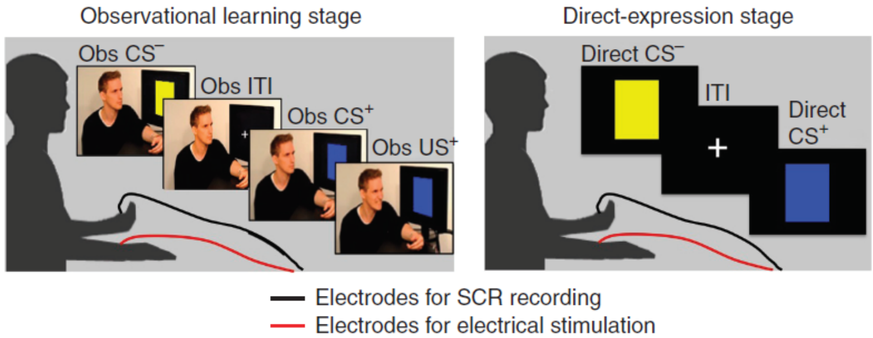

Figure 1. This figure is illustrating the two stages of the observational fear-conditioning paradigm. During the observational-learning stage, the subject (grey silhouette) watches a video of another person (demonstrator) as he is looking at a computer screen with blue (Obs CS^+) and yellow (Obs CS^-) squares. The blue square is paired with an electric shock to the demonstrator as seen by the painful facial expression. Between the squares in both stages an intertrial interval (ITI) is presented. During the direct-expression stage, the participant is seeing the same stimuli as previously the demonstrator (Direct CS^- and Direct CS^+). The participant is expecting to receive shocks via one of the two electrodes. The other electrode is measuring the participant's skin conductance response (SCR). Adapted from "Assessment of Social Transmission of Threats in Humans Using Observational Fear Conditioning," by J. Haaker, A. Golkar, I. Selbing, and A. Olsson, 2017, *Nature Protocols, 12*(7), p. 1379.

Empathy and its role in social fear learning

Newest brain-imaging results suggest that two main components amount to this "complex and multiphaceted social emotion" (Lamm, Bukowski, & Silani, 2016, p. 5) called *empathy*: *shared (emotional) representation or affect sharing* and *self-other distinction* (de Vignemont & Singer, 2006; Lamm et al., 2016; Singer & Lamm, 2009). Findings concerning the affect sharing account show that physical and neuronal representation activations are similar both when observing emotions of another person and when experiencing them first-hand; a more or less prompt resonance with another person. However, to nevertheless distinguish between one's own and another person's affective state, the competence of self-other distinction is necessary (Silani, Lamm, Ruff, & Singer, 2013). The following quote summarizes a broadly accepted narrow concept of empathy:

> There is empathy if: (i) one is in an affective state; (ii) this state is isomorphic to another person's affective state; (iii) this state is elicited by the observation or imagination of another person's affective state; (iv) one knows that the other person is the source of one's own affective state. (de Vignemont & Singer, 2006, p. 435)

Another concept of empathy distinguishes three main aspects: *cognitive empathy*, *affective empathy*, and *prosocial concern/motivation* (Zaki & Ochsner, 2012). Cognitive empathy includes recognizing (emotion recognition) and explicitly mentalizing about the other person's emotions or perspective (perspective taking), whereas affective empathy implies the afore-mentioned affect sharing. Both are naturally dependent by the specific social context and intrapersonal variables (Decety, 2011; Zaki & Ochsner, 2012). Prosocial concern/motivation is the behavioral facet of empathy and is not relevant for the purposes of this work. There is reason to believe that empathy includes exclusively the affective aspects, i.e. affect sharing (Singer, 2006), because aspects of cognitive empathy rather lie in the distinct domain of *mentalizing* or the so-called *theory of mind* which is "the capacity to represent others [sic!] people's intentions and beliefs" (Singer, 2006, p. 856).

The most common factor in the way of an empathic response is certainly the outgroup factor: For members of an outgroup, empathic response is dampened – the more antagonistic the outgroup the more significant this finding (Avenanti, Sirigu, & Aglioti, 2010; Xu, Zuo, Wang, & Han, 2009). Also, competition (Cikara, Bruneau, & Saxe, 2011), affective proximity (beloved vs. hated people; Bucchioni et al., 2015), attributed state of mind on the observed person (Singer et al., 2006[1]), and other factors (for a review see Cikara et al., 2011) that create perceived distance influence the intensity of empathy. Surprisingly, there is yet no study that

[1] In the case of this study, the statement is limited to the male population.

experimentally manipulated empathy in order to evaluate the impact this manipulation has on (social) learning.

There are two alternative predictions about how empathy can affect social fear-learning: Either social fear-learning is insensitive to cognitive manipulations such as empathy, or social fear-learning is indeed manipulable by attributions of mental state or trait to the observed person who experiences the pain. An indirect indication for the latter stems from the observation that the neuronal structures activated when a person feels empathy for another person's pain are the same structures that are activated when the person himself/herself experiences pain (Singer & Lamm, 2009). Moreover, emotions play a paramount role in learning and memory (Bear et al., 2007; LaBar & Cabeza, 2006), and an empathic response is a (social) emotional response (Lamm et al., 2016). Naturally, we feel less empathic for a person in pain when this person is perceived as a dangerous bully. However, does empathy de facto affect the degree of learning about a potential threat? Considering the paramount importance of learning about threats effectively as they might affect us personally at some point, this question becomes intriguing. The associative model of social learning argues that empathy serves as a moderator between the unconditioned stimulus (the demonstrator's expression of pain) and the unconditioned response (fear), altering the quality of the unconditioned stimulus and ultimately the degree of social learning (Olsson, McMahon et al., 2016). The above results indicate that empathy is not an automaticity but rather dependent on perception, emotions, and on situational factors. Thus and as argued before, albeit the lack of empirical support, empathy as an *emotional* state should be able to influence the degree of (social) learning.

Hypnosis

The term *hypnosis* can be used both as a term for a process and a product (Häuser, Hagl, Schmierer, & Hansen, 2016). The process concerns the *hypnotic induction* – typically suggestions that are aimed at inducing a relaxed and yet focused state of awareness[2]. The state of *trance*, as it is called in practitioner circles, is the product of the hypnotic induction[3]. In this work *hypnosis* will be employed in its meaning as a product.

The Society of Psychological Hypnosis, Division 30, of the American Psychological Association defines hypnosis officially as a "state of consciousness involving focused attention and reduced peripheral awareness characterized by an enhanced capacity for response to

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[2] For different kinds of hypnotic inductions, see Lynn, Maxwell, and Green (2017). Typically, suggestions for deep relaxation and yet focused attention and cooperation are used.

[3] Why it might not be productive to distinguish between an induction and hypnotic suggestions see Lynn and colleagues (2017); nevertheless, this distinction serves the purpose for this study.

suggestion" (Elkins, Barabasz, Council, & Spiegel, 2015, p. 6). This newest definition is putting hypnosis in the realm of a *state* theory. In the past, there has also been a *procedural* definition of hypnosis – both definitions have different implications and inherent biases (Lynn, Green et al., 2015). Nevertheless, it is agreed upon that the definition of hypnosis – be it a procedure or an (altered) state – is not satisfactory definable (Elkins et al., 2015; Landry & Raz, 2015). Hypnosis research knows yet too little to produce a specific enough definition; however, attempts to define it too broadly are doomed to become unfalsifiable.

There is evidence for hypnosis or trance being an altered state of consciousness, characterized by focused attention, concentration, and inner absorption (Kupers, Faymonville, & Laureys, 2005). Most people experience this state on a day-to-day basis, e.g. when driving on an empty, straight highway for a long time and suddenly realizing that the past minutes felt unusually short, the navigation felt automated, and the memory of the driven road is near inaccessible. Albeit, when speaking of an altered state of consciousness one should not confuse it with clearly distinct characteristics or neurophenomenological boundaries but rather think of it as a dynamic and "probabilistic relationship between a multitude of characteristics associated with a phenomenon" (Lush & Dienes, 2019, p. 39).

Three main components of hypnosis can be defined: absorption, dissociation, and suggestibility (Spiegel, 1991)[4]. As in the example of driving a car, absorption can express itself in a dilated perception of time (Jamieson, 2018) and a temporary inability to access explicit memory (Kihlstrom, 1997). Dissociation is linked with a shift in the sense of agency[5] (Lush & Dienes, 2019), e.g. when driving the car felt in hindsight automated. This changed sense of agency or, in other words, this experienced involuntariness in hypnotic responding is consistently stressed as a central phenomenon of hypnosis (Kihlstrom, 2018; Kirsch & Lynn, 1998; Weitzenhoffer, 1980). In other words, a hypnotic response "is to perform a voluntary action but to (intentionally) experience the action as involuntary" (Lush & Dienes, 2019, p. 36; see also Dienes & Perner, 2007).

It is yet unclear what mechanisms are responsible for hypnotic phenomena, although there are at least two influential perspectives: the *sociocognitive* and the *dissociation perspectives* (Lynn & Green, 2011). The sociocognitive perspective assumes that hypnotic behavior is based on the specific motivation, attitude, belief, and expectation of the individual as to how to "properly" behave in this kind of social situation – and very importantly on the rapport between hypnotist and hypnotized person (Lynn, Laurence, & Kirsch, 2015). The social norms and roles of

[4] According to some studies, the components *absorption* and *dissociation* do not explain much of the variability of hypnotic responding (Council, Kirsch, & Grant, 1996; Kirsch & Lynn, 1998).

[5] *Sense of agency* is the experience of having control over one's own actions (Haggard & Chambon, 2012).

hypnotist and hypnotized individual make it possible for an extraordinary kind of behavior and perception to occur (e.g. Lynn, Vanderhoff, Shindler, & Stafford, 2002). Social roles and intrinsic behavior motivators aren't usually reflected upon which is why hypnosis doesn't have to be reduced to simply "another every-day experience" – hypnotized people might indeed experience an altered state of consciousness during hypnosis (Huber, 2011). Nevertheless, some researchers have spoken out against the assumption of an altered state of consciousness (Kirsch, 2011; Lush & Dienes, 2019). On the other hand, representatives of the dissociation perspective believe to have found proof of a distinct altered state of consciousness (Jamieson & Burgess, 2014; McGeown, Mazzoni, Venneri, & Kirsch, 2009; for a review see Woody & Sadler, 2008). There is evidence supporting the notion that hypnosis can disrupt meta-awareness or metacognition, especially so in highly suggestible people (Dienes & Perner, 2007; Terhune & Hedman, 2017). This mechanism would explain the reported "loss of authorship over one's responses" (Terhune & Hedman, 2017). A third, new wave is the attempt to unify these two debates (Dienes, 2012; Dienes & Perner, 2007; Lush & Dienes, 2019).

Suggestibility is a wide area of research (for an overview, see Koban, Jepma, Geuter, & Wager, 2017). For the purposes of the present study, the definition of *hypnotic suggestibility* as a "trait of hypnotic responsiveness" (Jamieson, 2018, p. 258) is useful – suggestions being "explicit instructions aimed at modifying perception, memory and behavior" (Santarcangelo & Consoli, 2018, p. 1). There are two widely applied instruments measuring suggestibility as a trait and a proxy for hypnotizability[6]: the *Harvard Group Scale of Hypnotic Susceptibility, Form A* (HGSHS:A; Shor & Orne, 1962) and the *Stanford Hypnotic Susceptibility Scale, Form C* (SHSS:C; Weitzenhoffer & Hilgard, 1962)[7]. The HGSHS:A has a reported internal consistency ranging between .52 (Staudacher, Hagl, Piesbergen, & Peter, 2012) and .67 (Peter et al., 2014) for the German version, and between .74 (Kirsch, Council, & Wickless, 1990) and .80 (Shor & Orne, 1963) for the American version. The internal consistency for the American version of the SHSS:C is set at .85 (Hilgard, 1965).

Both scales are constructed and evaluated similarly: Both consist of twelve items/tasks. The tasks in the HGSHS:A and SHSS:C are slightly different, however, both consist of different motor tasks (e.g. hand lowering), positive and negative hallucination tasks (e.g. not being able

[6] Hypnotic suggestibility and hypnotizability are often used as synonyms (e.g. Lush & Dienes, 2019). Some researchers argue that due to findings showing that highly suggestible people respond to suggestions equally with and without an induction of hypnosis (Braffman & Kirsch, 1999; Mazzoni et al., 2009; McGeown et al., 2012), it is inaccurate to mix these concepts. However, first, contradictory findings do exist that show a surplus effect of a hypnotic induction (Derbyshire, Whalley, & Oakley, 2009) and, second, suggestibility is yet the single commonly used indirect measure of hypnotizability.

[7] Hypnotic susceptibility and suggestibility are synonyms (Jamieson, 2018).

to smell a strong scent), and an amnesia task (remembering three or less of the tasks at the end). For each successful item the participant receives a point, thus scoring at least 0 and at most 12. Different studies use different cut-offs to discriminate between high, medium, and low suggestible participants (Bongartz, 1985; Bongartz, 2000; Huber, Lui, Duzzi, Pagnoni, & Porro, 2014; Peter et al., 2014). The most common cut-offs for both scales are typically: 0-4 for low, 5-8 for medium, and 9-12 for high suggestibility (Egner, Jamieson, & Gruzelier, 2005; Lifshitz, Bonn, Fischer, Kashem, & Raz, 2013; Peter et al., 2014). The main difference between the two scales is that the HGSHS:A is applied in groups and the SHSS:C is applied in an individual setting.

Highly suggestible people are especially prone to following suggestions aimed at altering their emotions, thinking, perception, and behavior (Lifshitz, Cusumano, & Raz, 2013). These hypnotic responses are experienced as real and – as aforementioned – involuntary (Häuser et al., 2016). Distributions on the HGSHS:A scale suggest that approximately 26% of the American and 23% of the German population are highly suggestible (Bongartz, 2000), and that hypnotic suggestibility is normally distributed (Peter et al., 2014).

Numerous neuroimaging studies show a correlation of a specific suggestion targeted at a certain perception with the modulation in the equivalent neural system (for review see Landry & Raz, 2015). One study (Kosslyn, Thompson, Constantini-Ferrando, Alpert, & Spiegel, 2000) found that in highly hypnotizable participants instructions to alter color perception lead to respective subjective experience as well as a reflection of this phenomenon in respective brain areas. Another study (Raz, Fan, & Posner, 2005) showed that hypnotic suggestions targeted at word perception reduced the automatic cognitive Stroop effect. Moreover, both intensity and unpleasantness of painful stimuli can be reduced significantly by respective hypnotic suggestions which is also mediated by changes in brain activity (Faymonville et al., 2000) – and perceived pain intensity can be both induced and reduced (Derbyshire et al., 2009). Apart from visual hallucinations, auditory hallucinations due to hypnotic suggestions appear to be possible as well (Szechtman, Woody, Bowers, & Nahmis, 1998). Hypnotic suggestions can also induce paralysis via distinct brain processes inhibiting the targeted movement (Cojan et al., 2009). These exemplary studies are for different reasons methodologically not immaculate, however, they all advert to a factual influence on hypnotic suggestions on perception and behavior. To the author’s knowledge, there is no study employing hypnotic suggestions to alter empathy or associated factors. However, as argued above, empathy is conditional on perception and/or situational factors and should thus be manipulable by hypnotic suggestions.

For hypnosis research, it is crucial to understand the current state of science, which is that “[although] there is little question that hypnotic suggestions can produce marked profound alterations in consciousness, such findings are not dispositive of an altered or specific state responsible for hypnotic responses" (Lynn, Green et al., 2015, p. 392). In other words, when speaking of hypnosis, it is necessary to point out that there is (yet) no validation for hypnosis being a specifically altered state. There is yet not even a consistent and agreed-upon concept of behavioral and phenomenological characteristics of hypnosis (Lifshitz, Campbell, & Raz, 2012), which makes the operationalization even more difficult.

While hypnosis is being further investigated, there is no need to await its results as targeted hypnotic suggestions can indeed alter perception and cognitive performance. Thus, hypnosis presents itself as a convenient laboratory tool to manipulate variables of interest in a controlled way; it is also non-invasive and has practically no side effects (when applied professionally). From an ethical point of view, hypnosis can therefore be more acceptable than other common manipulators in experimental settings.

Research question, hypotheses, and aim of the study

As was mentioned above, Olsson, McMahon, and colleagues (2016) used three different instructions: Either the participants were told that the demonstrator is experiencing painful shocks, or that the demonstrator received hardly noticeable shocks and only acted as if the shocks were painful (or no instructions were given). This is an important aspect because with the instruction of hardly noticeable shocks the participants possibly did not expect to receive painful shocks themselves. On the one hand, this information indeed influenced their empathy towards the demonstrator. However, they also thought that the demonstrator received less painful shocks as the contextual appraisal was altered. In contrast to the study by Olsson, McMahon, and colleagues (2016), the goal of the present experimental design was to manipulate affect sharing in an isolated manner via suggestions, without taking the detour of manipulating the context factor (and neither the cognitive component).

In general, this study followed the observational fear-conditioning paradigm by Olsson, McMahon, and colleagues (2016); changes were administered in order to better allow inference from the data due to the degree of empathy. In this experimental study, hypnotic suggestions were administered to causally manipulate (increase or decrease) affect sharing. The demonstrator is allegedly receiving the same intensity of electric shocks in each condition; it is only the level of affect sharing towards the demonstrator which is manipulated.

In addition, the decision was made against a between-group design and in favor of a within-subject design. The advantage of this design is the dramatic reduction of the unsystematic variance, which is common in a between-subjects design, especially in small samples (Field, 2018). Of course, the downside of this design is a fatigued and/or bored participant who might develop practice over the course of the experiment and a more complicated analysis method.

The research questions are the following: Can state empathy be manipulated by hypnotic suggestions? If so, can social fear-learning as measured by SCR be manipulated by hypnotic suggestions targeted at altering empathy? And more generally, can hypnosis prove itself to be a suitable tool for empathy and, in general, neurocognitive research?

The first pair of hypotheses refers to the manipulation of empathy by hypnotic suggestions: Empathy is manipulated by a suggestion in that participants report, on average, significantly different levels of self-discomfort during observation of the other person in pain (suggestion for high empathy eliciting a higher level of discomfort) (H_1). The author sticks to the H_0 hypothesis when this self-report parameter, on average, does not differ significantly between the suggestion conditions.

The second pair of hypotheses concerns the main effect of social fear learning (a manipulation check to test whether the observational fear-conditioning paradigm was effective in inducing social learning in this study). The H_1 hypothesis being: There is a social learning effect, i.e. the difference between CS^+ and CS^- conditions as measured by SCR during the direct-expression stages is significant. The author would hold on to the H_0 hypothesis in case the difference between CS^+ and CS^- would not be significant and thus, on average, the participants would not have learnt to discriminate between the CS types.

The third pair of hypotheses concerns the main effect of the hypnotic suggestions on social fear learning. The H_1 hypothesis is defined as: the mean SCR during the direct-expression stages is significantly higher following the hypnotic suggestion for high empathy as compared to the suggestion for low empathy. The author would keep the H_0 hypothesis if this difference between suggestion conditions is not significant. Inferences on state empathy are implicit in that a significant difference in SCR is interpreted as a marker for social fear learning via a manipulated empathic response.

The overall aim of the study is to explore the possibilities of hypnosis in combination with an existing experimental paradigm for social fear-learning. Depending on the results, this work's aim is to replicate the findings of Olsson, McMahon, and colleagues (2016) with an optimized design to target affect sharing rather than contextual appraisal, and to show that hypnosis can be a useful tool in manipulating such cognitive states as empathy. It is considered a proof-of-concept pilot study.

Method

Sample

Approximately 350 Bachelor psychology students were initially screened for their hypnotic suggestibility in groups of 5-10 people using the German version of the HGSHS:A (Bongartz, 1980a). High scorers (score ≥ 6) were then invited to be tested individually with the German version of the SHSS:C (Bongartz, 1980b). High scorers in this test (score ≥ 6) were finally invited to take part in the experiment[8].

Twenty-three successfully screened participants (M_{age} = 21.57, SD_{age} = 2.06; 16 females; $M_{suggestibility}$ = 8.09, $SD_{suggestibility}$ = 1.20) gave their consent to participate in this study in accordance with the ethical approval of the University of Vienna. Inclusion criteria were the following: Bachelor psychology students between the ages of 18 and 40, no history of mental illnesses or severe organic diseases, no recent substance abuse, and no experience in studies with pain stimulation. The sample size is based on a previous study applying the observational fear-conditioning paradigm (Kleberg, Selbing, Lundqvist, Hofvander, & Olsson, 2015), a proposition paper for the observational fear-conditioning protocol (Haaker et al., 2017), and the decision to explore this field with a small-sampled pilot study.

The sample was recruited out of Bachelor psychology students via the credit points program established in the bachelor curriculum. For their participation in the suggestibility screening with the SHSS:C, participants were either rewarded with six credit points or 15 euros. Due to the amount of participants screened with the HGSHS:A group scale, participants were only offered (six) credit points as a reward. The selected 23 participants underwent a two-hour test and were compensated with 15€/hr. The Ethics Committee of the University of Vienna approved this reward system and a grant of the University of Vienna (Förderungsstipendium nach dem StudFG SS19) has been approved to compensate the costs.

Stimuli and Materials

The experiment was completed at a 24" LED monitor (resolution: 1920 x 1200; refresh rate: 59Hz). The subjects were seated in an approximately 16m^2 (172 sq ft) room with dimmed light in a comfortable chair in front of the computer screen with an eye-to-screen distance of 98.5cm (39inches). A mock electrode for electric shocks was used similar to that in the video (see Figure 2). Figure 2 also illustrates the stimuli for the application of the observational fear-conditioning paradigm.

[8] The decision to lower the cut-off scores for both scales was made due to the surprisingly significant difficulties finding highly suggestible participants. Based on results of other studies (Fidanza, Varanini, Ciaramella, Carli, & Santarcangelo, 2017; Peter et al., 2014), medium suggestible participants are likely to contribute to a potentially existing effect – even if to a lower extent.

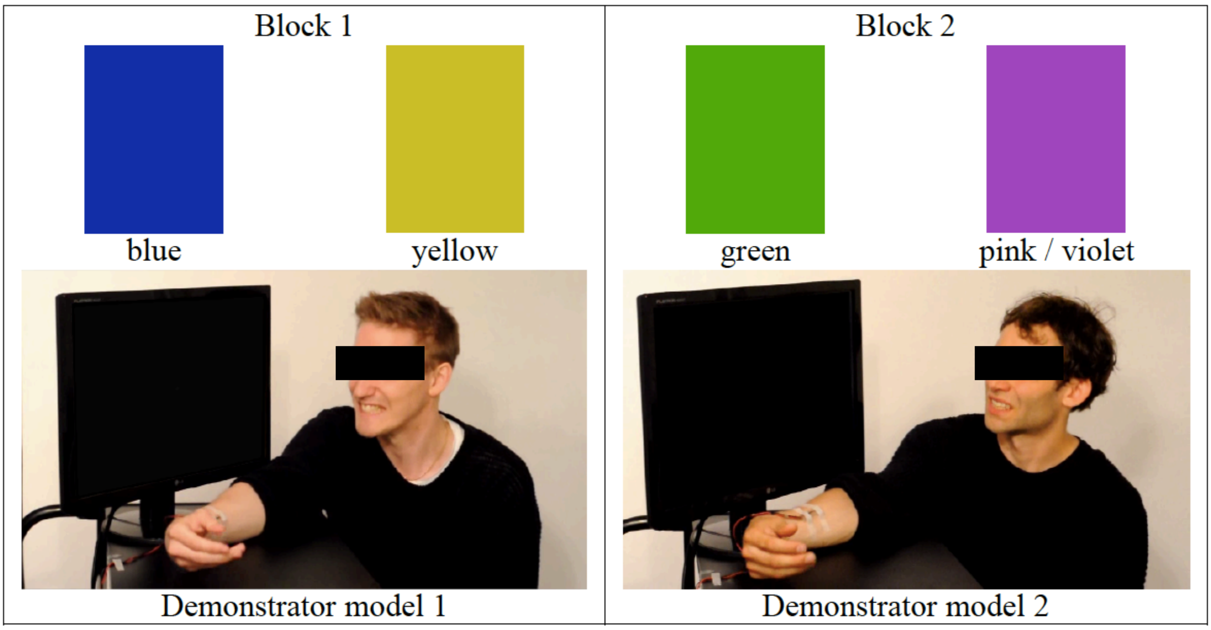

Figure 2. Antagonistic pairs of colors were employed in each block: blue and yellow / green and pink. A colorimeter was used to even the brightness of the colors approximately. The CS types of colors were also counterbalanced across subjects. Also depicted in this figure are both demonstrator models in the moment of expressing pain. Model 1 was shown during Block 1, Model 2 during Block 2. The blocks were presented in a counterbalanced fashion during the observational-learning stage. The pairs of colors were presented on the demonstrator's computer screen during the observational-learning stage and on the subject's screen during the direct-expression stage. The original videos of both demonstrators were kindly provided by Andreas Olsson via personal communication. Due to privacy protection, in this paper the models' eyes are censored.

The blocks were presented in a counterbalanced order. Presentation® software (v. 19.0, Neurobehavioral Systems, Inc., Berkeley, CA, www.neurobs.com) was used to program the script for the experiment, to present it and to collect the responses. For collection of skin conductance data, the TMSi Mobi8-BP physiological monitoring device (Twente Medical Systems International B.V., The Nether-lands, www.tmsi.com) with Bluetooth connection was used together with a TMSi MATLAB Interface provided by TMSi. The Mobi device has a maximum sampling rate of 2048Hz. The trial structure is depicted in Figure 3 and the order of the trials is illustrated in Figure 4.

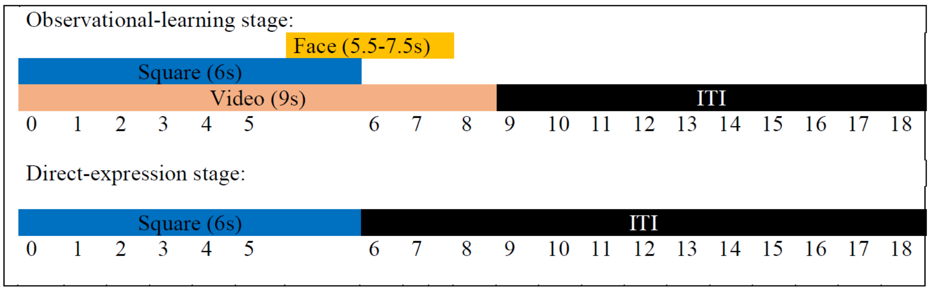

Figure 3. Depicted is the trial structure of each stage in a timeline fashion (the number rows from 0 to 18 represent the duration of one trial in seconds): the blue space indicates the presentation of the square which lasted for six seconds in each stage; the pink space in the first stage indicates the duration of the video (9s); the yellow space in the first stage represents the painful facial expression of the demonstrator between 5.5 and 7.5 seconds. Both stages finish with an intertrial interval (ITI, black bars) in form of a simple white cross on a black background.

Block 1		Block 2	
Stage 1	Stage 2	Stage 1	Stage 2
2	1	3	4
1	2	4	3
1	2	4	3
2	1	3	4
1	1	4	3
2	2	3	4
2	2	3	4
1	1	4	3
2	2	3	3
1	1	4	4
2	1	3	4
1	2	4	3

Figure 4. Illustration of the trial order: two blocks, each consisting of Stage 1 (observational-learning stage) and Stage 2 (direct-expression stage). Numbers 1–4 represent the four different colors, number 1 and 3 being the CS⁺ colors paired with an electric shock to the demonstrator(in red).

The hypnosis script was written in German by the author who is skilled in clinical Ericksonian[9] hypnosis. The script consisted of a traditional hypnotic induction with suggestions for relaxation, focused attention, concentration, and a countdown for a deeper state of hypnosis. The suggestions for high and low empathy were introduced with the concept of different intraindividual "states", one of those "states" being an extraordinary *openness* for other people's feelings/emotions; the other "state" being an extraordinary *closeness* for other people's feelings/emotions. Metaphors/helpful analogies suggested for not feeling empathic were: a closed window, a movie experience (when one did not wish to experience the feelings of the protagonist), a bullet-proof glass between the participant and other people. Metaphors/analogies suggested for feeling very empathic were: an open window, feeling like a parent for their child, sensible antennae, thinking of a beloved person. This suggestion was thoughtfully phrased to not accidentally eliminate self-other distinction: The subjects were never suggested to confuse themselves with the demonstrator. Each "state" was introduced properly and finally addressed personally to maximize the *absorption in* that "state" and the *dissociation into* that "state"[10]. A suggestion was given after each empathy-related suggestion to stay in a deep trance after opening the eyes for the trial presentation at the computer monitor. At the end of the paradigm,

[9] *Ericksonian hypnosis* is often associated with an indirect/permissive manner of suggestions (e.g. "you can allow yourself to feel X or Y"). In fact, Milton H. Erickson used both, permissive/indirect and authoritarian/direct suggestions – depending on the situation and the person. This script used both types of suggestions.

[10] The German language has two words for *you*: a formal and an informal. The participant was addressed formally until the "state" introduction. The "state" was addressed informally in order to further maximize the absorption.

reorientation was carried out by counting backwards and suggestions for feeling relaxed and alert after opening the eyes. A short, structured interview (see Appendix) with various self-report questions and questions to check whether CS^+ and CS^- colors could consciously be distinguished according to their threat potential followed immediately. Questions included: How many electric shocks did the person receive together with each square (from 0 to 6+)? How many shocks did you personally receive together with each square (from 0 to 6+)? How unpleasant were the electric shocks for each person in the video (from 0 to 10)? How unpleasant was it for you personally to watch each video (from 0 to 10)? How likeable was each person in the video for you (from 0 to 10)? How hypnotized did you feel during the different phases (from 0 to 10)? How strong was the effect of each suggestion (from 0 to 10)?

Study design

In this within-subject design, each subject completed the observational fear-conditioning paradigm twice. During the first block, the participants received a hypnotic suggestion for increased (or decreased) empathy towards the demonstrator[11] in the video; during the second block, participants received a hypnotic suggestion for decreased (or increased) empathy. The order of the two blocks was counterbalanced across subjects. According to the observational fear-conditioning paradigm, each block consisted of an observational-learning stage and a direct-expression stage. Each of the two stages consisted of twelve trials: six presentations of one square and six presentations of the other square. The squares were presented in a quasi-randomized order. In the observational-learning stage, four trials of the CS^+ square were accompanied by a shock to the demonstrator, while no trial of the CS^- square was accompanied by a shock. At no point in time did the subjects receive electric shocks. Squares had different complementary colors in the second block to avoid carry-over learning effects from the first block. Thus, the experiment included two independent variables: type of CS color (CS^+ / CS^-) and type of suggestion (suggestion for high vs. low empathy).

Procedure

The participants of this experiment were informed to take part in a study interested in the influence of hypnotic suggestions on pain perception. The experiment consisted of a single session of two hours per subject, during which the subjects completed the observational fear-conditioning paradigm under hypnosis. At the beginning, the subjects were informed about the

[11] In another study (Olsson, Kopsida, Sorjonen, & Savic, 2016) no effect of the male sex of the demonstrator on the SCR in regard to the participants' sexes has been found. This is why the decision was made in favor of a simpler design with two demonstrators of the male sex.

procedure of the experiment and were told that they may experience unpleasant, but not painful electric shocks during the experiment. The subjects then signed the informed consent. In a comfortable chair in front of a computer screen, the subjects were attached to an electrode to the hand and informed that the electrode would be used to deliver shocks during the test stage. In reality, the electrode was a mock. As argued above, it was necessary that the subjects were expecting to receive shocks. The skin conductance device was attached to the other hand and the subjects were informed about this electrode as well[12]. As the experiment began, the subjects underwent a hypnotic induction, followed by the suggestion for high or low empathy. After completing the first block of the fear-conditioning paradigm, the respective other suggestion was delivered, and the subjects completed the second block. Finally, subjects were guided out of the hypnotic state, had the opportunity to ask questions, and completed the structured interview. Herewith the experiment was over.

Data analysis

The dependent variable was the recorded SCR which was measured between 0.5 second after stimulus onset and 4.5 seconds. The data was preprocessed with Ledalab (v. 3.4.9), a software based on Matlab® (2014a, MathWorks, Natick, MA) for the analysis of skin conductance data (Benedek & Kaernbach, 2010). The chosen index for SCR estimation was chosen the z-transformed trough-to-peak amplitude, with the "trough" being the minima and the "peak" being the maxima SCR value in the interested time window after stimulus onset. Final analyses for both behavioral and biometrical data was performed with SPSS® (v. 25, IBM). A parametric repeated-measures *t*-test was applied on the SCR data to test for the second and third hypotheses, including estimation of a 95% confidence interval with bootstrap resampling (1,000 samples, bias-corrected and accelerated, BCa 95% CI) in order to analyze effect sizes (Cohen's *d*). Additional behavioral results are based on the data provided by the follow-up questions (see Table A of the Appendix), provide material to test the first pair of hypotheses and were analyzed with SPSS®, all correlations were analyzed two-sided.

[12] Additionally, ECG was measured at the participants' two digits and they were informed that an Eye Tracker without chin rest would measure their eye movements. The corresponding data is subject of another work and is thus not further mentioned in this paper.

Results

Behavioral results

Participants did not prefer one demonstrator model (*M* = 4.57, *SD* = 2.15) over the other (*M* = 5.22, *SD* = 2.49) in terms of likeability[13]. The difference, –0.65, BCa 95% CI [–2.29, 0.86], was not significant, *t*(22) = –0.83, *p* = .413, with an effect size of *d* = –0.3. On average, participants reported to find the person they were observing when given the suggestion to feel very empathic more likeable (*M* = 6.3, *SD* = 1.82) than when given the suggestion to feel the opposite (*M* = 3.48, *SD* = 1.88, *t*(22) = 5.47, *p* = .001, *d* = 1.5, BCa 95% CI [1.96, 3.74], see Figure 5).

On average, participants reported a higher level of personal unpleasantness (self-unpleasantness) observing the demonstrator when given the suggestion for high empathy (*M* = 5.87, *SD* = 1.71) than when given the suggestion for low empathy (*M* = 1.96, *SD* = 1.69, *t*(22) = 11.19, *p* < .001, *d* = 2.31, BCa 95% CI [3.30, 4.52]). Likewise, participants assumed on average that the level of the demonstrator's unpleasantness (other-unpleasantness) when receiving electric shocks is higher when given the suggestion for high empathy (*M* = 6.87, *SD* = 1.69) compared to when given the suggestion for low empathy (*M* = 5.65, *SD* = 2.27, *t*(22) = 2.74, *p* = .012, *d* = 0.54, BCa 95% CI [0.35, 2.09]). For both unpleasantness ratings see Figure 6.

As analyzed by a two-way repeated-measures ANOVA, there was a significant interaction effect between the level of self-unpleasantness and other-unpleasantness in respect of the administered type of suggestion ($F(1,22) = 26.86$, $p < .001$, $\omega_p^2 = .519$) in that participants reported significantly more similar unpleasantness for themselves and the demonstrator when given the suggestion for high empathy compared to when given the suggestion for low empathy, where they reported lower self-unpleasantness (see Figure 7).

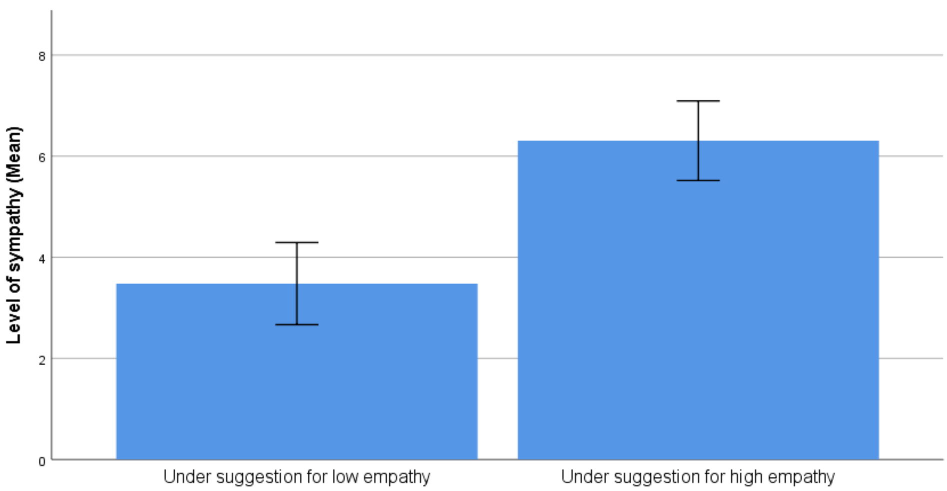

Figure 5. Participants' reported mean level of sympathy for the demonstrators during both suggestions is depicted: the left bar representing the condition with suggestions for low empathy, the right bar for high empathy. The difference between the bars is significant. Error bars represent the 95% confidence interval.

[13] For the corresponding questions here and hereafter see Appendix.

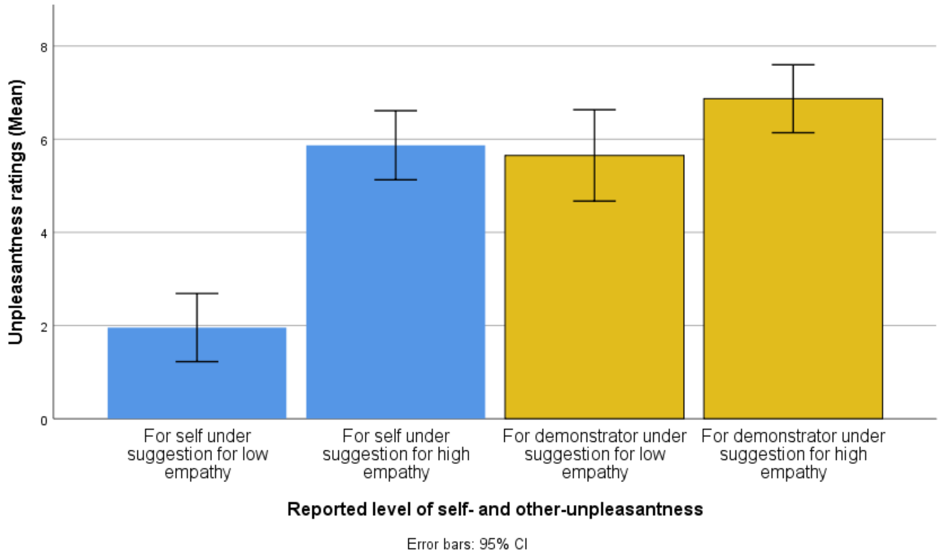

Figure 6. Participants' reported mean level of self-unpleasantness during observation of the demonstrators for each types of suggestions and the other-unpleasantness ratings are depicted. The difference between the blue bars is significant as well as the difference between the yellow bars. Error bars represent the 95% confidence interval.

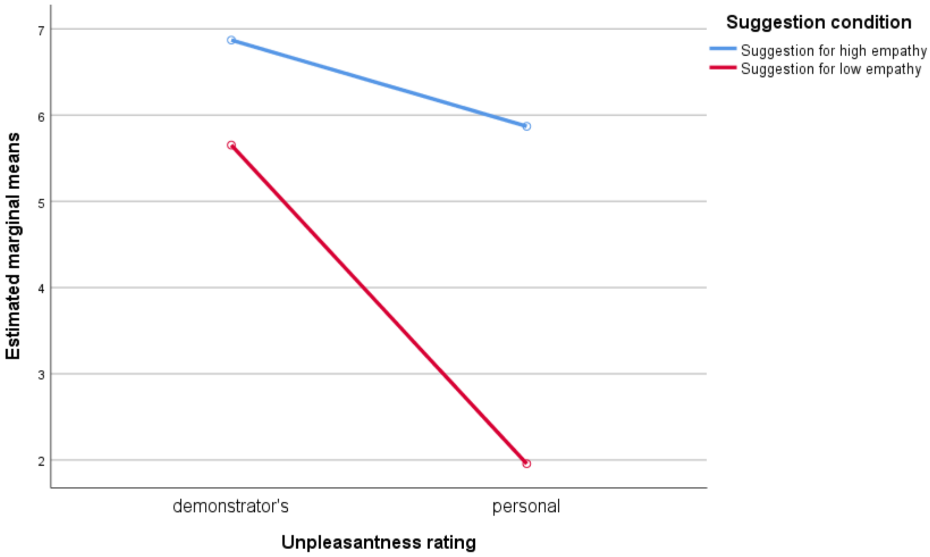

Figure 7. This figure depicts the unpleasantness ratings of the participants for either themselves (when observing the demonstrator's pain) or the assumed demonstrator's unpleasantness (when receiving electric shocks) as compared to both suggestion conditions (suggestion for high vs. low empathy). The significant interaction effect is illustrated in that the unpleasantness rating for the demonstrator was significantly more similar for both suggestion conditions than the personal unpleasantness rating. The participants rated the pain observation during the suggestion for low empathy significantly less unpleasant than during the suggestion for high empathy.

Participants' ratings of their hypnotic depth ranged between 5 and 9 ($M = 6.83$, $SD = 1.17$). On average, participants' self-reported (subjective) evaluation of their depth of hypnotic state did not differ between the suggestions for high empathy ($M = 6.74$, $SD = 1.69$) and low empathy ($M = 6.70$, $SD = 1.22$) during the observational-learning stage. This difference, 0.04, BCa 95% CI [–0.48, 0.61], was also not significant, $t(22) = 0.16$, $p = .874$, with an effect size of $d = 0.03$. Neither did it differ on average between the first direct-expression stage ($M = 6.74$, $SD = 1.29$) and the second ($M = 6.70$, $SD = 1.64$, $t(22) = 0.16$, $p = .874$, $d = 0.02$, BCa 95% CI [–0.52, 0.61]). Participants were also asked to rate the effectiveness of the suggestions and for both suggestions the rating ranged between 3 and 9.5 ($M = 7.02$, $SD = 1.55$). On average, participants rated the effectiveness of the first ($M = 7.23$, $SD = 2.05$) and the second suggestion ($M = 6.82$, $SD = 1.68$) as equally effective, $t(21) = 0.92$, $p = .368$, $d = 0.24$, BCa 95% CI [–0.52, 1.25]. They also rated both types of suggestions as equally effective on average: the suggestion for high empathy ($M = 7.32$, $SD = 1.59$) and the suggestion for low empathy ($M = 6.73$, $SD = 2.10$, $t(21) = 1.36$, $p = .188$, $d = 0.28$, BCa 95% CI [–0.27, 1.41]). One participant had to be excluded because the person has not received this question.

The reported effectiveness of the suggestion for high empathy was significantly positively correlated with the report of subjective depth of hypnotic state during the suggestion for high empathy, $\tau = .60$, BCa 95% CI [0.40, 0.79], $p < .001$. On the other hand, the reported effectiveness of the suggestion for low empathy did not significantly correlate with the report of subjective depth of hypnotic state during the suggestion for low empathy, $\tau = .27$, BCa 95% CI [–0.15, 0.62], $p = .116$. The mean subjective depth of hypnotic state in all for stages correlated significantly and positively with the perceived effectiveness of both suggestions, $\tau = .41$, BCa 95% CI [0.13, 0.64], $p = .011$.

Subjective effectiveness of the suggestion for high empathy did not significantly correlate with self-unpleasantness observing the demonstrator receiving electric shocks when given the suggestion for high empathy, $\tau = .31$, BCa 95% CI [–0.11, 0.66], $p = .074$. Likewise, there is no significant correlation for suggestions for low empathy, $\tau = –.27$, BCa 95% CI [–0.64, 0.13], $p = .114$. Perceived level of depth of hypnotic state when given the suggestion for high empathy did not significantly correlate with the level of self-unpleasantness when given the same suggestion, $\tau = .16$, BCa 95% CI [–0.25, 0.49], $p = .335$. There is also no significant correlation for suggestions for low empathy, $\tau = .06$, BCa 95% CI [–0.38, 0.45], $p = .74$.

Participants were asked after the experiment whether they had experienced a physical sensation (pain or prickling) when observing the demonstrator receiving electric shocks. The McNemar test for comparing two related conditions for nominal data showed that six participants reported no such experience for both suggestion conditions, two participants experienced a physical sensation for both suggestions, fourteen participants experienced a physical sensation only during the suggestion for high empathy, and none reported a physical sensation only during the suggestion for low empathy (see Figure 8). The McNemar test for comparing two related conditions for nominal data showed that the distribution of participants is significantly different between the two suggestion conditions, $p < .001$.

Participants were asked whether they had expected to receive electric shocks before each direct-expression stage. The McNemar test showed that this result is not significant, neither for the distributions comparing the expectancies between first and second block (*p* = .070), nor between the distributions comparing the expectancies between suggestion for low and high empathy (*p* = .070; see Table 1) – albeit both results are close to being significant.

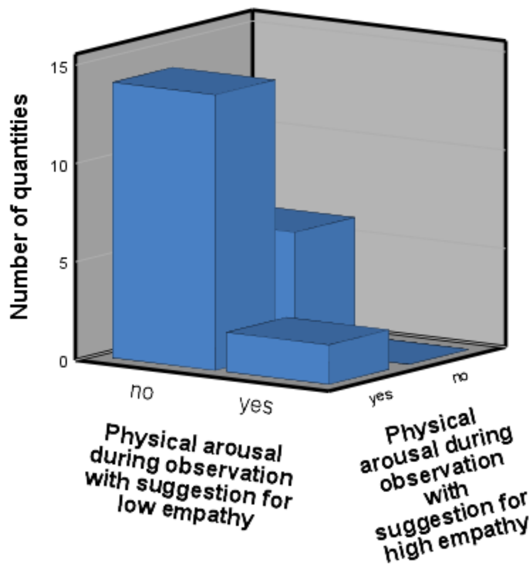

Figure 8. A 3D plot of quantities for the dichotomous variables physical sensation during observation with suggestion for low empathy and physical sensation during observation with suggestion for high empathy shows the apparent dominance of participants reporting physical sensation when observing the demonstrator's pain during the suggestion for high empathy. As well dominant is the number of participants reporting no physical sensation during the suggestion of low empathy.

Table 1

Contingency table for the number of participants (N = 23) expecting a shock during suggestion for high vs. low empathy

Expecting a shock during suggestion for high empathy	Expecting a shock during suggestion for low empathy: no	yes
no	3	1
yes	7	12

According to the questionnaire data, 11 out of 23 participants learned under both suggestion conditions which color was paired with an electric shock to the demonstrator, 5 did not learn correctly for either, and 7 learned it correctly for the last condition of the experiment.

Skin conductance response (SCR) results

A bootstrapped *t*-test showed a significant difference between average levels of SCR during the direct-expression stage when presented with the CS^+ color ($M = 0.73$, $SD = 0.54$) than when presented with the neutral color CS^- ($M = 0.21$, $SD = 0.46$). This difference, 0.52, BCa 95% CI [0.24, 0.81], was significant, $t(22) = 3.70$, $p = .001$, with an effect size of $d = 1.13$. Due to this successful manipulation check, it is possible to analyze the SCR difference values ($\Delta CS = CS^+ - CS^-$) for either one of the independent variables (suggestion for high vs. low empathy).

On average, when given the suggestion for high empathy ($M = 0.75$, $SD = 1.13$), SCR did not differ significantly from the SCR when given the suggestion for low empathy ($M = 0.30$, $SD = 0.63$, $t(22) = 1.75$, $p = .095$, $d = 0.71$, BCa 95% CI [–0.02, 0.95]; see Figure 9).

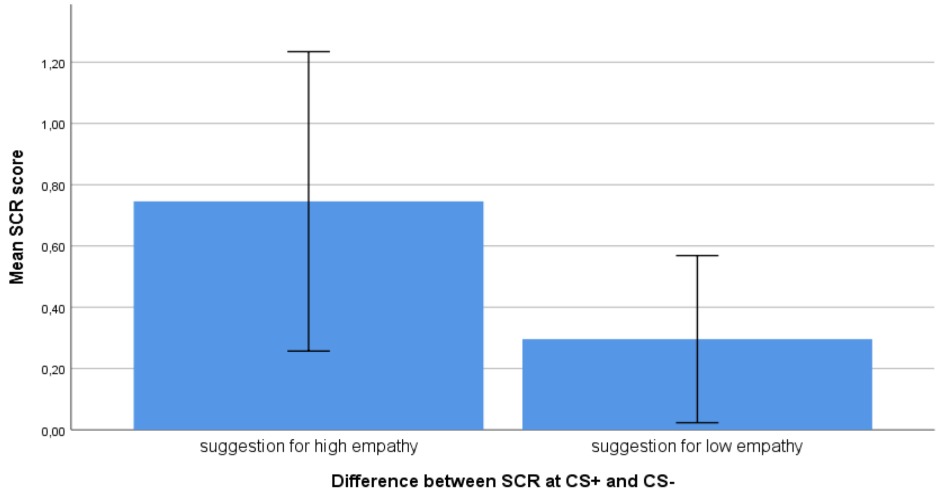

Figure 9. This simple bar chart represents the mean difference between SCR scores when being presented the pain-associated CS^+ square and the neutral CS^- square in the different suggestion conditions. Error bars represent the 95% confidence interval. The difference between both bars is not significant.

Discussion

The hypnotic induction and effectiveness of suggestions in this study can be considered successful according to the participants' self-reports. Neither subjective depth of hypnotic state nor subjective effectivity of suggestions decreased over the course of the two experimental blocks, which is an indication of stability of the participants' hypnotic experience. Moreover, a positive result concerns the observation that, on average, no difference between both suggestions (for high vs. for low empathy) in regard to their effectiveness was reported. Finally, the analysis of shock expectations showed that participants were not less likely to expect electric shocks during the second block compared to the first block. They were also not less likely to expect electric shocks during the suggestion for high empathy compared to the suggestion for low empathy (and vice versa). Participants' expectations to personally receive electric shocks during the direct-expression stages had to be continuous despite progress in time and despite the type of suggestion, which is hereby supported by the results.

Did the suggestions have an effect on empathy during the observational-learning stage according to the behavioral/self-report results? To begin with, both models were rated equally likeable independent of the given suggestion, making it reasonable to analyze differences of likeability between hypnotic suggestions. On average, participants rated the demonstrator model they observed under the suggestion for high empathy more likeable than the respective other demonstrator model under the suggestion for low empathy. This result was accompanied by a very high effect size, suggesting a strong effect. However, the main manipulation check for empathy is to be extracted from the unpleasantness results, where participants rated self-unpleasantness during the observation of the demonstrator in pain higher under the suggestion for high empathy than vice versa – again, with a very strong effect size. With this parameter successfully manipulated by the respective suggestions, the author rejects the first H_0 hypothesis in favor of the alternative H_1 hypothesis: empathy was indeed successfully manipulated towards a higher empathic level by the suggestion for high empathy when compared to the empathic level under the suggestion for low empathy. Additionally, the results showing a higher probability for experiencing a physical sensation under the suggestion for high empathy indirectly point towards an altered empathic response. Based on the affect sharing account of empathy, a higher empathic response for the demonstrator under the suggestion for high empathy can be inferred from the results.

With the strength of a medium effect size, participants rated other-unpleasantness higher under the suggestion for high empathy than vice versa. This finding is particularly interesting as it indicates different levels of emotion recognition in the participants according to the type of suggestion. The goal of this study design was to phrase the suggestions to exclusively influence affect sharing. Speculatively, the wording of the hypnosis script somehow influenced emotion recognition; or perhaps a dampened emotion recognition is one of the "side effects" of hypnosis.

Did the results reveal a social learning effect in that SCR was significantly higher after presentation of the CS^+ color compared to the SCR after presentation of the CS^- color irrespective of the type of suggestion? Indeed, this difference was significant; the second H_0 hypothesis is thus rejected in favor of the alternative H_1 hypothesis.

Did the suggestions have an effect on the degree of learning as measured via SCR during the direct-expression stage? According to self-report data, not all of the participants learnt to discriminate between CS^+ and CS^- colors correctly. However, none of the participants learned it correctly in the first condition *and* incorrectly in the second condition. This result can be explained with a temporarily negative influence of hypnosis on the access to explicit memory (Kihlstrom, 1997) in that some highly suggestible participants perhaps had difficulties remembering details from the first experimental block. Therefore, the self-report results will not be taken into account for consideration of the success of the manipulation check. Instead, implicit learning results as measured by SCR are the focus of this discussion. The difference in SCR between the types of suggestions showed to be not significant with a *p* value of .095. However, although strictly speaking non-significant, a *p* value under .100 can be carefully interpreted as a trend – especially when taking into account the medium-to-strong effect size. Nevertheless, according to the result of this study, the author holds on to the third H_0 hypothesis concerning the degree/intensity of social learning as measured by SCR: The intensity of social fear-learning as measured by SCR was not significantly higher following the hypnotic suggestion for high empathy as compared to the suggestion for low empathy.

A marginal finding concerns the interaction effect of the self-reported levels of unpleasantness for oneself and the demonstrator. As mentioned above, the results indicate that participants reported significantly more similar unpleasantness for themselves *and* the demonstrator when being given the suggestion for high empathy compared to when they were being given the suggestion for low empathy, where they reported lower self-unpleasantness than other-unpleasantness. Another possible interpretation of this result is that self-unpleasantness seems to be more influenced by the type of suggestion as opposed to the other-unpleasantness. To recapitulate, the self-unpleasantness results are based on the follow-up question how unpleasant the participant ranked the experience of observing the demonstrator(s) receiving shocks. This variable stands for the degree of affective empathy according to the evidence-based assumption that one of the prerequisites for empathy is a shared mental representation in the observer's system. On the other hand, the participants' rating of other-unpleasantness represents the cognitive aspect of empathy, which is – among other things – emotion recognition. Thus, affective empathy might be stronger influenced by suggestions than aspects of cognitive empathy. The effect size of this interesting observation is very high.

Finally, among the analyzed correlations comparing variables of unpleasantness, level of hypnotic depth, and effectivity of suggestions, only two correlations turned out significant. First, the positive correlation between the level of hypnotic depth in the high-empathy condition during the direct-expression stage and the effectivity of the suggestion for high empathy. This significant correlation was accompanied by a very strong effect size. This result is not surprising given the selection of participants according to their suggestibility skills. It is thus an interesting result that no positive correlation could be found for the low-empathy suggestion – although both types of suggestions were rated equally effective. Second, the mean rating of the levels of hypnotic depth and of effectiveness of suggestions correlated positively.

Participants (n = 3) who did not expect to receive electric shocks at any time could have been excluded. However, probability of shock expectations is likely linked to the type of suggestion and the hypnotic state (Lifshitz et al., 2012): Some participants (including those who only took part in the screening procedures) reported feeling indifferent or apathetic for their environment during hypnosis. Indeed, indifference towards exogenic factors is one of the suggestions of a traditional hypnosis induction or at least a side-effect of other suggestions targeted at focusing attention on inner processes. This is why excluding those participants could possibly reduce an existing effect of suggestion on SCR. It might thus be interesting to administer posthypnotic suggestions[14] in a between-subjects design when a large enough sample size is available.

The main finding of the study by Olsson, McMahon, and colleagues (2016) was a weaker learning effect in the low-empathy group as measured by SCR, implicating a moderator role of contextual appraisal in social fear-learning. Our study design optimized this aspect in order to better allow inference on manipulation of empathy. The result was near significant with a *p* value of .095 and a medium-to-strong Cohen's *d* of 0.71. Cautiously speaking, this tendency effect or trend may encourage replicating this study design with a larger sample size. In any case, hypnotic manipulation of empathy proved to be well applicable for the observational fear-conditioning paradigm and, generally, for manipulating empathic responses.

Another aim of the study was to explore the possibilities of hypnosis in the field of social fear-learning and to show that hypnosis is a useful tool in manipulating a cognitive state like empathy. Although SCR results did not indicate success, the behavioral results from the follow-up self-report questions are worthwhile exploring more thoroughly. In particular, ratings of unpleasantness are relevant for this discussion as they indicate changes in affective and cognitive aspects of empathy. As argued above, both unpleasantness ratings (self- and other-unpleasantness) and thus both the affective and cognitive aspect of empathy are a matter of hypnotic suggestion, with affective empathy seemingly more likely to be subject of influence by hypnotic suggestions. To the author's assessment, this aim is successfully accomplished. Certainly, more research with hypnosis as a tool is necessary.

If hypnosis continues to prove itself capable of manipulating empathy, hypnosis should accordingly be capable of manipulating social learning because – as argued above – emotions influence the learning process to a significant extent (Bear et al., 2007; LaBar & Cabeza, 2006).

[14] A posthypnotic suggestion is a suggestion given during hypnosis and unfolding its effect in the "normal waking" state.

As Olsson, McMahon, and colleagues have attested in their paper of 2016, “no studies of humans have examined how learning about threats by observing others is modulated by *empathy* [emphasis in the original quote]” which is why this line of empathy research is still in its infancy stages, leaving us with the question whether or not social learning is influenceable by cognitive and affective manipulation such as empathy. What makes this question worthwhile exploring is the fact that different studies contribute to different hypotheses (e.g. LaBar & Cabeza, 2006; Olsson & Phelps, 2004; Olsson, McMahon et al., 2016; Singer & Lamm, 2009). The results of this study contribute to the hypothesis that social fear-learning is not manipulable, however, they have to be interpreted in the discussed context.

This study is the first of its kind. Therefore, this work is meant to be more of a proof-of-concept pilot study, which is why obvious methodological limitations like the small sample size and the absence of a control condition have deliberately been accepted. Hopefully, this work’s results will be able to contribute to and inspire future studies in this field.

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Appendix

Two versions of the same questionnaire were applied, depending on the order of the blocks of the participant at hand. The questions and the corresponding images (provided for better recollection) were presented in form of a slide presentation. The participants' oral answers were written down by the investigator. As exemplified in Table A and translated from German, the questionnaire consisted of the following questions.

Table A

Postexperimental questionnaire

Slide	Text/question on the slide	Answer options	Picture (if provided)
1	Questions for the second video series	None	Picture of the second model
2	How many electric shocks did the person receive together with this square?	0 - 5, 6+	Picture of the blue/pink square
3	How many shocks did you personally receive together with this square?	0 - 5, 6+	Picture of the blue/pink square
4	How many electric shocks did the person receive together with this square?	0 - 5, 6+	Picture of the green/yellow square
5	How many shocks did you personally receive together with this square?	0 - 5, 6+	Picture of the green/yellow square
6	How unpleasant were the electric shocks for the person in the video?	(not at all) 0 - 10 (extremely)	Picture of the second model
7	How unpleasant was it for you personally to watch these videos?	(not at all) 0 - 10 (extremely)	Picture of the second demonstrator model
8	How likeable was the person in the video for you?	(not at all) 0 - 10 (extremely)	Picture of the second model
9-16	(same questions for colors and demonstrator model of the first block)		
17	How hypnotized did you feel… … during the first series of videos? … during the first experiment phase? … during the second series of videos? … during the second experiment phase?	(not at all) 0 - 10 (extremely)	
18	How strong was the effect… … of the first suggestion? … of the second suggestion?	(not at all) 0 - 10 (extremely)	Pictures of both models placed beside the equivalent question