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## The presence of your absence

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*Published in:*  
Behaviour Research and Therapy

*DOI:*  
[10.1016/j.brat.2018.04.006](https://doi.org/10.1016/j.brat.2018.04.006)

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*  
Final author's version (accepted by publisher, after peer review)

*Publication date:*  
2018

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Boddez, Y. (2018). The presence of your absence: A conditioning theory of grief. *Behaviour Research and Therapy*, 106, 18-27. <https://doi.org/10.1016/j.brat.2018.04.006>

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The presence of your absence: A conditioning theory of grief

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**Abstract**

I present a conditioning theory of grief. From conditioning research on appetitive disorders (e.g., addiction and binge eating), I borrow the concept cue-elicited craving. More precisely, the theory postulates that, throughout a life together, a variety of cues become associated with the presence of the loved one and that because of this these cues can trigger craving and (an action tendency for) searching for the deceased. Starting from this perspective, I additionally invoke extinction phenomena to explain the possible persistence of grief. Arguably, the theory has good heuristic value, because it allows to explain a variety of grief symptoms and to bring together existing knowledge in a unifying learning framework. In addition, the theory has good predictive value, because it opens the door to considering new research and treatment directions.

*Keywords:* grief; associative learning; conditioning; extinction; generalization

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**Introduction**

*Finn, a middle-aged male, lost his girlfriend about five years ago [1; prolonged grief]. Finn reports that, after the loss, he so intensely longed for her that it would make him “go crazy” [2; craving and frustration]. Only about one year ago, it got better, in the sense that since then he can be more or less at ease at home [3; extinction]. However, sometimes it is still as bad as when she just passed away. To give just a few examples, hearing a romantic song on the radio still makes him long for her, as does seeing somebody with the same hairstyle as hers. In addition, grief still overtakes him at times when he least expects it. Recent examples of this include a trip to the seaside (where he and his girlfriend used to go to relax) and a Christmas family gathering [4; (no) generalization of extinction]. He also broke down when having spaghetti, her favourite meal, at a restaurant [5; return of responding]. One of the reasons that Finn is looking for therapeutic help is that he recently lashed out at his mother for accidentally washing his girlfriend’s pillow, an item that he cherished [6; evaluative conditioning and sign tracking], but has lost his girlfriend’s scent because of the washing. Finn also mentions that he still regularly goes to the square where he and his girlfriend used to meet for lunch [7; habit]. In addition, he describes another recent incident that worried some people close to him. With a couple of friends, he went to the cinema to see a movie. After a vote, the group of friends decided on a movie that happened to be a sequel to a movie that he and his girlfriend had seen together. However, 15 minutes into the movie, Finn decided to leave and drove his car to the house of his girlfriend’s parents (where he used to pick her up when they just started dating). He stayed in his car, parked in front of the house, reminiscing about his girlfriend for about two hours, before driving to his current home [8; Pavlovian-instrumental transfer]. His friends consider Finn’s behaviour to be “abnormal”, since it is happening so long after the loss. Finn does not know whether his behaviour is*

*normal or not, but wonders whether it might mean that he and his girlfriend had a bond so special that most people cannot even begin to understand [9; catastrophizing].*

Finn's name is fictitious, but his story as sketched in the above case study is real. Based on the description, he might suffer from prolonged grief (PG). This disorder is characterized by disabling symptoms for lengthy periods (according to the least stringent criterion for at least six months after the loss; Jordan & Litz, 2014), including intense craving and searching for the deceased, being constantly reminded of the deceased, and cherishing reminders of the deceased (Boelen, van den Hout, & van den Bout, 2006; Shear, 2015). Studies have estimated the prevalence to be 4-5% in the general population and 7-25% among bereaved individuals (Kersting, Brähler, Glaesmer, & Wagner, 2011; Newson, Boelen, Hek, Hofman, & Tiemeier, 2011). Despite comorbidity with depression and anxiety disorders in clinical samples (Simon et al., 2007), PG also occurs independently of these disorders, uniquely contributing to increased risk of morbidity and suicide, health problems such as myocardial infarction (cf. the proverbial broken heart), and overall reduced quality of life (Jordan & Litz, 2014; Shear et al., 2011; Shear, 2015; Stroebe, Schut, & Stroebe, 2007).

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) explicitly includes PG as a condition requiring further research. The decision to consider (persistent) grief behaviour as a pathology in need of diagnosis has not gone uncontested. Researchers have indeed demonstrated that diagnosis can lead to stigma (Eisma, 2018) and that current diagnostic criteria allow for a large amount of different symptom combinations, which decreases utility of the diagnosis for research and practice (Lenferink & Eisma, 2018).

This controversy notwithstanding, a better understanding of grief is obviously needed. Many myths surrounding grief are firmly entrenched in Western culture, for example the idea

that successful grieving involves stages of reaction to loss (for a detailed discussion of a series of myths see Wortman & Silver, 1989; Wortman & Boerner, 2011). Knowledge of the mechanisms involved in the development and maintenance of grief is important for the early identification of those at risk for problematic grief and for the development of more effective care. Although cognitive behavioural therapy holds promise, studies have indeed shown that some of the current grief therapies are ineffective or even harming rather than helping (subgroups of) grieving individuals (Boelen, 2016; Dimidjan & Hollon, 2010; Neimeyer, 2000).

In this paper, I explore whether an associative learning framework may help us to explain grief behaviour and its possible persistence. Associative learning is a basic behavioural capacity shared by human and non-human animals alike and is defined as a change in behaviour caused by a co-occurrence of events (De Houwer, Barnes-Holmes, & Moors, 2013). The scientific study of associative learning was given a head start by Pavlov's (1927) famous conditioning experiments in dogs. Since those experiments, the field has kept on evolving, leading to more refined experimental designs and theories (for a review see Haselgrove, 2016). But, however advanced this research field may have become, can it also serve to make sense of one's innermost reactions in response to the loss of a loved one? Below, I argue that associative learning theory can indeed go a long way in providing insight in some important aspects of grief. After introducing the theory, I will discuss the relation between this theory and existing theories about grief (for an elegant review of existing theories see Maccallum & Bryant, 2011).

## **Conditioning**

An important building block of the proposed theory is appetitive conditioning. Before describing how appetitive conditioning may play a role in grief, I will describe the general

concept. Studies on the topic of food craving and addiction have demonstrated that cues that have been paired with a desired outcome can come to elicit what is termed cue-elicited craving: Intense longing for the substance that goes hand in hand with (an action tendency for) approach or search behaviour (Jansen, 1998; Zellner & Edwards, 2001). For example, in a laboratory paradigm developed by Van Gucht and colleagues, two serving trays are used as cues and eating a piece of chocolate is used as the desired outcome (e.g., Van Gucht, Baeyens, Vansteenwegen, Hermans, & Beckers, 2010; Van Gucht, Vansteenwegen, Beckers, & Van den Bergh, 2008; Van Gucht, Vansteenwegen, Van den Bergh, & Beckers, 2008). Both serving trays are shortly and alternately presented on a little table in front of participants before being taken away again. Crucially, while one of the trays is on the table, participants are always asked to eat a piece of chocolate, whereas they never get to eat chocolate when the other tray is on the table. As a result, the serving tray paired with chocolate consumption, but not the other, typically comes to elicit craving for chocolate: People report longing for chocolate when seeing this tray. This tray also comes to elicit an action tendency for approach behaviour (as measured in a stimulus-response compatibility reaction time task; Van Gucht et al., 2008b). Such action tendency can be understood as a goal or inclination to act, but does not necessarily translate in an overt action (Moors, Boddez, & De Houwer, 2017). Similar results have been obtained in a laboratory paradigm in which nicotine rather than chocolate is used as a desired outcome (Thewissen, Snijders, Havermans, van den Hout, & Jansen, 2006; Thewissen, van den Hout, Havermans, & Jansen, 2005).

Taken together and making abstraction of specific laboratory paradigms, this type of findings shows that environmental cues paired with a desired outcome can make people crave for that outcome and can trigger (an action tendency to) searching behaviour. This abstract principle can be made more intuitive by applying it to daily life experiences that everybody will recognize. For example, this principle can help us understand why the smell of a waffle



makes us crave eating a waffle and search for a waffle stand. Indeed, in such situation, the craving could be explained by the assumption that this smell (i.e., the cue) previously co-occurred with the consumption of waffles (i.e., the desired outcome). Analogously, seeing somebody with a glass of beer can make us crave having a beer, because of the previous co-occurrence of these events (Collins & Brandon, 2002).

This paper's central claim is that a similar principle may explain some crucial characteristics of grief. More precisely, I theorize that, throughout a life together, cues become associated with the presence of the loved one, which functions as desired outcome, and that because of this these cues may develop the potential to trigger craving for the loved one and to trigger an action tendency for searching behaviour. All three components of this theoretical statement—the roles of the cues, of the desired outcome and of the triggered responses—deserve comment.

With respect to the role of the cues, it is important to note that it is assumed that these may be external and/or internal, depending on the individual learning history. An example of an external cue associated with the presence of the other could be a shared double bed or the place where the deceased used to work. An example of an internal cue could be feeling miserable or in need of social support, given that the deceased person used to make sure he/she was present in such situations (for an extensive discussion of conditioning with internal cues see Zaman, De Peuter, Van Diest, Van den Bergh, & Vlaeyen, 2016).

With respect to the claim that the presence of a loved one can function as a desired outcome, a recent study demonstrated that activating the mental representation of the lost one activates brain regions that are also central in addiction (O'Connor et al., 2008). It is also of note that, theoretically speaking, every stimulus can become a desired outcome (Moors et al., 2017), making the claim that the presence of a loved one can function as such a desired outcome noncontroversial.<sup>1</sup> There is indeed no doubt that the presence of a loved is something

that people value positively and is something for which people go to great lengths (e.g., travel a long way).

With respect to the triggered responses, appetitively conditioned responding appears to be a strong match for grief behaviour. The craving corresponds with the longing and yearning for the deceased person which numerous studies have identified as the cardinal symptom of PG (Prigerson et al., 2009; Shear, 2015). The action tendency for searching behaviour can be seen as corresponding to the urge to restore proximity to the lost person. This can occur literally by visiting the grave, but may also manifest itself in, for example, looking out for the deceased person in familiar places or the wish to die in order to be with the deceased person (Boelen et al., 2006; Boelen, 2016). In PG, these responses have two features that make them especially disabling. The first feature is that, by definition, symptoms persist for a very long time (i.e., they are prolonged). The second feature is that numerous stimuli and situations trigger these symptoms (Boelen et al., 2006; Lichtenthal, Cruess, & Prigerson, 2004; Raphael & Martinek, 1997). Both features fit well with an associative learning account and will be discussed in later sections of this paper (see sections on extinction and generalization).

### **Extinction**

As discussed above, throughout a life together, cues can become associated with the presence of the loved one. After the decease, these cues (e.g., the shared double bed) will, for obvious reasons, no longer co-occur with the presence of the loved one. Repeated presentation of a cue without an outcome typically results in a reduction of conditioned responding (i.e., extinction; Bouton, 2002). The craving response, however, is known to extinguish relatively slower than other conditioned responses. In, for example, the research paradigm of Van Gucht and colleagues described above, repeatedly presenting the serving tray (that initially co-occurred with chocolate consumption) without any chocolate does not

readily cease cue-elicited craving. Even when participants report that they no longer expect to eat chocolate, their craving for chocolate remains high when seeing this serving tray (e.g., Van Gucht et al., 2008a; Van Gucht et al., 2008b).<sup>2</sup> Translating this to grief, this would correspond to a situation in which one does not subjectively expect the loved one to be present anymore, but nonetheless still craves for his/her presence. We can also recognize the slow extinction of craving in the above-described case study of Finn: Only after up to four years after losing his girlfriend, he managed to be at ease at home [see 1 & 3 in the case study]. By that time, there will have been many instances in which the event of being in the house and being in the presence of his girlfriend did not co-occur.

What is more is that research on appetitive conditioning suggests that craving can even temporarily increase—rather than extinguish or decrease—due to non-occurrence of the desired outcome (Tiffany, 1999). Similarly, outcome deprivation is known to increase appetitive responding (Mitchell & Gormezano, 1970). This seems to confirm the adage that absence makes the heart grow fonder. As such, this provides an important backbone of the conditioning theory of grief, since it certainly seems that the craving for the loved one increases after the decease.

In addition, outcome deprivation can lead to anger and frustration. Tiffany (1999) illustrates this with a case of an alcoholic who started craving beer (i.e., the desired outcome) because of seeing a beer stand at a festival (i.e., the cue). On closer examination, he discovered that the beer stand was closed for remodelling. This obstacle not only resulted in enhanced craving, but also in anger and frustration at being thwarted in the attempt to drink. Importantly, this case description is corroborated by an extensive literature of animal experiments (Amsel, 1992; Amsel, 1994). Rats demonstrate behaviour indicative of frustration (e.g., vigorously trying out different responses, aggression towards the experimenter, and even urinating and defecating) when a desired outcome (e.g., a food

reward) remains absent in a situation where it had been present previously (Amsel, 1992).

Translating this to the case study of Finn, this seems to correspond to him reporting that, in the beginning, he used to “go crazy” of longing [see 2 in the case study]. The absence of his girlfriend seemed to not only intensify his longing for her, but also to be extremely frustrating.

On top of these difficulties with the initial extinction of craving, experimental research on extinction of conditioned responding (Bouton, 2002; Vervliet, Baeyens, Van den Bergh, & Hermans, 2013; Vervliet, Craske, & Hermans, 2013) has revealed a number of additional characteristics that can explain why overcoming grief can be especially difficult: (1) extinction generalizes poorly and (2) successfully extinguished responses can still return at a later time. Below, I discuss these difficulties.

**Generalization.** Research has shown that even when extinction is successful, it does not readily generalize to other cues (Barry, Griffith, Vervliet, & Hermans, 2016; Boddez et al., 2012; Vervliet, Vansteenwegen, Baeyens, Hermans, & Eelen, 2005). In, for example, the study of Barry and colleagues (2016), a cue was paired with an (in their study, aversive) outcome in a first phase, so that it came to elicit conditioned (fear) responding. In the subsequent extinction phase, a different but perceptually similar cue was presented without the outcome. This perceptually similar cue elicited the same amount of conditioned responding at the beginning of the extinction phase, which then as expected gradually decreased throughout the extinction phase. Crucially, Barry et al. demonstrated that this successful extinction learning did not generalize to other cues: The presentation of yet another perceptually similar cue still led to conditioned responding. Translating this to Finn, it is of note that, after a while, being at home did not elicit longing for his girlfriend anymore [see 3 in the case study]. However, this successful extinction learning did not generalize to other

cues. For example, grief still overtook him when making a trip to the seaside [see 4 in the case study and note that Finn and his girlfriend often went to the seaside together, making it likely that being at the seaside has become associated with her being present]. Experiments such as that of Barry et al. (2016) suggest that Finn will have to learn separately that being at the seaside does not mean that he will be enjoying his girlfriend's presence, that his girlfriend will no longer be present at Christmas family gatherings and that seeing somebody with the same hairstyle as her in the distance does not mean that he and his girlfriend can walk up to each other and be in each other's company [see 4 in the case study].

This lack of generalization of extinction learning helps to explain why grieving can be more difficult after a long-lasting relationship in which many activities were shared, like a parent-child relationship or a partner relationship (Boelen, 2016; Lobb et al., 2006). In such cases, there will be many more cues that have been linked to the presence of the loved one and that will have to be extinguished separately.

At the same time and in contrast with this narrow generalization of extinction, the experiment of Barry et al. (2016; also see Boddez et al. 2012) also illustrates that acquisition learning does generalize widely: The conditioned responding that was established to one cue, was also elicited by a perceptually similar cue (as evidenced by high responding to this perceptually similar cue at the very beginning of the extinction phase). This wider generalization of acquisition is a well-established finding in a variety of conditioning preparations (Bouton, 2002). In fact, more and more evidence is emerging that such generalization of acquisition is a crucial pathological process across mental disorders (Hermans & Baeyens, 2013; Hermans, Baeyens, & Vervliet, 2013). Take, for example, a person who gets bitten by an aggressive dog. Only if this person develops conditioned fear for not only this dog, but for dogs in general, would one speak of dog phobia. In this respect, researchers commonly differentiate between perceptual and conceptual generalization

(Hermans & Baeyens, 2013; Dymond, Dunsmoor, Vervliet, Roche, & Hermans, 2015). In the case of perceptual generalization, a cue that shares perceptual elements with a cue that co-occurred with the outcome also comes to elicit conditioned responding (Boddez, Bennett, van Esch, & Beckers, 2017). For example, not only the previously shared double bed may elicit craving for the loved one, but also seeing a sofa for two persons in a furniture boutique. In the case of conceptual generalization, conditioned responding that is established to one cue is also elicited by conceptually related cues (even if these cues do not show perceptual overlap; Bennet, Vervoort, Boddez, Hermans, & Baeyens, 2015). For example, Finn's grief responses elicited by hearing a love song on the radio may be understood as an instance of conceptual generalization [see 4 in the case study]. Both the shared double bed and the song could be considered members of a conceptual category "things concerning two people", providing the basis for such generalization.

**Return of Responding.** In the section above, it was discussed that, due to narrow generalization of extinction learning and wide generalization of acquisition learning, responding to a wide array of cues has to be extinguished separately when losing a loved one. Further explaining why it may be difficult to overcome grief, research has also demonstrated that even when responding to an individual cue is extinguished successfully, responding to this very same cue can return later on. More precisely, a variety of conditions, including context switches and even the mere passage of time, can trigger a return of original responding. For example, if cue and outcome first co-occur in context A, and the cue is then successfully extinguished in context B, the cue can come to elicit renewed conditioned responding when it is presented in context A again or in a novel context C (ABA renewal or ABC renewal respectively; Bouton, 2002; Vervliet et al., 2013a; Vervliet et al., 2013b). This finding has been well-established in (appetitive and other) conditioning preparations and has

also been confirmed in the above-described laboratory paradigm by Van Gucht and colleagues. In a variant of their standard paradigm, they created two different contexts by using different lighting in the room, resulting in the room being either relatively brightly lit or relatively dark (Van Gucht et al., 2008a; Van Gucht et al., 2008b). During acquisition, one of the serving trays was paired with chocolate consumption in one context. During the subsequent extinction phase, both trays were presented without chocolate in the other context. When participants were then tested in the original acquisition context, a renewal effect was observed, evidenced by restored approach tendencies and by participants reporting that they again expected to eat chocolate when seeing the tray that had previously been paired with chocolate consumption.

What does all this mean for grief? As said, throughout a life together, cues will become associated with the presence of the loved one. After the decease, one will learn that these cues no longer co-occur with the presence of the loved one (i.e., extinction learning). However, there can always be a return of responding. Let us illustrate this with an example. After the decease, the shared double bed will no longer co-occur with the presence of the loved one, which will ultimately lead to a decrease in conditioned responding. At a later time, the double bed may however come to elicit renewed responding. Suppose, for example, that Finn would move to another house. If he reassembles the very same bed in his new house, it may come to elicit longing for his girlfriend again because of the context switch. In the case study, it is also described that Finn broke down when having a spaghetti (which was his girlfriend's favourite meal) at a restaurant [see 5 in the case study]. Even though he reported in a later therapy session to have often made this meal at home since her passing (supposedly leading to extinction of the relation between spaghetti and the presence of his girlfriend), the context switch to the restaurant might have caused a return of responding.

**Evaluative Conditioning.** At this point, I want to broaden the scope to an in this paper hitherto ignored conditioned response that may be of relevance for grief. Conditioned valence refers to a change in the valence of a cue that is due to co-occurrence with a positive or negative outcome (De Houwer, 2007; De Houwer, 2011). A series of studies found that conditioned valence does not extinguish (e.g., Vansteenwegen, Francken, Vervliet, De Clercq, & Eelen, 2006).<sup>3</sup> In the context of grief, a cue that is positively valenced because of its pairing with the loved person may therefore retain its positive valence for a long time. In the case study of Finn, it is mentioned that he cherishes his girlfriend's pillow [see 6 in the case study]. One may assume that the valence of the pillow is due to his girlfriend having used it (i.e., due to the previous co-occurrence of the pillow and his girlfriend). Other behaviour that is often seen in grief can be understood in this way as well. Consider, for example, parents who have lost their child and keep a piece of his/her clothing or a plush toy on a little altar in the house. Starting from an associative learning perspective, one would say that the valence of these items was acquired through their co-occurrence with the presence of the child and may be fairly permanent.

Finn's behaviour with respect to the pillow, and cherishing behaviour in general, cannot only be explained by invoking the concept of conditioned valence, but also by invoking a learning phenomenon termed sign-tracking. Sign tracking, which has been extensively studied in rats, describes the propensity of subjects to behaviourally engage (touching, gnawing, sniffing, etc.) with a cue that has been paired with a desired outcome (e.g., a food reward; Flagel, Akil, & Robinson, 2009; Meyer, Ma, & Robinson, 2012; Morrison, Bamkole, Nicola, 2015). Studies have found support for the hypothesis that sign tracking involves the cue acquiring the incentive value of the outcome. As such, the cue becomes a desired outcome itself or, in other words, the content of a goal (Moors et al., 2017). Since sign tracking is also resistant to extinction (Morrison et al., 2015), it may provide an



elegant analogy for the cherishing of items in the context of grief. Just imagine Finn snuggling his head into the pillow and cuddling it as if it was his girlfriend and compare this to a rat treating a cue as if it was his food reward. With respect to Finn lashing out at his mother for washing the pillow with his girlfriend's scent [see 6 in the case study], it is of note that, according to appraisal theories, the interference with goal satisfaction may elicit aggression (Moors et al., 2017). More precisely, by washing the pillow, the desired outcome was destroyed and the goal of making contact with it could no longer be satisfied.

**Instrumental Learning.** Next to cues, one may of course also associate one's own behaviour with the outcome of being in the presence of the loved one. For example, throughout a life together, going to a certain place might systematically result in being in the company of the loved one. Behaviour that results from the relation between the behaviour and its outcome is termed instrumental or operant behaviour (Bouton, 2007; De Houwer et al., 2013).

**Habits.** In the learning literature, the dominant view is that instrumental behaviour can be either goal-directed or habitual. In the case of goal-directed behaviour, the behaviour is driven by the desired outcome (i.e., the goal). In the example above, going to that place would be driven by the desired outcome of being in the presence of the loved one. However, through repetition, goal-directed behaviour can become habitual (Wood and Runger, 2016). I propose to define habitual behaviour at the phenomenological level as behaviour that is no longer driven by the outcome that initially installed it. An elegant and well-established procedure to assess whether behaviour has actually become habitual is the outcome devaluation procedure (Adams & Dickinson, 1981; Heyes & Dickinson, 1993). In the first phase of such a procedure, subjects learn to perform a response (e.g., lever pressing) to obtain an outcome

(e.g., food). To investigate whether the behaviour is (still) caused by the outcome, it is in a subsequent test phase assessed whether manipulating the outcome changes the behaviour. One can do this by changing the value of the outcome (e.g., by satiating the subject with food before the test, so that food is no longer highly valued) or by omitting the outcome altogether (i.e., extinction training). If these manipulations do not have an effect on the response, it is concluded that this behaviour is not driven by the outcome and is therefore habitual.

The habit concept may explain why Finn still regularly goes to the square where he and his girlfriend used to meet for lunch [see 7 in the case study]. Given that they often used to meet there, the behaviour of going to the square around lunchtime might, through repetition, have become habitual and therefore insensitive to omission of the outcome of being in the presence of his girlfriend.<sup>4</sup>

Next to more cues being associated with the outcome of being in the presence of the loved one (as discussed in the section on generalization above), habit formation is another factor that provides insight in why grieving can be more difficult after a long-lasting relationship in which many activities were repeatedly done together (Boelen, 2016; Lobb et al., 2010). In this case, a wide set of behaviours might, through repetition, have become insensitive to omission of the outcome of being in the presence of the loved one. Such enduring behaviour might be interpreted as a failure to integrate the reality of the loss into one's mental representations.

***Pavlovian-instrumental transfer.*** The interaction between cue-elicited responding (as discussed in the previous sections of this paper) and instrumental behaviour (as discussed in the current section of this paper) may also provide insight in some aspects of grief behaviour. Conditioning research has revealed an effect termed Pavlovian-instrumental transfer (Pit; Holmes, Marchand, & Coutureau, 2010). In a typical procedure, a cue is paired with a desired

outcome (i.e., Pavlovian learning) and participants are separately trained to perform an instrumental response to obtain the same outcome (i.e., instrumental learning). In the test phase, the cue is presented while the instrumental response can be emitted. The typical result is that the cue, relative to appropriate control cues, will elicit the response that previously resulted in the outcome (i.e., Pit). For example, Lovibond and Colagiuri (2013) developed a procedure in which participants first learned that a coloured light resulted in chocolate and then were separately trained to press a button to receive the same chocolate outcome. In the transfer test, they observed that presentation of the chocolate-paired cue led to a higher rate of button pressing than a control cue. Interestingly, we may assume such a Pit effect to be at play in the incident in which Finn suddenly left the cinema and drove to the house of his girlfriend's parents [see 8 in the case study]. With respect to the Pavlovian learning, it is important to know that the movie that Finn and his friends were watching was a sequel to a movie that he and his girlfriend had seen together. Therefore, this movie can be seen as a (generalized) cue that has been associated with the presence of his girlfriend. With respect to the instrumental learning, driving to her parents' house can be seen as instrumental behaviour that previously resulted in being in her presence, because he used to pick her up there when they just started dating. So, in line with the events described in the case study, a Pit effect would indeed imply that the movie, as a cue, would elicit driving to her parents' house, the instrumental behaviour. The reason that the Pit effect is discussed in this section is that Pit, just like habits, is fairly insensitive to extinction training. More specifically, attempts to reduce Pit by presenting the cue without the desired outcome have produced mixed results (Lovibond, Satkunarajah, & Colagiuri, 2015; Cartoni, Balleine, & Baldassarre, 2016). This means that repeatedly going to the movie without being in the presence of his girlfriend will by itself not necessarily lower Finn's tendency to emit behaviour that previously resulted in being in her presence. What does seem to reduce Pit is experiencing that the cue-elicited

response no longer results in the desired outcome (Cartoni et al., 2016). In the case of Finn, this would imply that experiencing that driving to her parent's house, as preceded by being at the movies, does not result in being in her presence would eventually make such behaviour disappear. So, contrary to the intuition of Finn's friends, his behaviour can be made insightful and would eventually disappear by itself [see 9 in the case study].

***Avoidance.*** Cues that are associated with traumatic loss may come to elicit avoidance, similar to what happens in anxiety disorders (e.g., posttraumatic stress disorder; PTSD). For example, if the grieving person is a survivor of the car accident in which the loved one died, then he may avoid the place of the accident (e.g., because that place elicits intrusions or elicits fear of a new accident; Wegerer, Blechert, Kerschbaum, & Wilhelm, 2013). Such instrumental avoidance is known to strongly interfere with extinction learning as it prevents exposure to traumatic cues and thereby symptom reduction (Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014).

Avoidance may also play a role in grief that does not completely overlap with its role in anxiety disorders. The theory presented in this paper is built on the assumption that, throughout a life together, certain cues will come to signal the desired outcome of being in the presence of the loved one. Crucially, after the loss, new signal relations might come into play: These same cues will now come to signal negative affect like frustration that is caused by the absence of the loved one (see discussion above; Amsel, 1992; Amsel, 1994). Once these new signal relations are learned, instrumental avoidance could come into the picture. Avoidance would serve the function of not being confronted with this negative affect. For example, after the loss the previously shared double bed would come to result in the outcome of experiencing negative affect, so by staying away from the bed one would avoid the negative affect. This insight opens the door to applying the well-known avoidance theory of Mowrer

(1947) to grief. The theory of Mowrer assumes that avoidance is reinforced by fear reduction. In our example, the grieving person could fear coming to experience negative affect like frustration when being in the presence of the bed. Leaving the room with the bed would then be reinforced by the reduction in fear of having to go through this negative affect.

Interestingly, patients who have been diagnosed with prolonged grief do not only display relatively stronger avoidance (Eisma et al., 2014; Eisma et al., 2015), but also stronger approach of reminder cues as compared to healthy controls (Maccallum, Sawday, Rinck, & Bryant, 2015). Learning theory offers one way to solve the apparently paradoxical co-existence of approach and avoidance in grief. Learning theorists have hypothesized that conditioning comprises two forms of learning: learning about signal relations and learning about referential relations (Baeyens, Vansteenwegen, Hermans, & Eelen, 2001). Cues that once signaled the presence of the love one can come to elicit avoidance after the loss as outlined in the paragraph above. However, cues can also have a mere referential relation to an outcome (Baeyens, Eelen, Van den Bergh, & Crombez, 1992). This can be explained by use of the following example. A holiday souvenir can refer to a pleasant evening abroad without having signal value. As such, the souvenir can make one think about the evening abroad, but it will not elicit the expectancy of an imminent pleasant evening (Baeyens et al., 1992; Baeyens et al., 2001). Similarly, a religious relic – like a piece of cloth that has made contact with the body of Jesus Christ – can refer to Jesus Christ but does not have signal value with respect to His imminent presence. As opposed to cues with signal value, I put forward the hypothesis that cues with a mere referential relation to the loved one will elicit approach behaviour (e.g., the pillow in the case study of Finn). Cues that have a mere referential relation will indeed not come to elicit negative affect like frustration when the loved one stays absent because there was no expectancy about the presence of the loved one in the first place. In summary, the present hypothesis entails that cues that signaled the presence of the loved

one will come to elicit avoidance, whereas cues that merely refer to the loved one will come to elicit approach. Learning theorists have developed techniques to install referential relations as separate from signal relations (for details see Baeyens et al., 2001), which would allow to assess this hypothesis in the laboratory.

### **Evaluation**

The quality of every theory depends on the extent to which it allows to organize existing knowledge (i.e., its heuristic value) and the extent to which it allows to generate new knowledge (i.e., its predictive value; De Houwer et al., 2013). Before I turn to the evaluation of the heuristic and predictive value of the conditioning account of grief, I will summarize its basic premises.

**Summary.** The theory states that throughout a life together, a variety of external cues (e.g., a shared bed or the workplace) and internal cues (e.g., feeling in need of social support) become associated with the presence of the other. Presumably, these events develop the potential to elicit the expectancy that the other will be present, to trigger craving, and to trigger searching behaviour that would result in restoration of proximity if the loved one were still alive (e.g., looking out for the deceased in familiar places). As in addition, craving in grief may become especially strong and frustrating because access to the deceased is blocked for obvious reasons. That is, the loss of the loved one forces one into a situation of extinction learning. The crucial aspects of what can make grief so disabling, is (1) that symptoms can persist for a very long time and (2) that numerous stimuli can trigger memories of the deceased. It was proposed that this is respectively (1) due to slow or non-permanent extinction of (a subset of) conditioned responses and (2) due to excessive generalization of acquisition learning. I also discussed that conditioned valence and sign tracking may shed

light on why some reminders elicit cherishing behaviour. With respect to one's own behaviour, instrumental behaviours (e.g., going to a certain place) that previously resulted in being in presence of the loved one may become habitual and therefore persist even when they no longer result in this desired outcome. Pit concerns the interaction between cue-elicited responding and instrumental behaviour. More precisely, it describes how cues that have been associated with the presence of the loved one can lead individuals to actively seek out their company. In case of decease of the loved one, this would of course be in vain. Finally, cues that once signaled the presence of the love one can come to elicit avoidance because they come to signal negative affect like frustration that is caused by the absence of the loved one.

**Heuristic Value.** The conditioning account of grief has good scope (Hughes, Barnes-Holmes, & Vahey, 2012), since it can explain a variety of topographically different behaviours characteristic of it. When having another look at the case study, a wide range of complex behaviour is described. Although most of the behaviour in the case study may already evoke some intuitive understanding (and sympathy), the theory allows explaining this behaviour by invoking well-established learning principles. What is more is that the theory is not limited to grief after death, since the same learning principles may explain grieving after divorce and other types of break-up between individuals. The only two requirements for the learning principles to be applied are (a) that a loved one is involved (i.e., that there is a desired outcome) and (b) that there was a shared life (i.e., that there are cues and behaviours that have become associated with the presence of the loved one).

**Strength of grief.** It is of note that these same two requirements may also shed light on the strength of grief. An empirically established predictor of the strength of grief is who has died and how important that person was, with people who lose a partner or a child being at

higher risk of PG (Boelen, 2016). In such case, the two requirements are indeed best fulfilled: partners and children are loved ones that will have shared a great deal of activities with the surviving person. The latter means that a plethora of cues and behaviours will be associated with the presence of the loved one. Let us, for the sake of clarity, compare this with a person who loses a grandfather who he rarely sees. Although maybe harsh to say, this person will probably not have loved his grandfather as much as he loves his partner or children (i.e., there is a less effective desired outcome) and, not many cues and activities will be associated with the presence of the grandfather. Accordingly, the theory would (correctly) predict that grief is less intense in this case. Obviously, it is still possible that grief may take other forms than the frustrating cue-elicited craving that the theory considers important, so that there can still be a form of (non-pathological) grieving for the grandfather in this example.

One related learning mechanism that I have not discussed yet and that can explain why grief can be worse after a long-lasting relationship deserves mentioning here. Solomon and Corbit (1974) noticed that emotional reactions to a stimulus change with repeated confrontation to it. In this context, they described changes in reaction to (illegal) drugs due to repeated administration. For example, when using heroin for the first time, one would experience a strong high and little withdrawal. However, with repeated administration this reaction flips, and one would experience a poor high and strong withdrawal. Solomon and Corbit (1974) give a plethora of examples in which they recognize a similar pattern and shortly mention grief in this context as well. When one goes on a first date, one might indeed experience very strong excitement during the date, but one would typically experience little “withdrawal” (loneliness) after the date. However, after years of marriage with that person the reaction may flip as well: Excitement in the presence of this person may reduce substantially, but withdrawal may increase strongly. In the case of decease of the loved one, this withdrawal cannot be undone by a next “dose” of the loved one either. Grief would therefore be most



strong after a long-lasting relationship according to the insights of Solomon and Corbit (1974). In addition, prediction error upon breaking a well-learned contingency between a cue / behaviour and a desired outcome is likely to be stronger than upon breaking a newly learned contingency (Schultz, Dayan, & Montague, 1997). Such increase in prediction error can cause negative affect (Van de Cruys, 2017) and as such account for stronger grief after a long-lasting relationship (implying well-learned contingencies between cues / behaviours and the presence of the loved one) at the mental level.

The strength of grief is not only determined by who has died and the nature of the relationship, but also by the abruptness of the decease: An unexpected death is more likely to lead to persistent grief, as compared to an expected death (e.g., after chronic illness; Boelen, 2016; Boelen, De Keijser, & Smid, 2015; Kristensen, Weisæth, & Heir, 2012). We may try to explain this empirical observation by invoking principles embedded in the conditioning theory. One could speculate that, in the case of chronic and terminal disease of the loved one, some of the necessary extinction learning already occurs before death. For example, an ill partner might not sleep in the shared bed anymore, because he/she stays in the hospital or cannot climb the stairs anymore. Interestingly, a gradual decrease in outcome omission is also known to diminish later return of extinguished conditioned responding (Gershman, Jones, Norman, Monfils, & Niv, 2013; Shiban, Wittmann, Weissinger, & Mühlberger, 2015). In case of chronic disease, the presence of the loved might indeed gradually decrease (e.g., because the loved one is progressively less and less at home), hence allowing for such more permanent extinction learning. In such case, it is as if the state of the world in which the loved one is still present gradually fades into a state of the world in which the loved one is absent. Gershman et al. (2013) hypothesized that — at the mental level — such gradual change in states allows the individual to permanently update and adapt to the new state of affairs. In contrast, a sudden change in states (e.g., due to the sudden death of a loved one) would leave

the risk that the individual would sometimes behave as if the old state of affairs still holds (e.g., behave as if the loved one was still alive).

In addition, in the case of protracted illness, being in the presence of the (suffering) loved one may become difficult or hard to bear. Consequently, this presence would no longer function as a positive or appetitive outcome. Such change in valence of the outcome is known to decrease conditioned responding (e.g., Rescorla, 1974) and could be expected to reduce the symptoms typically seen in grief.

***Transdiagnostic framework.*** As mentioned previously, comorbidity is not uncommon in the case of PG (Simon et al., 2007). The most common is comorbidity with depression and PTSD (Jordan & Litz, 2014).

From the present perspective, this comorbidity can be understood by assuming that common learning mechanisms play a role in comorbid disorders. For example, habit learning, discussed above as a possible factor underlying persistent grief, has also been proposed as a mechanism underlying (rumination leading to) depression (Lijima, Takano, Boddez, Raes, Tanno, 2017; Watkins & Nolen-Hoeksema, 2014).

A second way to understand the comorbidity between PG and depression is through the research on learned helplessness. This research shows that the inability to secure desired outcomes (e.g., being safe) leads to enduring passivity and emotional problems that correspond to the symptoms of depression (Overmier, 1996). Similarly, the inability to secure the desired outcome of being in the presence of the loved one might lead to symptoms of depression.

Finally, a third way to understand the comorbidity between grief and depression is by considering the presence of the loved one to be a controlling stimulus (Ferster, 1966; Costello, 1972). It is indeed likely that the presence of a loved one not only serves as outcome (as

discussed before), but also as controlling stimulus of instrumental behaviour. That is, this presence may activate mental presentations of desired outcomes (i.e., goals; e.g., having a tasty and healthy meal) and thereby trigger instrumental behaviour that allows to secure these outcomes (e.g., cooking such meal). The absence of the loved one precludes this goal priming mechanism (Förster, Liberman, & Friedman, 2007) and could therefore lead to enduring passivity (e.g., no longer engaging in cooking meals) as seen in depression.

With respect to comorbidity with PTSD, it is of note that some of the learning principles that I proposed to be at play in PG have already been proposed as mechanisms underlying PTSD (e.g., slow extinction and excessive generalization; Boddez, Baeyens, Hermans, & Beckers, 2013; Guthrie & Bryant, 2006; Lenaert et al., 2014). This provides a possible pathway towards comorbidity between PG and PTSD. What is more is that the death of a loved one can be considered to be a traumatic event, especially when it concerns an unexpected (e.g., violent) death (Boelen, 2016; Boelen et al., 2015; Kristensen et al., 2012). This makes insightful why symptoms of grief (i.e., behavioural changes caused by the death of a loved one) and symptoms of PTSD (i.e., behavioural changes caused by a traumatic event) can co-exist in the same person.

***Relation with existing models.*** In this section, I compare the conditioning account with three existing theories about grief (Boelen, van den Hout, and van den Bout, 2006; Shear and Shair, 2005; Stroebe and Schut, 1999; for an elegant review see Maccallum & Bryant, 2013). I will hereby try to bridge the gap between construct formulations in the present learning theory and construct formulations in these existing theories. Accordingly, the present theory should not be seen as competing with these existing theories, but rather as compatible.

*Boelen, van den Hout and van den Bout (2006).* Boelen et al. (2006) developed a

cognitive behavioural conceptualization of PG. They identified three problematic processes:

(a) poor integration of the loss in autobiographical memory; (b) the use of avoidance strategies, and (c) negative appraisal about the self, the loss, and one's grief reactions.

From the present perspective, the poor integration of the loss in autobiographical memory can be understood as corresponding to the above-discussed extinction deficits. More precisely, a plethora of cues will be associated with the presence of the loved one. These cues can make one expect, crave or search for this presence. As discussed, extinction of some of these responses may go slowly and, in addition, successful extinction also generalizes poorly. In the case study, it is, for example, described that after some years Finn did not show grief symptoms anymore when being at home, but experienced a resurgence of grief responses when making a trip to the seaside or when going to a Christmas family gathering [see 4 and 5 in the case study]. The fact that after the death a plethora of cues can still make one expect or search for the presence of the loved one can of course be described as a poor integration of the loss in autobiographical memory. Similarly, emitting habitual behaviour (e.g., still setting the table for the loved one) may give the impression that one conducts oneself as if the loved one were still alive.

As shortly mentioned above, the problematic aspect of using avoidance strategies can also be understood from the perspective of extinction learning. Extensive research has shown that avoidance behaviour interferes with extinction learning (Volders, Boddez, De Peuter, Meulders, & Vlaeyen, 2015). If, for example, a grieving person sleeps on the couch in the living room instead of in the previously shared bed (example from Shear, 2015), there is no opportunity to experience that the bed no longer co-occurs with presence of the loved one and therefore there will be no extinction learning.

The role of negative appraisals about the self, the loss, and one's grief reactions are not instantly within the scope of a learning perspective, although the concept of

catastrophizing may help to bridge the gap (Vlaeyen & Linton, 2000). Catastrophizing about one's conditioned responses increases the subjective threat value of these responses, since it endows these symptoms with a threatening meaning. For example, one might interpret strong craving for the loved one as a sign that one should not go on without him/her and that one would be better off dead too. It is of note that we can recognize this catastrophizing in a mild form in the case study in which Finn wonders whether his symptoms signify that he and his girlfriend had a bond so special that most people cannot even begin to understand [see 9 in the case study]. In the section on predictive value, I will argue that such catastrophizing can be an important target of psycho-education.

*Shear and Shair (2005)*. Shear and Shair's (2005) attachment based model of PG is quite different from that of Boelen et al. (2006). The central thesis of this model is that the loss of a loved one leads to a mismatch between the mental representation of the attachment figure as available and the reality of his/her absence. This mismatch activates the attachment system, but the attachment figure will not be available to ease the stress of the mismatch. The vicious circle will end when the permanence of the loss is integrated in memory. These premises are in line with the appetitive conditioning theory of PG. As said, the theory assumes that, throughout a life together, a plethora of cues and behaviours become associated with the presence of the loved one. However, the death of the loved one forces one into extinction learning because the loved one will no longer be present. This matches Shear and Shair's idea of the mismatch between the representation of the attachment figure as available and their actual absence. It was also discussed that internal cues (e.g., feeling stressed and in need of social support) may become associated with the presence of the loved one, given that the loved one made sure that he/she was available in such situations. This can be seen as the translation of Shear and Shair's thesis that the stress of the mismatch activates the attachment

system and the expectancy that the attachment figure will be available. Finally, the theory implies that grieving will stop when all associations between the cues and the presence of the loved one are permanently extinguished, which matches Shear and Shair's idea that grieving will end when the permanence of the loss is integrated in memory.

*Stroebe and Schut (1999)*. The third existing theory to which I compare the conditioning account is a model that was introduced by Stroebe and Schut (1999). These authors propose that successful grief should be understood as the ability to flexibly oscillate between a focus on aspects of the loss (e.g., remembering the loved one) and a focus on restoration (e.g., doing new things). The model has made a strong impact in the literature, although some authors pointed out that the cognitive and functional mechanisms involved in loss and restoration-oriented processing have not yet been explicitly clarified (Maccallum and Bryant, 2013). One could also argue that the theory focuses more on a description of successful recovery from grief than on its etiology. For this reason, I postpone the comparison with this theory to the paragraph on treatment implications. There I will argue that the positive effects of focussing on loss and restoration can be understood as resulting from, respectively, facilitated extinction learning and association splitting.

**Predictive value.** As said, the value of a theory not only depends on whether it allows to organize existing knowledge (i.e., heuristic value), but also on the extent to which it allows to gather new knowledge (i.e., predictive value). In the previous section, it was argued that the conditioning account of grief has good heuristic value, because it allows to explain a variety of grief symptoms and even allows to anchor existing PG theories in a unifying learning framework. In this section, I will discuss its predictive value. The theory may inspire future research in at least two important ways. First, the theory allows to identify some potential risk

factors for developing PG. Second, the theory provides hints on how to conduct treatment.

***Risk factors.*** With respect to the potential risk factors for developing PG, there is evidence for individual differences in extinction learning (Guthrie & Bryant, 2006), generalization (Lenaert et al., 2014), and habit formation and sign tracking (Flagel, Akil, & Robinson, 2009). For example, in the studies of Guthrie and Bryant (2012) and Lenaert et al. (2014), participants were invited to the lab to complete an aversive conditioning task including, respectively, an extinction or generalization test. Participants were later assessed for anxiety symptoms after occurrence of a stressful life-event. In these longitudinal designs, slower extinction and wider generalization slopes at baseline predicted more anxiety symptoms at follow-up. Similarly, individual differences in extinction and generalization in (appetitive) conditioning at baseline (e.g., right before or around the time of the loss) may predict the onset of PG. This would provide important evidence for the conditioning account of PG, since this account heavily relies on the role of extinction and generalization. In addition, it would be of clinical interest, as identification of at-risk individuals would allow for efficient prevention (Boddez, Davey, & Vervliet, 2017).

***Treatment.*** With respect to treatment implications, the conditioning account of grief opens the door to considering and investigating new treatment options. Whether there is a need for treatment in the first place should of course be discussed with the grieving person. A guiding principle could be to assess to what extent grieving behaviour interferes with reaching other goals (e.g., performance in a work context or taking care of remaining loved ones). That being said, some directions are discussed below.

***Association splitting.*** Association splitting entails pairing the target behaviours and

cues with a (high) number of outcomes different from the outcome that drives responding (Moritz, Jelinek, Klinge, & Naber, 2007; Schneider et al., 2016). The presumed mechanism is that increasing the number of associations reduces the effectiveness of existing associations (Anderson, 1974). For example, going to the seaside [where Finn used to go with his girlfriend; see above and see 4 in the case study] could be paired with a series of other outcomes. From now on, when there, Finn could systematically visit the local art galleries, go surfing, etc. This would change the meaning of being at the seaside: It would no longer signal being in the presence of his girlfriend, but it would come to signal seeing new art, etc. As said, association splitting may be a mechanism that underlies the positive effects of the focus on restoration as posited in the model of Stroebe and Schut (1999). Doing new things will change the meaning of cues that previously mainly signaled being in the presence of the loved one.

*Reconsolidation interference.* The conditioning approach of grief may also inspire the evaluation of the effectiveness of memory reconsolidation interference techniques to reduce PG symptoms (for a review see Beckers & Kindt, 2017). An extensive discussion of this literature is out of the scope of this paper, but for the present purposes it suffices to indicate that this set of techniques is said to have the potential to erase emotional memory by a simple pharmacological or behavioural intervention. For example, oral administration of propranolol (i.e., a  $\beta$ -adrenergic receptor antagonist) before presenting a fear conditioned cue can permanently erase the expression of the fear memory (Kindt, Soeter, & Vervliet, 2009). One popular explanation states that presenting the cue reactivates the corresponding memory trace. This means that the person will think back of when the cue was followed by its outcome. A theoretical assumption is that a reactivated memory trace has to be placed back in long-term memory after use, because the memory trace would otherwise fade away. Propranolol is



supposed to prevent this placing back, which would cause the memory trace to wither and lose its ability to elicit emotional responses (Beckers & Kindt, 2017).

Although translating this to grief may at first sight be taken to imply that loved ones may be erased from memory, experimental evidence suggests that the techniques typically leave declarative memories intact (e.g., Kindt et al., 2009). That is, although the cues no longer elicit aversive responding (e.g., fear-potentiated startle), the participants can typically still remember and verbally report the cue-outcome contingencies. Hitherto, this response dissociation has mainly been observed in human fear conditioning experiments, but a similar pattern would be a valuable treatment outcome to pursue for PG: This would correspond to a situation in which the grieving person can be reminded of the lost one without experiencing the frustrating craving and search tendencies.

*Exposure therapy.* The conditioning account is also in line with the success of exposure therapy in the treatment of PG (Bryant et al., 2014). Theorists have indeed argued that the working ingredient of exposure therapy is the confrontation with conditioned cues and the resulting facilitation of extinction learning (Craske et al., 2014). It is worthwhile to mention that suggestions to overcome the above-discussed limited generalization of extinction and return of responding are available in the literature (e.g., extinction with multiple cues and in multiple contexts; Craske et al., 2014; Pittig, van den Berg, Vervliet, 2015). However, many of these suggestions are based on research that makes use of fear conditioning procedures, so research on how this translates to appetitive conditioning and PG would be necessary. In addition, in light of the above-discussed evidence that craving is fairly resistant to extinction treatment, it would be interesting to investigate the added value of combining techniques such as association splitting with exposure therapy for PG. As mentioned, the beneficial effects of exposure therapy can be linked to Stroebe and Schut's (1999) suggestion

that a focus on the loss is a necessary element of successful recovery from grief. That is, confrontation with reminders of the loved one could help to diminish (some forms of) conditioned responding.

*Hidden goals.* As discussed, grief may also involve habit-like behaviour that is no longer driven by the desired outcome that initially installed it. For example, Finn still goes to the square where he and his girlfriend used to meet for lunch, even if going there no longer results in the desired outcome of being in her presence [see 7 in the case study]. Moors et al. (2017) recently put forward that habitual behaviour may, however, still be driven by other outcomes than the outcome that initially installed it (i.e., so-called hidden goals). In the case of Finn, going the square may, for example, be driven by the desired outcome of paying tribute to his deceased girlfriend. Identifying such hidden goals would provide the tool to change the behaviour at hand (if that would be therapeutically beneficial). For example, encouraging Finn to pay tribute in another and maybe more straightforward way should satiate this hidden goal (Moors et al., 2017) and therefore reduce the behaviour of going to the square.

*Psycho-education.* A final treatment implication of the conditioning account of grief is that it may inspire the content of psycho-education. Psycho-education about the origin of craving could change catastrophic interpretations and, accordingly, alleviate suffering. For example, a resurgence of strong craving while being on holiday would be understood as caused by a shift away from the context in which extinction learning already took place rather than as a sign that one is better off dead too because one cannot even enjoy a holiday anymore.

**Conclusion**

In the present paper, I have put forward a conditioning account of grief behaviour. I proposed that the presence of the other person functions as a desired outcome. This simple suggestion brought grief behaviour within the scope of universal learning principles. It is my hope that the current work will contribute to a better understanding of people suffering from grief and that it will facilitate the development of new diagnostic and therapeutic tools.

### **Acknowledgements**

The author declares no conflict of interest. The author is grateful to Paul Boelen, Tom Beckers, Mathilde Descheemaeker, Maarten Eisma, Dirk Hermans, Julie Krans, Sara Scheveneels, Bram Vervliet, and Jonas Zaman for interesting discussions about the topics at hand.

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## Footnotes

<sup>1</sup> It is worth mentioning that additional evidence for this idea was obtained in a new laboratory model. In a recent series of three pilot studies, I consistently found that a symbolic representation of a loved one (more precisely, the appearance of the name of this person on the computer screen) can induce cue-elicited craving. In these studies, two circles of different size functioned as cues. One circle systematically preceded the appearance of the name, while the other circle never preceded its appearance. Participants reported more longing for the loved one when shown the former cue than when shown the latter cue (Y Boddez, unpublished observations).

<sup>2</sup> Something similar was found in the three pilot studies mentioned in footnote 1. When, in a subsequent phase, both circles were repeatedly presented without the name of the loved one, participants quickly reported to no longer expect to get to see the name of the loved one. However, despite this reduction in the expectancy measure, they continued to report craving for the loved one when seeing the circle that previously preceded the name of the loved one (Y Boddez, unpublished observations).

<sup>3</sup>It is of note that a meta-analysis suggests that conditioned valence can sometimes be reduced due to CS-only presentations after the conditioning phase (be it very slowly). However, it has been argued that this is due to habituation of the liking of the CS rather than due to extinction learning (Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010).

<sup>4</sup>More anecdotally, it is of note that one may use also use the habit concept to explain the behaviour of the legendary loyal Akita dog Hachiko. His owner would commute to work by train and each evening Hachiko would go to the railway station to meet him upon his return. One day at work, his owner died and therefore did not return to the railway station. However, Hachiko kept going to the railway station, even if this did not result in the outcome of being with his owner anymore (Hachikō, n.d.).