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Five reasons to cry—FRC: a taxonomy for common antecedents of emotional crying

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Abstract
Human beings are probably the only creatures with a capacity to shed emotional tears. While prior work has mostly used data-driven approaches to identify situational antecedents of adult crying, we present a theory-based taxonomy. Assuming that crying is preceded by the frustration or satisfaction of psychological needs, we postulate that the most common antecedents of crying can be organized into five categories—that is, the Five Reasons to Cry (FRC): loneliness, impotence, overload, harmony, and media. Testing our assumptions in a retrospective study (N = 720, pre-registered) and a thirty-day electronic diary study (N = 91) showed that (i) crying episodes could be reliably assigned to the FRC, (ii) the theorized relations to frustrated/satisfied psychological needs emerged, and (iii) the categories were systematically related to subjective well-being, indicating their criterion validity. In sum, this research provides a valid taxonomy of common situational antecedents of adult emotional crying.

Keywords Emotional crying · Psychological needs · Subjective well-being · 8 DIAMONDS

Introduction

It is notable that human beings, but likely no other creatures, have a capacity to shed emotional tears (Vingerhoets et al., 2000). This exciting phenomenon has attracted attention not only in the early days of psychological research (Breuer & Freud, 1895/1957) but also in recent years (for a current review, see Bylsma et al., 2021). Specifically, understanding and categorizing the antecedents of emotional crying has been a central research topic (Vingerhoets et al., 2001). The present work aims to provide a theoretically derived taxonomy to categorize the most common antecedents of emotional crying reflecting the reasons why people are crying.

Prior work relied on data-driven approaches to establish crying taxonomies (see Table 1 for an overview). Researchers conducting prior studies building the basis for our current work either assigned participants' open response reports of their last crying episode into ad hoc categories, or they used exploratory factor analysis to identify clusters among statements describing hypothetical circumstances in which people cry. As shown in Table 1, research using factor analytical approaches resulted in two to four crying factors, whereas most open-response approaches resulted in more categories. The question arises: How many categories are needed to capture the most common triggers of emotional crying? Is it two, eight, any number in between, or even more?

From our point of view, this question cannot be answered based on any prior studies due to four shortcomings. First, most factor analytical approaches relied on the Adult Crying Inventory (ACI; Becht & Vingerhoets, 2002), which contains several items that do not include a description of a *stimulus* (e.g., "I cry when I feel sad"). If a person says, s/he cried because s/he was sad, it remains unclear whether the person was sad because s/he remembered the death of her/is grandmother, or because s/he had an argument with a friend, or because s/he was worrying about the future. Since the mere description of an emotion does not reveal the antecedent of crying, work that used the ACI is limited in this respect. Second, crying proneness scales contain rather uncommon triggers of crying, like "a group that's working harmoniously" (Denckla et al., 2014). Accordingly, these approaches contain only limited ecological validity and can

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Table 1 Chronological overview of existing crying taxonomies

Authors	Year	Approach	Proposed taxonomy
Millings et al.	2016	[a]Explorative and confirmatory factor analyses on basis of participants' ACI ratings	(1) threat to self, (2) joy, and (3) sadness
Denckla et al.	2014	[a]Explorative and confirmatory factor analyses on basis of participants' crying proneness scale ratings	(1) attachment tears, (2) societal tears, (3) sentimental/moral tears, and (4) compassionate tears
Laan et al.	2012	[a]Separation of ACI-items into two categories (no theoretical explanation provided)	(1) positive antecedents and (2) negative antecedents
Bylsma et al.	2011	Labels assigned by the authors to categorize open-response reports on crying episodes (labels were not theoretically embedded)	(1) conflict, (2) loss, (3) personal failing, (4) suffering of others, (5) positive experience, (6) physical condition, (7) mental experience, and (8) combination/other
Bylsma et al.	2008	Labels assigned by the authors to categorize open-response reports on crying episodes (labels were not theoretically embedded)	(1) conflict, (2) loss, (3) personal inadequacy, (4) witnessing suffering, (5) physical suffering, (6) psychological suffering, and (7) positive events
Scheirs & Sijtsma	2001	[a]Exploratory factor analysis on basis of ACI ratings	three-factor solution: (1) distress, (2) joy, and (3) sadness; two-factor solution: (1) negative emotions and (2) positive emotions
Vingerhoets et al.[b]	1997	Labels assigned by the authors to categorized open-response reports on crying episodes (labels were not theoretically embedded)	(1) rejection, (2) personal inadequacy (including: 'becoming the cause of other people's suffering' and 'having done something in conflict with your conscience'), (3) physical pain, injury, and psychological pain (e.g., seeing other people suffer, making people disappointed), (4) separation, (5) criticism, being rebuked, and (6) positive factor
Wagner et al.[b]	1997	Labels assigned by the authors to categorize open-response reports on crying episodes (labels were not theoretically embedded)	no taxonomy proposed, but the following antecedents were reported: (1) confrontation with death and (2) overtired, frustrated, or been criticized or humiliated by senior staff
Williams & Morris[b]	1996	[a]Exploratory factor analysis on basis of 30 antecedents of crying	(1) personal distress: (a) feeling alone or helpless, (b) being criticized or hurt, and (2) tender feelings
Kraemer & Hastrup	1986	Labels assigned by the authors to categorize open-response reports on crying episodes (labels were not theoretically embedded)	(1) being moved emotionally, (2) watching a TV program or movie, (3) death of family or friends, and (4) feeling sad or depressed
Frey et al.[b]	1983	Labels assigned by the authors to categorize open-response reports on crying episodes (labels were not theoretically embedded)	(1) interpersonal issues, (2) media matters, and (3) sad thoughts
Bindra[b]	1972	Labels assigned by the author (labels were not theoretically embedded)	(1) elation—typically associated with situations like reunion, reciprocation of love, or music, (2) dejection—often linked with separation and/or loss, and (3) anguish—frequently associated with conflict, humiliation, or failure
Young[b]	1937	Labels assigned by the author to categorize open-response reports on crying episodes (labels were not theoretically embedded)	(1) disappointment or discouragement, (2) lowered self-esteem and a sense of personal inadequacy, (3) unhappy mood, (4) organic state, (5) special events, like death of a loved one […], music or movie or sermon, and (6) laughter to the point of tears
Borgquist[b]	1906	Labels assigned by the author to categorize open-response reports on crying episodes (labels were not theoretically embedded)	(1) grief or sadness, (2) anger, and (3) joy

ACI Adult Crying Inventory

[a]based on crying proneness ratings, [b]also mentioned in the overview provided by Vingerhoets and colleagues (2001). Please note that we omit unpublished, pre-printed, and non-empirical work in this overview

hardly reveal why people *typically* cry. Third, open-response approaches hardly offered theoretical explanations for their proposed categories. Moreover, work using this approach did not examine interrater reliabilities, which makes it difficult to evaluate the proposed taxonomies. Fourth, a multivariate perspective is mostly missing in prior work. That is, no data is available to evaluate the construct or the criterion validity of the proposed taxonomies (for an exception, see Denckla et al., 2014). In line with these considerations, Bylsma et al. (2021, p. 144) stated that "[…] more psychometric research is needed to characterize better a typology of crying both in the clinical context and in the natural environment".

Given that most (if not all) prior taxonomies were developed applying *data-driven* approaches, we aim to contribute to a better understanding of emotional crying by developing a *theory-driven* taxonomy. In what follows, we first define emotional crying, then outline our theory-driven approach to categorize crying, and finally present empirical evidence for our assumptions.

Definition of emotional crying

Tears can be categorized into basal, reflex, and psycho-emotional tears (Murube, 2009). The present work is devoted to the latter phenomenon which we will refer to as (emotional) crying. Besides the shedding of tears, crying is often accompanied by vocalizations, sobbing, and certain facial expressions. As the term itself implies, emotional crying can be understood as one form of emotional expression (Vingerhoets et al., 2000).

We propose that considering theories on emotions can help to better grasp the phenomenon of emotional crying. Applying an appraisal-theory perspective seems especially promising in this context. Appraisal theories assume that episodes that involve emotions comprise the following components: (a) appraisal, (b) action tendencies, (c) somatic responses, (d) expressive behavior, and (e) emotional experiences or feelings (Moors, 2013). A confrontation with a large pit bull (stimulus) could be decomposed as follows: (a) *My life is in danger*; (b) *preparation for flight*; (c) *increased heartbeat*; (d) *eyes wide open*; and (e) *fear*. This example illustrates two important assumptions. First, the stimulus must be goal-relevant to elicit an emotion. A large pit bull is more likely relevant for the goal of remaining physically unharmed, than a Chihuahua. Second, the appraisal component is assumed to play a causal role when emotions are elicited. The appraisal "I have known the pit bull for ten years, it will not bite me" probably triggers a quite different process than the appraisal „my life is in danger". This consideration is not unique to appraisal theories but is also reflected in other emotion theories. Both, basic emotion approaches (e.g., Ekman, 1972) and social construction approaches (e.g., Harré, 1986) assume that the appraisal component has a causal role in the emergence of emotions. Even though the appraisal component is assumed to initially trigger the emotion episode, this process is by no means strictly linear ($a \rightarrow b \rightarrow \ldots \rightarrow e$), but all components are assumed to interact in a bidirectional and synchronizing manner ($a \leftrightarrow b$, $a \leftrightarrow c$, …; see Scherer & Moors, 2019, for a current review). As crying is observable by others, it could be subsumed under the behavioral component of the above-described process (see Bylsma et al., 2021, for a similar conceptualization by using the term *crying behavior*).

The appraisal-perspective provides specific guidance regarding which components of an emotion episode are suitable to serve as antecedents of crying. Given that the feeling component (e.g., "I feel sad") is assumed to result from the reflection of the other components (Scherer & Moors, 2019), it seems not qualified for that purpose. We propose that focusing on the stimulus and its appraisal is most fruitful (see Vingerhoets et al., 2001, for a discussion of this issue). The term appraisal means that a stimulus is evaluated regarding its impact on one's well-being (Scherer & Moors, 2019). Stimuli can be appraised either with regard to satisfaction or frustration of well-being (Frijda, 1986) and this evaluation can take place against different backgrounds. If current goals serve as a frame of reference, the appraisal can vary inter-individually, since current goals can be idiosyncratically very different between persons. If, on the other hand, psychological needs, like the need for relatedness (Deci & Ryan, 2000), serve as a frame of reference, the appraisals of different individuals are more similar, since it is assumed that psychological needs apply to all people (and thus vary less strongly than current goals). Aiming to establish a theory of common antecedents of human emotional crying, we suppose that a psychological need perspective is especially fruitful for our endeavor.

Psychological needs

Crying represents an *emotion expression* and emotions enter the scene when psychological needs are frustrated or satisfied (e.g., Tay & Diener, 2011). If my partner is breaking up with me, this frustrates my need for relatedness, which might be accompanied by tears of sadness. If my wife tells me that she is pregnant (and we have a desire to have children), this might be one of the strongest possible satisfactions of my need for relatedness and might be accompanied by tears of happiness. Apparently, psychological needs seem highly relevant in the context of emotional crying and we will therefore refer to them in order to substantiate our taxonomy. Further, satisfaction of psychological needs has been directly linked to better SWB and the effect seems comparable across different cultural backgrounds (e.g., Chen et al., 2015). Different research groups and scholars have dealt with psychological needs (e.g., Baumeister & Leary, 1995; Deci & Ryan,

2000; Grawe, 2004; Young et al., 2006). Even though these approaches differ regarding the specific terms used, there is significant agreement that humans have the following basic needs: *relatedness*, *autonomy*, and *competence* (see Sheldon et al., 2001 for an empirical perspective). Humans "want to feel effective in their activities (competence), to feel that their activities are self-chosen and self-endorsed (autonomy), and to feel a sense of closeness with some others (relatedness)" (Sheldon et al., 2001, p. 326). These three needs are postulated in the self-determination theory (SDT; Deci & Ryan, 2000), to which we refer to in the following.[1] In the context of crying, needs have been mostly neglected. Given their general link to emotions and to subjective well-being (Chen et al., 2015), it seems highly plausible that they are also related to crying. Next, we elaborate on how we developed our taxonomy.

Development of the taxonomy

Our theory-driven approach for the development of a taxonomy containing the *most common* triggers for adult crying consisted of four steps. First, we formulated theoretically plausible crying categories drawing on the frustration/satisfaction of psychological needs. Second, we reduced the complexity of our taxonomy by keeping the categories that were empirically most common. Third, we performed a dry run and tested whether the items of the ACI could be reliably assigned to our taxonomy. Fourth, we conducted a retrospective and a thirty-day long diary study to test our assumptions. The frustration/satisfaction of the above-mentioned needs suggested the following crying categories.

1. *Loneliness* This category represents crying due to frustrated relatedness. The following examples came to mind when we thought about tears due to relatedness frustration: (i) dispute with a friend, (ii) separation from family (e.g., homesickness), and (iii) being rejected from a relevant group or person (e.g., lovesickness). The examples cited here have in common that a desired interpersonal closeness to other people goes unfulfilled. We assume that the valence associated with this category is exclusively negative.
2. *Impotence* This category represents crying due to frustrated autonomy. The following examples came to mind when we thought about tears due to autonomy frustration: (i) confrontation with the fact that someone is seriously sick or dead, (ii) realization of one's mortality, and (iii) confrontation with helpless others. Each of these examples has a high potential to trigger the insight that humans can control their lives only to a certain extent. We assume that the valence associated with this category is exclusively negative. We assume that confrontation with impotence is most potent to elicit tears when someone we feel close to is involved; accordingly, frustrated relatedness might be relevant in the sense of a subordinate need for this category.
3. *Overload* This category represents crying due to frustrated competence. The following examples came to mind when we thought about tears due to competence frustration: (i) stress at work, (ii) self-reproach for personal failure, and (iii) worries about the future. This set of examples has in common a mismatch of situational demands and coping resources. We assume that the valence associated with this category is exclusively negative. Threatened autonomy might be relevant in the sense of subordinate needs for this category since a mismatch of skills and demands has the potential to make limited control salient.
4. *Harmony* This category represents crying due to satisfied relatedness. The following examples came to mind when we thought about tears due to relatedness satisfaction: (i) learning about a wanted pregnancy, (ii) bursting into a fit of laughter with important others, and (iii) listening to an inspiring speech. These examples have in common that a desired interpersonal closeness to other people is fulfilled. We assume that the valence associated with this category is exclusively positive.
5. *Freedom* This category represents crying due to satisfied autonomy. The following examples came to mind when we thought about tears due to autonomy satisfaction: (i) being released from jail, (ii) the end of an abusive relationship, and (iii) survival of a serious illness. Here, the examples have in common that a desired autonomy is regained. We assume that the valence associated with this category is predominantly positive. Given that all examples can be associated with a preceding frustration of autonomy, we also expect some negative valence.
6. *Success* This category represents crying due to satisfied competence. The following examples came to mind when we thought about tears due to competence satisfaction: (i) finishing one's studies, (ii) winning a competition, and (iii) getting a longed-for job. This set has in common that people feel effective in their activities. We assume that the valence associated with this category is predominantly positive. Since all examples can be associated with a preceding privation, some negative valence might be expected.

[1] It is uncertain whether self-esteem should be considered as a fourth need (Sheldon et al., 2001). In short, self-esteem means that humans want to feel as a "worthy person who is as good as anyone else rather than feeling like a 'loser'" (Sheldon et al., 2001, appendix). We assessed self-esteem in Study 1 but found high correlations with competence; thus, we decided not to refer separately to self-esteem when substantiating our taxonomy.

These six categories have in common that they *directly* affect the person who is crying. We propose that another category of crying can be theoretically derived from a psychological need perspective, which involves a more *vicarious* way of shedding tears.

7. *Media* The consumption of media/art content is part of everyday life for most individuals. It takes place via video-on-demand platforms, social networks, playing computer games, watching TV, going to the movies, reading books, magazines, newspapers, and so on. Vorderer et al. (2006) proposed that enjoyment from media consumption can result from an immediate and transient hedonic experience, e.g., when watching a funny movie, or from a satisfaction of psychological needs, such as relatedness, autonomy and competence (see also Rigby & Ryan, 2016). The latter assumption is well-examined in the context of computer games. Tamborini et al. (2010) demonstrated that satisfaction of the SDT-needs while playing explained about 50% of the variance in enjoyment (for similar results, see Oliver et al., 2016; Peng et al., 2012; and Ryan et al., 2006). Since watching movies or series is more passive in nature, it was assumed that relatedness is the most dominant need involved in this context (Rigby & Ryan, 2016). In parallel, Oatley (1999) proposed that identification with a protagonist and the possibility to vicariously experience scenarios and emotional reactions, are main motivational forces underlying fiction reading. However, some considerations and findings suggest that passive forms of media consumption also satisfy other needs than relatedness. First, it can be argued that even though passive, watching a movie or reading a book is a *voluntary* exposure to media content (Rigby & Ryan, 2016). In line, evidence suggests that binge-watching (i.e., the intensive, consecutive use of televised series) can increase perceived autonomy and well-being (Granow et al., 2018).[2] Second, current empirical evidence demonstrates that watching series is not only associated to the satisfaction of relatedness, but of all SDT-needs (Sherrick et al., 2021).

   In sum, we assume that this category is related to a satisfaction of all SDT-needs, while the strongest relations probably occur for relatedness. The following examples came to mind when we thought about tears due to confrontation with media/art: (i) watching a sad or funny movie, (ii) watching an inspiring speech on TV, and (iii) empathizing with the protagonist in a book. These examples have in common that the crying individual is mostly *vicariously* affected, by relating to or identifying with the protagonist of the consumed media/art content. We assume that the valence associated with this category is mixed as individuals can shed tears of sadness and joy in response to movies. We further assume that media/art content is able to elicit crying when it deals with topics of all other categories (e.g., rejection from someone), thus, it represents a hybrid category in this respect. Even though the topics of the other categories can be involved in media-related crying, different need relations are expected. When someone is crying because of being rejected, this should be associated with relatedness-frustration (loneliness). Crying while watching a movie about someone being rejected should be more likely related to relatedness-satisfaction (as theorized in the previous paragraph). This suggests that the media category cannot simply be subsumed under the other categories, but represents an independent reason of crying.

Study overview

We conducted a pilot study, a validity check and two empirical studies. In the pilot study, we tested whether we could detect the proposed categories empirically. In the validity check, we tested whether independent raters could use our taxonomy to reliably categorize the items of the ACI. In Study 1, participants reported on their last crying episode and we tested the reliability of our taxonomy, the prevalence of the proposed categories, and the construct and the criterion validity. In Study 2, we conducted an electronic diary study to test our assumptions in an ecologically valid way. For all studies, we report on all measures, data exclusions, and how we determined sample size. Data were analyzed using SPSS (version 26) and R (version 4.1; R Core Team, 2020) with lme4 (version 1.1.27.1; Bates et al., 2015) to perform multilevel modelling. Materials, data, codebooks and codes are available under https://osf.io/ynema/.

Pilot study

Materials and methods

The study was approved by the local ethics committee. All participants signed an informed consent form and received 1€ (approx. 1$) as compensation.

[2] However, it should not go unmentioned that binge-watching can also exert negative effects on well-being, especially when goal conflicts and feelings of guild are involved.

Procedure

The aim of the pilot study was to get a first impression of how frequently the proposed categories occur empirically. For this reason, we asked participants to describe their last crying episode in a few sentences. The study contained additional measures, which are not reported here for the sake of brevity (all measures are described in the supplemental material). The study contained one attention-check item ("please answer 'completely accurate'"). Participants were excluded if they answered it incorrectly.

Analytical strategy

The first author (rater A) assigned participants' crying episodes to one of the above-mentioned categories, to a "residual" or a "vague" category. The vague category was used when the episode was described too vaguely (e.g., "I cried"). The risual category was used when a specfic reason was mentioned but did not fall within our taxonomy (e.g., "I broke my ankle"). Items that were assigned to one of the above-mentioned categories were then rated by rater B and rater C. This procedure was held constant for all studies in this article. The ratings for the pilot study, validitiy check, Study 1, and Study 2 were performed by the same three raters.

Sample

Our sample comprised 298 participants ($M_{age} = 26.12$, $SD_{age} = 4.57$, $range_{age} = 18–40$, 254 women, 44 men, 62.80% students). A study by Horstmann et al., (2020, Study 2) served as template for sample size and sample composition (see supplements). We recruited German-speaking participants from the crowdworking platform clickworker. Data were collected in December 2020.

Results

Interrater-reliability for FRC

Fleiss' Kappa was almost perfect, $\kappa = 0.90$ (cf. Landis & Koch, 1977; see Table S1 for details).

Prevalence of the categories

Most crying episodes were overload-related (26%), followed by media (25%), loneliness (21%), impotence (13%) and harmony (4%). None of the episodes were success- or freedom-related. Three episodes fell into the residual category (1%). The vague category was used for 10% of the episodes.

Discussion

We observed a high interrater reliability when our taxonomy was used to categorize crying episodes. The pilot study revealed empirical evidence for the existence of all categories except success and freedom. Even though extraordinary success, like winning an important athletic competition, can undoubtedly trigger crying, our results suggest that such episodes occur rarely in Jane or John Doe's everyday life. In parallel, a boost in freedom that is potent enough to trigger tears seems to occur seldomly. With this in mind, we decided to reduce the complexity of our model to a taxonomy of *common* crying triggers by dropping success and freedom. Hence, we assumed the Five Reasons to Cry (FRC) are sufficient to capture the most common crying antecedents. A model that takes all triggers of crying into account would certainly be desirable but is not feasible for at least two reasons. First, a model that refers to *common* crying triggers can be empirically tested more stringently than a model that also considers *rare* crying triggers; that is, frequent triggers can be sampled without requiring participants to recall crying episodes that occurred months or years ago. Second, a limitation to common triggers increases the ecological validity of our model. In a next step, we tested whether independent raters could use our taxonomy to reliably categorize the items of the ACI.

Validity check

Materials and methods

Procedure

Three independent raters used the FRC to categorize the items of the ACI. The ACI is "[p]robably the most extensive list […] which contains a total of 55 negative and positive situations and emotions that are more or less likely to elicit tears in several cultures" (Vingerhoets et al., 2001, pp. 80–81). A priori, we excluded seventeen items as they did not contain an appraisable stimulus or were formulated ambiguously (see last row in Table 2).

Measures

The raters were familiar with the conceptualization of the FRC. They assigned the 38 remaining items to one of the FRC or to a residual category.

Table 2 Results of the validity check—assignment of ACI items to the FRC

1) Loneliness	**2) Impotence**
… when I say goodbye to loved ones	… at funerals
… over loss of love relationship	… when a tragic event happens
… when involved in quarrels/conflicts	… when I realize my own vulnerability/mortality
… having been humiliated/insulted	… when I attend/witness memorial meetings
… when I experience opposition from someone else	… because of problems of someone else
… when someone criticizes or lectures me	… when I see others suffering
… when I feel rejected by others	… out of pity for others
	… when I watch other people crying
3) Overload	**4) Harmony**
… when things do not go well with work/studies	… when making love
… when I do not succeed in getting things together	… when someone does something very special for me/someone
	… at weddings
	… sometimes I laugh so hard I cry
	… when practicing religious activities
	… when I am reuniting with friends/family members
	… I can be moved to tears by beauty of natural scenes
	… when I hear national anthem or see national flag rise
5) Media	**Residual category**
… when I hear a happy song	… deliberately to make someone feel sorry for me
… when I hear a sad song	… when I have achieved success
… while reading poetry	… when I experience physical pain
… film/TV happy ending	… when I am ill [not seriously]
… when reading certain books	
… in response to beauty of arts	
… when watching awards ceremony at sporting event	
… while I watch sad film/TV	
… when watching/hearing an admired person	
Excluded	
Stimulus missing:	**Too ambiguous:**
… when I feel frightened	… when things don't go as I want them to
… when I feel sad	… when I am in a blind-alley situation
… when I feel angry	… when talking with therapist/doctor
… when I am in despair	… if I remember sad things that happened to me
… when I feel very happy	… happy memories
… when I feel powerless	… when I experience painful memories
… when feeling self-pity	… when I experience disgust or contempt for something/one
… when I feel relieve	
… when I feel ashamed	
… when I feel guilty	

Analytical strategy

Fleiss' Kappa served as indicator of interrater reliablity.

Results and discussion

Fleiss' Kappa was almost perfect, $\kappa = 0.87$ (Landis & Koch, 1977). Nine items fell into media, eight into impotence, eight into harmony, seven into loneliness, and two into overload (Table 2). Hence, it was possible to reliably assign most of the ACI items to one of our proposed categories. In sum, we found further evidence in favor of the FRC.

For an additional evaluation of our taxonomy's construct validity, we measured *situation characteristics* in our next study. Since we did not introduce the concept so far, we would like to do so at this point. By situation characteristics we refer to an elementary evaluation or interpretation of situations with regard to psychologically relevant features (Rauthmann et al., 2014). In contrast, *situation cues* are conceptualized as physical stimuli that can be objectively qualified (e.g., who is present in the situation? cf. Rauthmann et al., 2014). The assessment of situation characteristics is especially fruitful for our endeavor as this allows us to capture an elementary evaluation of crying episodes. To better grasp the concept of situation characteristics, an analogy to personality traits can be drawn. Just as personality traits help to describe relevant person characteristics (e.g., "Peter is extraverted"), situation characteristics are used to characterize relevant features of a situation (e.g., "the situation was sexually charged"). According to a framework proposed by Rauthmann and colleagues (2014) eight situation

characteristic dimensions—the so-called situational 8 DIAMONDS—can be differentiated: Duty, Intellect, Adversity, Mating, pOsitivity, Negativity, Deception and Sociality. The basic idea underlying the DIAMONDS model is that individuals evaluate situations in a capacity-saving way with regard to underlying qualities that have proven to be relevant (Rauthmann et al., 2014).

Study 1

Materials and methods

The study was approved by the local ethics committee. All participants signed an informed consent form and received 1€ (approx. 1$) as compensation.

Procedure

We asked participants to report on their last crying episode and to rate it on several scales. Further, participants themselves assigned their crying episodes to one of the FRC. For exploratory analyses, we asked participants whether another person (or animal) was involved in their crying episode, and we instructed participants to describe and rate one non-crying episode of the previous day. Finally, we assessed subjective well-being (SWB).

The study was pre-registered under https://osf.io/w9d38. Hypotheses are summarized in Table 3. The study contained two attention-check items (e.g., "please answer 'not accurate at all'"). Participants were excluded from the study if they answered one of these items incorrectly.

Measures and instructions

We instructed participants to mention a stimulus when describing their last crying episode and gave various examples (e.g., "I saw a touching movie"). To prevent priming effects, we gave two examples for each of the FRC. Participants were able to move to the next survey page after 20 s had elapsed.

We formulated 15 items to capture the FRC (three items per category, see Table S2). Participants were instructed to choose one of the given reasons that best described their crying episode. Participants could also choose an open-response answer, in case none of our items was applicable.

We used the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS—daily measures) to assess need satisfaction/frustration for relatedness, autonomy, and competence in the crying episode (Mabbe et al., 2018).[3] A sample item for autonomy satisfaction reads, "I felt a sense of choice and freedom in the things I did". Each need was measured with two frustration and two satisfaction items (1 = "not accurate at all", 8 = "completely accurate").

We used the S8-I, an ultra-brief questionnaire, to assess the situation characteristics of the crying episodes (Rauthmann & Sherman, 2018). According to a framework proposed by Rauthmann and colleagues (2014), eight situation characteristic dimensions—the so-called situational 8 DIAMONDS—can be differentiated. The item for Duty was *work had to be done*; for Intellect, *deep thinking was required*; for Adversity, *someone was threatened, accused, or criticized*; for Mating, *potential sexual or romantic partners were present*, for pOsitivity, *the situation was pleasant*; for Negativity, *the situation contained negative feelings* (*e.g., stress, anxiety, guilt,* etc.); for Deception, *someone was deceived*; and for Sociality, *social interaction was possible or required*. Responses were given on an 8-point rating scale (1 = "not accurate at all", 8 = "completely accurate"). The scale was applied to get additional information regarding the construct validity of the FRC.

Participants reported how long they had cried (in minutes) and how intensely (1 = "little intense", 7 = "very intense"; Becht & Vingerhoets, 2002).

We used the intensity subscale from the Multidimensional Emotion Questionnaire (MEQ) to assess emotion intensity in the crying episode (Klonsky et al., 2019). The scale measures ten emotions, each with one item—namely, happy, inspired, enthusiastic, proud, excited, sad, afraid, anxious, ashamed, and angry (1 = "very weak", 8 = "very strong").

The WHO-5 well-being index (WHO-5) from Topp et al. (2015) was used to assess the affective/eudaimonic component of SWB with 5 items. If participants reported a crying episode within the past four weeks, they were instructed to rate the WHO-5 for the period since crying ($\omega = 0.92$). Respondents whose crying episode was more than one month ago were instructed to relate the WHO-5 items to the last two weeks ($\omega = 0.92$). A sample item reads "I have felt cheerful in good spirits" (1 = "at no time", 8 = "all of the time").

Analytical strategy

First, we calculated Fleiss' Kappa. Second, we examined the prevalence of the categories with relative frequencies. Third, we tested the construct validity of our taxonomy by conducting the following analyses: We computed a multinomial logistic regression (MLR) predicting the FRC by need frustration/satisfaction. MLR is an extension of binary logistic regression used when the dependent variable consists of more than two unordered categories. One category is set as a baseline category, and the coefficients

[3] We used four items from Thewissen et al. (2008) to measure self-esteem satisfaction/frustration.

Table 3 Overview of preregistered hypotheses, research questions, and exploratory analyses in Study 1

Hypotheses	
1)	Do the categories differ with respect to psychological needs? In contrast to media …
	1a) …loneliness is characterized by higher relatedness-frustration (lower relatedness-satisfaction)
	1b) …impotence is characterized by higher autonomy-frustration (lower autonomy-satisfaction) and higher relatedness-frustration (lower relatedness-satisfaction)
	1c) …overload is characterized by higher competence-frustration (lower competence-satisfaction) and higher autonomy-frustration (lower autonomy-satisfaction)
	1d) …harmony is characterized by higher relatedness-satisfaction (lower relatedness-frustration)
2)	Do the categories differ with respect to situation characteristics? In contrast to media …
	2a) …loneliness is characterized by higher adversity, mating, negativity, sociality, and lower positivity
	2b) …impotence is characterized by lower positivity as well as higher negativity and sociality
	2c) …overload is characterized by higher duty and negativity as well as lower positivity
	2d) …harmony is characterized by higher mating, positivity, and sociality
3)	Do the categories differ with respect to emotion intensity? In contrast to media …
	3a) …loneliness is characterized by lower happiness and higher sadness
	3b) …impotence is characterized by lower happiness and higher sadness
	3c) …overload is characterized by lower happiness and higher sadness
	3d) …harmony is characterized by higher happiness and lower sadness
4)	Do the categories differ with respect to crying characteristics (i.e., duration and intensity of crying)?
	4a) crying duration is longer for loneliness, impotence, and overload compared to media (no difference between harmony and media)
	4b) crying is more intense for loneliness, impotence, and overload compared to media (no difference between harmony and media)
5)	Do the categories differ with respect to their relation to subjective well-being?
	5a) the categories differ with respect to their relation with subjective well-being
	5b) subjective well-being is higher for individuals who report a harmony-related crying episode comparted to individuals who report a media-related crying episode (within the past 4 weeks)
	5c) subjective well-being is higher for individuals who report a media-related crying episode compared to individuals who report a loneliness-, impotence- and overload-related crying episode (within the past four weeks)
6)	Do crying- and non-crying-episodes differ with respect to situation characteristics?
	6a) crying-episodes are characterized by lower duty and positivity as well as higher intellect, adversity, mating, and negativity
Research Questions (no hypotheses)	
7)	Can raters reliably assign participants' crying-reports' to the proposed categories?
8)	Can participants assign their crying-episode to one of our proposed categories, and does our rating match participants' ratings?
Further analyses	
	Are there further emotion-differences between the crying-categories?
	Are there further emotion- and need-differences between non-crying- and crying-episodes?
	How often is the "other-category" used when participants use the "Five-Reasons-to-Cry inventory"?

As we found high correlations between self-esteem and competence empirically, we decided not to refer to self-esteem when substantiating our taxonomy (see also Footnote 1). Accordingly, hypotheses related to self-esteem are not depicted in this table. Please note that alternative labels were used for three of the crying categories in the pre-registration (conflict instead of loneliness, death instead of impotence, and stress instead of overload)

are the expected change in the logit for each unit change in the predictor. Further, we computed MLRs predicting the FRC by the 8 DIAMONDS and by emotion intensity. In addition, we used univariate ANOVAs to test whether the FRC differed with respect to crying characteristics. Fourth, we tested criterion validity conducting a univariate ANOVA to test whether the FRC differed with respect to SWB.

Sample

We used G*Power to determine the sample size (Faul et al., 2009). We conducted the power analysis for a test with structural similarities to multinomial regressions. We determined sample size for a MANOVA with five groups (i.e., FRC), 8 response variables (i.e., 8 DIAMONDS), a power of $(1 - \beta) = 0.95$, $\alpha = 0.001$, and $f^2 = 0.02$ (small

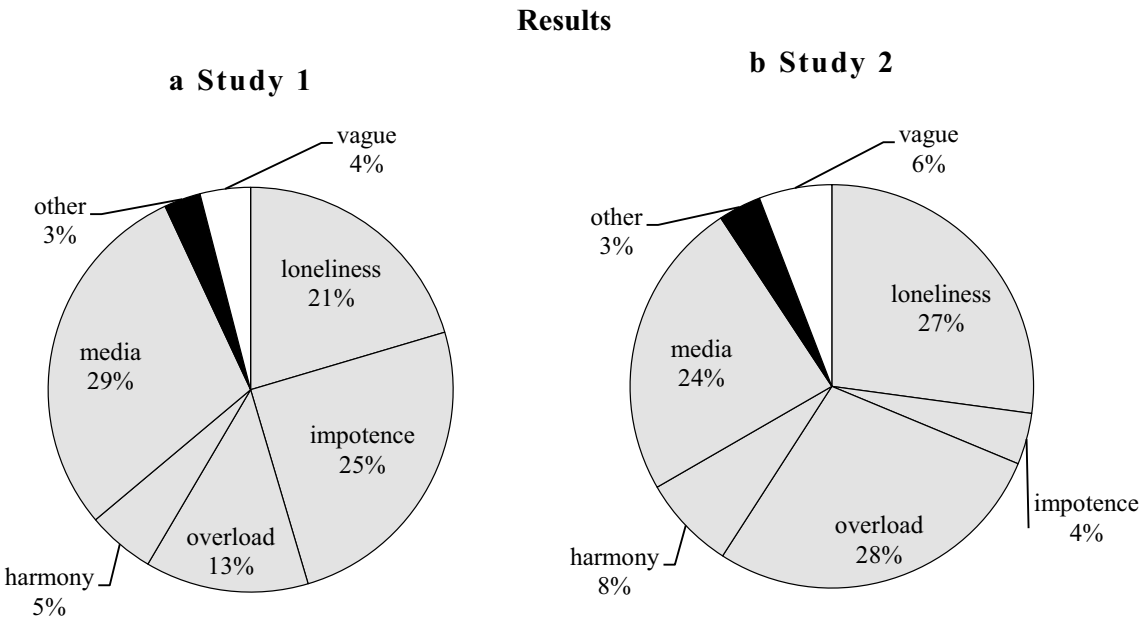

Fig. 1 Prevalence of the FRC for **a** Study 1 and **b** Study 2

effect). This resulted in a required sample size of $N = 720$. Our sample comprised $N = 720$ participants ($M_{age} = 39.31$, $SD_{age} = 12.63$, $range_{age} = 18–85$,[4] 301 women, 418 men, 1 non-binary, 13% students). We recruited German-speaking participants from the crowdworking platform clickworker. Data were collected in February/March 2021.

Results

Prevalence and reliability

Most crying episodes were media-related, followed by impotence, loneliness, overload, and harmony (Fig. 1a). The residual (other) category was small. Only 4% of the episodes could not be assigned due to inaccurate description (vague). Fleiss' Kappa was almost perfect, $\kappa = 0.87$. Participants categorized their crying episode using one of our 15 items in 93.7% of all cases. Only in 6.3% of the cases was the open response option chosen. The interrater reliability between participants' ratings and the ratings of the three independent raters was substantial, $\kappa = 0.78$.

Differences in psychological needs for FRC

Five of the six need measures significantly predicted the FRC (Fig. 2, Tables 4, and 5; alpha-level $\alpha = 0.001$[5]). We did not find a significant effect for competence-satisfaction.

We chose media as the reference category because it represents the broadest category thematically, i.e., media can be considered as a hybrid category in which the topics of the other categories can occur.

Media was characterized by medium satisfaction and low frustration of all needs. Descriptively, a parallel but more pronounced pattern was observed for harmony. The main findings were that (i) loneliness was associated with relatedness-frustration; (ii) impotence was associated with autonomy-frustration; (iii) overload was associated with competence-frustration, and (iv) harmony was associated with relatedness-satisfaction. A detailed discussion of all findings is provided in the discussion section.

We tested whether a focus on three needs was sufficient by assessing self-esteem as an additional need. Since correlations between self-esteem- and competence-satisfaction ($r = 0.76$) as well as between self-esteem- and competence-frustration ($r = 0.75$) were very high, we concluded that considering relatedness, autonomy, and competence was sufficient.

[4] Two participants did not indicate their age.

[5] α-level was set to $\alpha = .001$ to adjust for multiple testing; see also power analysis and pre-registration. Note that we referred to confidence intervals when interpreting the regression coefficients.

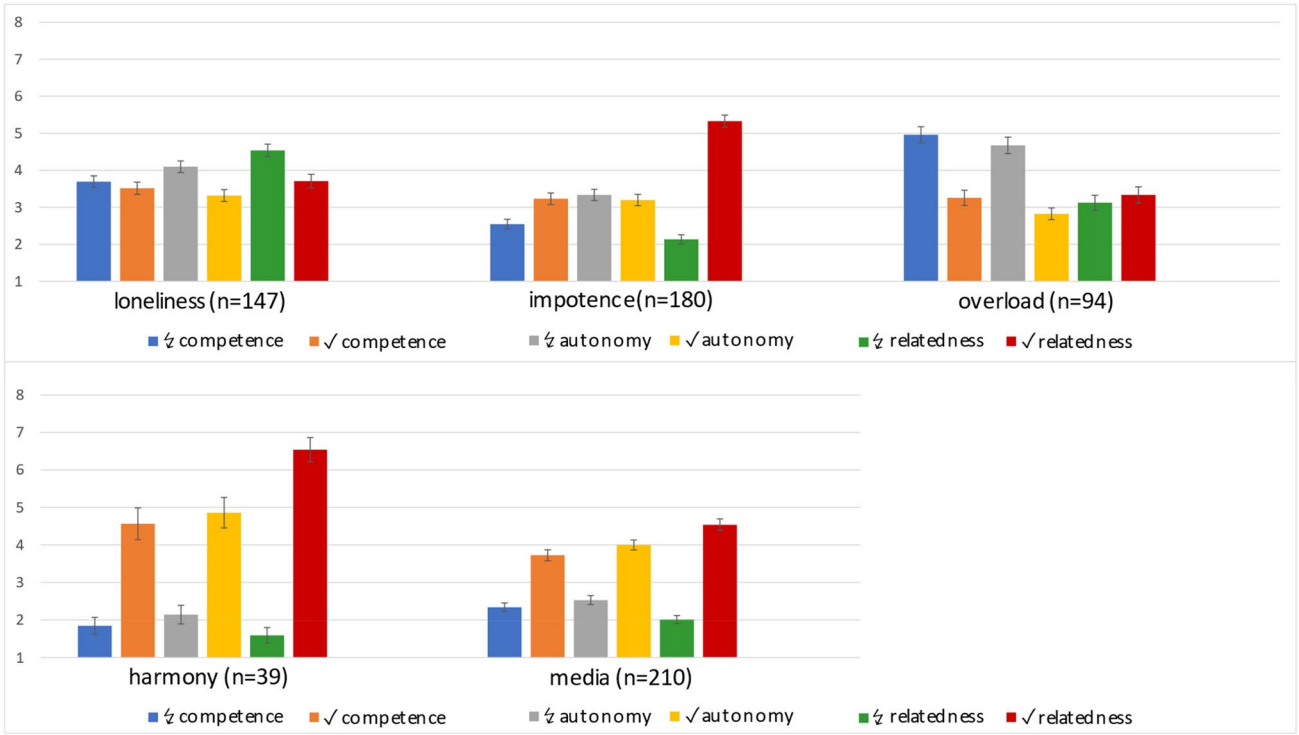

Fig. 2 Mean need frustration/satisfaction scores for FRC. ↯ = frustration of psychological need; ✓ = satisfaction of psychological need. Error-bars denote ± 1 SE

Table 4 Likelihood ratio tests for the multinomial regression predicting FRC by needs

	− 2 Log Likelihood of Reduced Model	χ^2	*df*	*p*
Competence frustration	1545.36	56.98	4	< 0.001
Competence satisfaction	1495.89	7.51	4	0.111
Autonomy frustration	1520.10	31.72	4	< 0.001
Autonomy satisfaction	1516.27	27.90	4	< 0.001
Relatedness frustration	1584.40	96.02	4	< 0.001
Relatedness satisfaction	1550.10	61.72	4	< 0.001
Intercept	1542.82	54.45	4	< 0.001

Model fit information: $\chi^2(24) = 428.05$, $p < 0.001$; Negelkerke's $R^2 = 50$

Differences in 8 DIAMONDS for FRC

Five of the 8 DIAMONDS significantly predicted the FRC, while intellect, adversity, and deception were not significant predictors (Fig. 3, Tables 6, and 7). Media served as the reference category and was characterized by low duty, adversity, mating, and deception, as well as by medium intellect, positivity, and negativity. The main findings were that (i) loneliness was associated with low positivity as well as high sociality, mating, and negativity; (ii) impotence was characterized by high sociality as well as low mating and positivity; (iii) overload was related to high duty and negativity as well as to low positivity; and (iv) harmony was associated with high positivity and sociality.

Differences in emotion intensity for FRC

Examining the relations between the predictors revealed high correlations between sad-happy ($r = -0.68$), sad-enthusiastic ($r = -0.67$), enthusiastic-happy ($r = 0.84$), enthusiastic-inspired ($r = 0.70$), and happy-inspired ($r = 0.65$). To circumvent problems related to multicollinearity, we omitted sad, enthusiastic, and inspired as predictors.

Three of the seven remaining emotions significantly predicted the FRC. Ashamed was close to significance, while the effects for afraid, excited, and proud were not significant (see Tables S3 and S4). Media served as the reference category and was characterized by low-to-medium intensity of all emotions, but with a medium intensity of sadness. The main findings were that (i) loneliness was associated with low happiness as well high anger and anxiety; (ii) impotence was characterized by high anxiety as well as low happiness and shame; (iii) overload was related to low happiness as well as to high anger and anxiety; and (iv) harmony was associated with high happiness.

Table 5 Parameter estimates for the multinomial regression predicting FRC by needs

	B	SE	Wald	df	p	exp(B)	95% CI for exp(B)	
							Lower bound	Upper bound
Loneliness								
Competence frustration	− 0.03	0.09	0.11	1	0.740	0.97	0.82	1.15
Competence satisfaction	− 0.06	0.09	0.54	1	0.462	0.94	0.79	1.11
Autonomy frustration	0.27	0.08	10.48	1	0.001	1.31	1.11	1.55
Autonomy satisfaction	− 0.19	0.09	4.27	1	0.039	0.82	0.69	0.99
Relatedness frustration	0.57	0.08	48.68	1	< 0.001	1.77	1.51	2.08
Relatedness satisfaction	− 0.09	0.07	1.80	1	0.180	0.91	0.80	1.04
Intercept	− 1.65	0.37	19.86	1	< 0.001			
Impotence								
Competence frustration	− 0.03	0.08	0.15	1	0.700	0.97	0.83	1.14
Competence satisfaction	− 0.08	0.07	1.25	1	0.263	0.92	0.81	1.06
Autonomy frustration	0.29	0.07	15.94	1	< 0.001	1.34	1.16	1.54
Autonomy satisfaction	− 0.30	0.08	15.43	1	< 0.001	0.74	0.64	0.86
Relatedness frustration	0.02	0.08	0.06	1	0.802	1.02	0.87	1.20
Relatedness satisfaction	0.25	0.05	21.10	1	< 0.001	1.28	1.15	1.42
Intercept	− 0.84	0.33	6.39	1	0.011			
Overload								
Competence frustration	0.53	0.09	32.33	1	< 0.001	1.69	1.41	2.03
Competence satisfaction	0.19	0.11	3.06	1	0.080	1.21	0.98	1.49
Autonomy frustration	0.40	0.09	18.25	1	< 0.001	1.49	1.24	1.78
Autonomy satisfaction	− 0.49	0.12	16.21	1	< 0.001	0.61	0.48	0.78
Relatedness frustration	− 0.04	0.09	0.15	1	0.695	0.96	0.80	1.16
Relatedness satisfaction	− 0.19	0.08	5.38	1	0.020	0.83	0.71	0.97
Intercept	− 2.28	0.47	23.12	1	< 0.001			
Harmony								
Competence frustration	− 0.10	0.16	0.40	1	0.526	0.90	0.65	1.24
Competence satisfaction	0.02	0.11	0.02	1	0.882	1.02	0.83	1.25
Autonomy frustration	− 0.12	0.13	0.85	1	0.356	0.88	0.68	1.15
Autonomy satisfaction	0.01	0.12	0.02	1	0.902	1.01	0.81	1.28
Relatedness frustration	− 0.03	0.17	0.03	1	0.872	0.97	0.69	1.37
Relatedness satisfaction	0.39	0.10	14.73	1	< 0.001	1.48	1.21	1.82
Intercept	− 3.47	0.74	21.77	1	< 0.001			

SE standard error, *CI* confidence interval

Differences in crying characteristics for FRC

Crying duration significantly differed between the FRC, $F(4,665) = 10.51$. $p < 0.001$. $\eta_p^2 = 0.06$. A planned contrast revealed that crying duration was longer in loneliness, impotence, and overload compared to harmony and media, $t(665) = 4.91$, $p < 0.001$, $r = 0.19$, |MD| = 9.66, 95% CI [5.79; 13.53] (Fig. 4a). Crying intensity significantly differed between the FRC, $F(4, 665) = 18.61$. $p < 0.001$. $\eta_p^2 = 0.10$. A planned contrast revealed that crying intensity was higher in loneliness, impotence, and overload compared to harmony and media, $t(665) = 6.53$, $p < 0.001$, $r = 0.25$, |MD|= 1.06, 95% CI [0.74; 1.38] (Fig. 4b).

Differences in SWB for FRC

Subjective well-being significantly differed between FRC, $F(4, 493) = 13.63$, $p < 0.001$, $\eta_p^2 = 0.10$ (Table 8). A planned contrast revealed that SWB was lower in loneliness, impotence, and overload compared to media, $t(493) = 4.33$, $p < 0.001$, $r = 0.19$, |MD|= 0.66, 95% CI [0.36; 0.96]. A second contrast revealed that SWB was higher for harmony than for media, $t(493) = 4.10$, $p < 001$, $r = 0.18$, |MD|= 1.16, 95% CI [0.61; 1.72].

Addition analyses

To maintain brevity of this article, we present additional evidence in the supplemental material. This comprises (i)

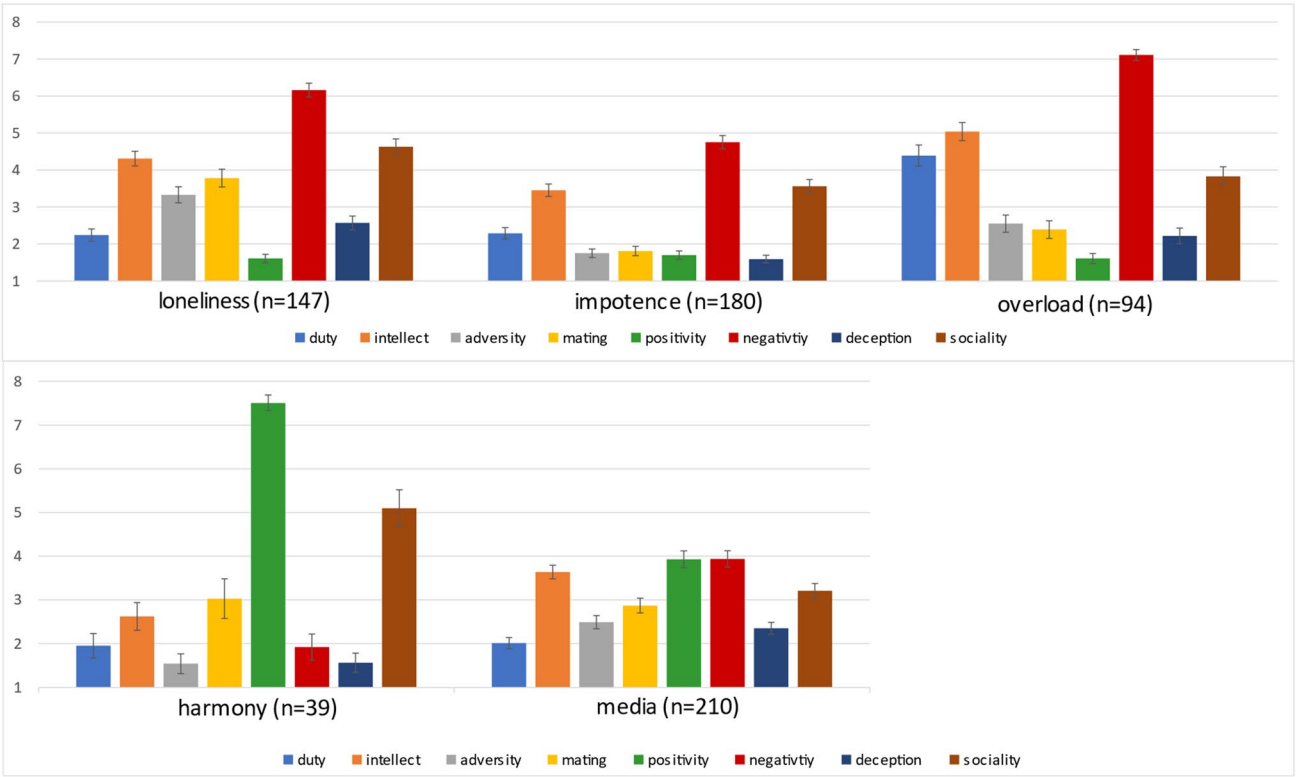

Fig. 3 Mean 8 DIAMONDS scores for FRC. Error-bars denote ± 1 SE

Table 6 Likelihood ratio tests for the multinomial regression predicting FRC by 8 DIAMONDS

	− 2 Log Likelihood of Reduced Model	χ^2	*df*	*p*
Duty	1379.07	84.87	4	< 0.001
Intellect	1306.137	11.93	4	0.018
Adversity	1312.40	18.20	4	0.001
Mating	1331.95	37.75	4	< 0.001
Positivity	1452.03	157.83	4	< 0.001
Negativity	1349.25	55.05	4	< 0.001
Deception	1305.20	11.01	4	0.027
Sociality	1324.73	30.53	4	< 0.001
Intercept	1438.22	144.02	4	< 0.001

Model fit information: $\chi^2(32) = 578.20$. $p < .001$; Negelkerke's $R^2 = .61$.

a language analysis of the FRC, (ii) analysis of whether another creature was involved in the crying episodes, and (iii) whether and how crying and non-crying episodes differed.

Discussion

Is our taxonomy sufficiently comprehensive and reliable?

We found that participants mostly relied on our categories to assign their crying episodes. Only in 6.3% of the cases was the open-response option used. The interrater reliability between participants' ratings and the ratings of the three raters was substantial. This suggests that our taxonomy covers the most common antecedents of crying and legitimizes the decision to drop 'success' and 'freedom' for the sake of parsimony and ecological validity.

Is our taxonomy construct-valid?

One crucial aspect of the study was to test the relations between the FRC and psychological needs. We found evidence in favor of our theoretical considerations. Focusing on the most dominant effects within each category (i.e., highest odds ratios), we found the following relations. Contrasted against media, loneliness was characterized by higher relatedness-frustration. Impotence was related to higher autonomy-frustration. Overload was associated with a higher competence-frustration. Harmony was characterized

Table 7 Parameter estimates for the multinomial regression predicting FRC by 8 DIAMONDS

	B	*SE*	*Wald*	*df*	*p*	*exp(B)*	*95% CI for exp(B)*	
							Lower Bound	*Upper Bound*
Loneliness								
Duty	0.12	0.08	2.31	1	0.128	1.13	0.97	1.33
Intellect	0.01	0.06	0.02	1	0.883	1.01	0.90	1.13
Adversity	− 0.00	0.07	0.00	1	0.987	1.00	0.88	1.14
Mating	0.17	0.06	10.09	1	0.001	1.19	1.07	1.32
Positivity	− 0.54	0.09	37.85	1	< 0.001	0.59	0.49	0.69
Negativity	0.16	0.06	6.63	1	0.010	1.17	1.04	1.32
Deception	− 0.09	0.07	1.60	1	0.207	0.91	0.79	1.05
Sociality	0.18	0.06	9.31	1	0.002	1.20	1.07	1.34
Intercept	− 1.18	0.43	7.41	1	0.006			
Impotence								
Duty	0.36	0.08	21.67	1	< 0.001	1.43	1.23	1.67
Intellect	− 0.03	0.06	0.36	1	0.551	0.97	0.87	1.08
Adversity	− 0.24	0.08	9.78	1	0.002	0.79	0.68	0.92
Mating	− 0.16	0.07	6.18	1	0.013	0.86	0.76	0.97
Positivity	− 0.47	0.07	48.05	1	< 0.001	0.63	0.55	0.71
Negativity	− 0.01	0.05	0.07	1	0.791	0.99	0.89	1.09
Deception	− 0.24	0.09	7.69	1	0.006	0.79	0.67	0.93
Sociality	0.16	0.06	8.68	1	0.003	1.18	1.06	1.31
Intercept	1.28	0.36	12.74	1	< 0.001			
Overload								
Duty	0.62	0.08	54.19	1	< 0.001	1.86	1.58	2.19
Intellect	0.18	0.07	6.27	1	0.012	1.20	1.04	1.38
Adversity	− 0.22	0.09	6.32	1	0.012	0.81	0.68	0.95
Mating	− 0.04	0.07	0.33	1	0.564	0.96	0.83	1.11
Positivity	− 0.38	0.11	11.23	1	0.001	0.68	0.55	0.85
Negativity	0.57	0.10	31.13	1	< 0.001	1.77	1.45	2.16
Deception	− 0.24	0.09	6.84	1	0.009	0.79	0.66	0.94
Sociality	0.01	0.07	0.02	1	0.896	1.01	0.88	1.16
Intercept	− 4.60	0.79	33.83	1	< 0.001			
Harmony								
Duty	0.09	0.14	0.41	1	0.524	1.09	0.83	1.45
Intellect	− 0.13	0.12	1.19	1	0.275	0.88	0.70	1.11
Adversity	− 0.12	0.19	0.39	1	0.532	0.89	0.62	1.29
Mating	− 0.07	0.09	0.66	1	0.416	0.93	0.78	1.11
Positivity	0.71	0.19	14.61	1	< 0.001	2.04	1.41	2.93
Negativity	− 0.07	0.15	0.18	1	0.668	0.94	0.69	1.26
Deception	− 0.02	0.20	0.01	1	0.935	0.98	0.67	1.45
Sociality	0.33	0.09	14.63	1	< 0.001	1.39	1.17	1.65
Intercept	− 6.58	1.53	18.42	1	< 0.001			

SE standard error, *CI* Confidence Interval

by higher relatedness-satisfaction (all effects consistent with pre-registration). We will discuss the detailed results for each category in the following paragraphs.

Loneliness was additionally characterized by higher autonomy-frustration and by lower autonomy-satisfaction (inconsistent with pre-registration). Although not expected, a lack of influence seems plausible for that category. While we did not find significantly lower relatedness-satisfaction in loneliness (inconsistent with pre-registration), we found the expected pattern on a descriptive level.

Impotence was further characterized by lower autonomy-satisfaction (consistent with pre-registration). We found neither higher relatedness-frustration nor lower relatedness-satisfaction (inconsistent with pre-registration). In contrast,

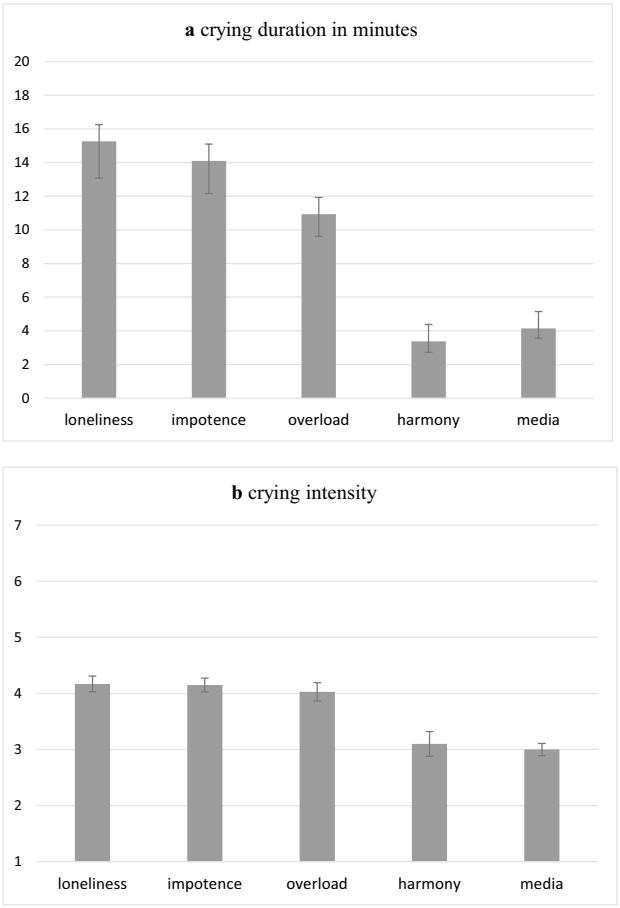

Fig. 4 Mean scores of the crying characteristics for the FRC. Higher scores indicate **a** longer crying and **b** more intense crying. Error-bars denote ± 1 SE

Table 8 Descriptive statistics for subjective well-being depending on the antecedent of crying

	M	*SE*	*N*
Loneliness	4.07	0.14	111
Impotence	3.96	0.17	106
Overload	3.71	0.17	76
Harmony	5.74	0.28	37
Media	4.57	0.12	168

As pre-registered, only participants who cried within the past four weeks were considered for this analysis (total $N = 498$)

impotence was associated with *higher* relatedness-satisfaction. One explanation could be that impotence is associated with frustrated relatedness in the short term, but not in the long term. The death of a friend might initially frustrate relatedness, but social rituals, such as condolence visits and funeral services, may outweigh this initial frustration.

Overload was additionally associated with higher autonomy frustration and lower autonomy satisfaction (consistent with pre-registration). While we found the expected effect for lower competence satisfaction only on a descriptive level, we unexpectedly found lower relatedness satisfaction (inconsistent with pre-registration). Furthermore, harmony was related to lower relatedness-frustration only on a descriptive level (inconsistent with pre-registration).

When summing up the relations of the FRC to psychological needs, we admit that the results do not support all our predictions. Most strikingly, we found *higher* relatedness-satisfaction in impotence; however, we think it is important to consider the following deliberations. First, regarding the most dominant relations within each category, we found that loneliness was characterized by higher relatedness-frustration, impotence by higher autonomy-frustration, overload by higher competence-frustration and harmony by higher relatedness-satisfaction (all observed primary relations are consistent with pre-registration). Second, even though we observed some results that we did not predict and in turn did not observe some of the predicted results, these findings do not debunk our theorizing in general. Of course, some aspects of our model do need to be revised.

The results for the 8 DIAMONDS revealed further evidence in favor of our crying categories: Loneliness was characterized by higher mating, negativity and sociality, and lower positivity (consistent with pre-registration). Adversity did not predict loneliness (inconsistent with pre-registration), but the assumed pattern could be observed descriptively. We found lower positivity and higher sociality for impotence (consistent with pre-registration), but we did not observe significantly higher negativity (inconsistent with pre-registration). At least on a descriptive level, negativity was higher in impotence compared to media, and the analysis further suggested that impotence was characterized by lower mating and higher duty (inconsistent with pre-registration). Lower mating does not conflict with our conceptualization of the category, however, the duty-effect is puzzling and needs further commentary. Looking at the mean scores, it becomes apparent that duty was actually a bit higher in impotence compared to media. Given the small standard-errors, this difference was statistically significant. Practically, the duty-effect seems negligible. For overload, duty and negativity were higher than for media, while positivity was lower (consistent with pre-registration). Harmony was characterized by higher positivity and sociality (consistent with pre-registration); however, we did not find the proposed effect for higher mating. This suggests that harmony-related crying more often involves friends or family members than romantic partners.

We found that crying duration and intensity were longer/higher for loneliness, impotence, and overload compared to harmony and media (consistent with pre-registration). The following explanations might be feasible in this context. First, emotional states might be much easier to regulate when

triggered by media. One could, for example, tell oneself that it was 'just a movie'. Second, longer and more intense crying in the three aversive categories might be explained by the principal 'bad is stronger than good' (Baumeister et al., 2001). Assuming that negative events and information have a stronger influence on people than do positive ones might explain the observed difference between harmony and the three aversive categories.

We also examined the FRC with regard to emotion intensity. We found lower happiness in loneliness, impotence, and overload compared to media and higher happiness in harmony (consistent with pre-registration). Given the restrictions due to multicollinearity, we could not test the predicted effects for sadness. On a descriptive level, the expected pattern emerged. We observed interesting exploratory findings. Loneliness was characterized by higher anger and anxiousness, impotence was related to lower shame and higher anxiousness, and overload was characterized by higher anger and anxiousness. In sum, the observed effects for emotion intensity seem reasonable and provide further evidence for the soundness of the FRC.

Does our taxonomy possess criterion validity?

While prior research could not reveal a clear picture concerning the relation between crying and SWB (summarized in Barthelmäs & Keller, 2021), the present findings demonstrate that the reason that triggers the crying qualifies that relation. As expected, SWB was lower when crying was related to loneliness, impotence, and overload (compared to media). Furthermore, SWB was higher when crying was harmony-related. This suggests that our taxonomy possesses criterion validity.

Limitations

We provided respondents with forced-choice options to categorize their crying episodes. Allowing for the selection of multiple response options will be a meaningful extension of this line of research and we should be implemented in next generation of research. Further, given that participants provided retrospective recalls of their last crying episodes, our data are at risk to be influenced by recall biases.

Study 2

We therefore report on findings of an electronic diary study, in which participants reported on their affect and arousal state every evening across thirty consecutive days. If participants reported that they had cried during the day, they were instructed to provide information about that episode. Given the retrospective design of Study 1, we tried in Study 2 to get closer to the actual event of crying.

Materials and methods

The study was approved by the local ethics committee. All participants signed an informed consent form. As compensation, participants received course credit or had the chance to win one of 20 Amazon vouchers worth 10€ (approx. 10$). This study's design and its analysis were not pre-registered.

Procedure

We used the *Telegram-Survey-Bot* to conduct the electronic diary study (Barthelmäs et al., 2021). The software is freely available under https://github.com/Raze97/Telegram-Survey-Bot. Participants used their private smartphone to participate. They were instructed to install the messenger app *Telegram* and to add a study-specific chatbot-account to their contact list. Android and iOS users could participate. The software provided survey links once a day at 18:00. Participants could complete the survey until 12:00 the next day.

Measures

We asked participants to rate their affective state every evening on the underlying core dimensions, i.e., affect and arousal. Specifically, we applied Self-Assessment Manikins (SAMs), which is a commonly used and validated strategy to assess affect and arousal in an efficient way (Bradley & Lang, 1994).

When they had cried during the day, we instructed participants to rate the episode regarding the 8 DIAMONDS (Rauthmann & Sherman, 2018), emotion intensity (Klonsky et al., 2019), and crying characteristics (Becht & Vingerhoets., 2002). To make participation via smartphone user-friendly, we used a 5-point Likert scale for all items that could be answered with a rating scale.

Initially, we conducted this study as a pilot for a registered report aiming for a large-scale examination of crying in everyday life; accordingly, the study contained various trait and state measures. To maintain brevity of the current article, we only report on measures related to the FRC (see Table S12 for a complete list of all measures).

Sample

We used the approach described by Rotondi and Donner (2012) to determine sample size regarding interrater reliabilities. We used the following settings: 95% CI, lower limit $\kappa = 0.70$, upper limit $\kappa = 0.90$; $\alpha = 0.05$; number of raters = 3, anticipated prevalence = see results of Study 1 (full code is

Table 9 Random intercept model predicting crying duration and crying intensity by FRC

Predictors	Crying duration in minutes			Crying intensity		
	Estimates	CI	*p*	Estimates	CI	*p*
Intercept	3.83	− 0.63 to 8.30	0.093	1.67	1.40 to 1.94	< 0.001
Loneliness	10.74	4.90 to 16.59	< 0.001	1.07	0.72 to 1.43	< 0.001
Impotence	5.92	− 4.76 to 16.61	0.277	1.01	0.35 to 1.67	0.003
Overload	5.90	0.11 to 11.69	0.046	1.00	0.64 to 1.35	< 0.001
Harmony	3.20	− 5.10 to 11.50	0.450	0.56	0.05 to 1.07	0.031
Random effects						
σ^2	252.56			0.99		
τ_{00}	52.71			0.15		
ICC	0.17			0.13		
N	71			71		
Observation	264			264		
Marginal R^2/conditional R^2	0.052/0.216			0.153/0.263		

Crying episodes were nested in individuals; random effects represent variability between individuals; τ_{00} = variance between individuals, σ^2 = variance between crying episodes

depicted in the supplements). This resulted in a required sample size of $N = 74$. The final sample comprised of 91 participants ($M_{age} = 25.48$, $SD_{age} = 11.27$, $range_{age} = 18–64$, 60 women, 19 men, 2 non-binary; 10 participants did not provide demographic information). The sample comprised German-speaking students and employees, who were recruited via personal contact. Data were collected in December 2020 and January 2021.

Results

Compliance-rate

The compliance rate was 83.74%, as we counted 2286 completed questionnaires (91 ∗ 30 = 2730 questionnaires sent out). Participants reported 291 crying episodes during the study period. They needed 4.05 min ($SD = 1.76$ min) to complete a survey on average. Twenty participants did not report a single crying episode, whereas 71 participants reported at least one crying episode.

Prevalence and interrater reliability of FRC

Most crying episodes were overload-related, followed by loneliness, media, harmony, and impotence (Fig. 1b). The residual category was small: 6% of the episodes could not be assigned due to inaccurate description (vague). Fleiss' Kappa was almost perfect ($\kappa = 0.83$).

Crying characteristics

As crying episodes were nested within participants, we first estimated unconditional means models: 75.6% of variation in crying duration and 81.5% of the variation in crying intensity are attributable to differences in crying episodes rather than differences between individuals. Including FRC as predictor, the results indicate that participants cried longer when the reason was overload ($b = 5.90$, $p = 0.046$) or loneliness ($b = 10.74$, $p < 0.001$) compared to media (Table 9). For example, the mean duration of crying for media reasons was 3.83 min (i.e., model intercept), while the mean duration of crying for loneliness was 14.57 (i.e., intercept plus coefficient loneliness). The intensity of crying was higher for all reasons compared to media.

Time-course of affect/arousal depending on crying-reason

As time points were nested within participants, we first estimated unconditional means models, finding that 68% of variation in affect and 69.7% of the variation in arousal are attributable in changes over time rather than differences between individuals. Next, we estimated unconditional growth models testing for linear and polynomial time trends by including time as predictor (Table S13). The intercepts represent the mean in affect and arousal on the day of the crying episode, while higher scores indicate more positive affect/more calmness (e.g., mean affect on the day of the crying episode was 3.67). There was a quadratic effect of time on affect ($b = 0.02$, $p < 0.001$) and arousal ($b = -0.04$, $p < 0.001$). The time coefficients represent the changes in the mean per day (or general per measurement unit). In sum, the results indicate that affect was lower/less positive and arousal higher on a crying day.

Given that individuals cry for different and distinct reasons, in a next step we explored the temporal effects and reasons to cry in combination (Figs. S5 and S6). The intercepts

in Table S14 represent the mean affect and arousal on the day of crying for media. There were main effects for overload and loneliness. The coefficients represent the changes in mean affect ($b_{Overload} = -0.41$, $p < 0.001$, $b_{Loneliness} = -0.34$, $p < 0.001$) and mean arousal ($b_{Overload} = 0.45$, $p < 0.001$, $b_{Loneliness} = 0.44$, $p < 0.001$) when the crying reason was overload and loneliness, respectively, compared to media. There was a significant interaction between the crying reason and temporal effects, indicating that changes in affect over time were stronger in loneliness or overload compared to media. In other words, the increase in affect (more positive) was larger after a loneliness or overload crying episode compared to a media episode. The results show that affect and arousal decrease over time for overload and loneliness, but there was no temporal effect of media on affect and arousal.

8 DIAMONDS and emotions

Given the modest sample size, we could not calculate meaningful test-statistics when exploring the 8 DIAMONDS and emotion profiles for the FRC. Even though we can only present descriptive statistics (i.e., means and standard-errors), they show such clear parallels to the retrospective studies that we consider them worth reporting (Figures S7 and S8). In short, duty was highest in overload and low in all other categories. Loneliness seemed to be characterized by high adversity and sociality, impotence by high negativtiy, and harmony by high positivity. Overall, the three aversive categories were associated with aversive emotions, and harmony seemed characterized by pleasant emotions.

Discussion

Comparing the prevalence of the FRC between Study 1 and Study 2, we observed similar frequencies for loneliness, harmony, and media; however, we found about twice as many overload-related episodes in Study 2 and only 4% (vs. 24%) impotence-related crying episodes. This shift might be traced back to the older sample in Study 1. Older age is associated with decreases in neuroticism across life span (Wortman et al., 2012), which explains the lower prevalence for overload-related crying in Study 1. Given that increasing age is a crucial risk factor for disease, this might explain why participants reported more impotence-related crying in Study 1. Alternatively, one might conclude that impotence-related crying is somewhat overestimated in retrospective studies. The prevalence for harmony-related crying was low in both studies and is comparable with prior work (Bylsma et al., 2011; Vingerhoets et al., 1997). This speaks against a systematic underestimation of positive tears in our studies.

In line with the diary study by Bylsma et al. (2011), we found a quadratic effect of time on affect. In comparison to the day before and after crying, affect was worst on the crying day, i.e., affect over time followed a U-shape. We found a comparable pattern for arousal. In comparison to the day before and after crying, arousal was highest on the crying day (i.e., inverted U-shape). Importantly, these effects were qualified by the FRC. We found a U-shape pattern for affect in loneliness and overload. On a descriptive level, impotence was also characterized by a U-shape of affect, while harmony was characterized by an *inverted U-shape* of affect.

Results for crying characteristics were similar to Study 1 as we found longer crying duration and higher crying intensity for the aversive categories. On a descriptive level, we found first evidence suggesting that 8 DIAMONDS and emotion profiles were similar regardless of whether crying episodes are examined with a diary approach or a retrospective study. Further, interrater reliability was similar when comparing the retrospective and diary approaches.

Limitations

We did not collect data on need frustration/satisfaction. Even though informative, the analyses focusing on the 8 DIAMONDS and emotion profiles can only be considered as preliminary.

General discussion

Since crying is a peculiar human phenomenon, we aimed to contribute to a better understanding of this special form of emotion expression. We provide a theoretically derived taxonomy to categorize the most common antecedents of emotional crying: The Five Reasons to Cry. The provided evidence suggests that our taxonomy covers most crying episodes reported by adult individuals. We found high interrater reliabilities when our taxonomy was used to categorize crying episodes, and we found a substantial overlap between participants' self-ratings and our ratings.

In contrast to most former approaches, we provided multivariate data to evaluate our crying taxonomy. Regarding the 8 DIAMONDS, we found sound relations to the FRC. Loneliness, impotence, and overload were associated with high negativity and low positivity, while harmony was associated with a reversed pattern, and media was characterized by medium positivity and negativity. This pattern aligns with our theoretical assumptions. Overload was associated with increased duty. This finding is especially noteworthy as it separates overload from the two other aversive categories. Differences in crying characteristics (i.e., duration and intensity) indicate that media and harmony are separable from the three aversive categories. The aversive categories can in turn be differentiated based on their relations to psychological needs. Most strikingly, they showed specific associations

Table 10 Five reasons to cry—empirical relations to psychological needs and 8 DIAMONDS

1) loneliness	2) impotence	3) overload
needs: ↯ relatedness ↯ autonomy **8 DIAMONDS:** ↑ mating ↓ positivity ↑ negativity ↑ sociality	**needs:** ↯ autonomy ✓ relatedness **8 DIAMONDS:** ↓ adversity ↓ positivity ↑ negativity ↑ sociality	**needs:** ↯ competence ↯ autonomy **8 DIAMONDS:** ↑ duty ↓ positivity ↑ negativity
4) harmony	5) media	other
needs: ✓ relatedness **8 DIAMONDS:** ↑ positivity ↓ negativity ↑ sociality	**needs:** ✓ relatedness **8 DIAMONDS:** ↕ positivity ↕ negativity	•physical pain •outstanding success •boost in freedom •manipulative crying •…

↯ = frustration of psychological need; ✓ = satisfaction of psychological need; ↑ = high; ↓ = low; ↕ = medium

to the three needs postulated in self-determination theory (SDT; Deci & Ryan, 2000). Loneliness was associated with relatedness-frustration, overload was related to competence-frustration and impotence was associated with autonomy-frustration. The relations to psychological need satisfaction/frustration suggested a parallel pattern for media and harmony. Both categories were associated with satisfaction of psychological needs, but the pattern was more pronounced for harmony. In sum, these findings suggest that the proposed categories are not only theoretically but also empirically distinguishable.

FRC in a nutshell

Table 10 depicts the empirical relations of the FRC to psychological needs and situation characteristics. Contrary to our hypotheses, impotence was characterized by relatedness-satisfaction and loneliness by autonomy-frustration.

Comparing FRC to former crying taxonomies

Our work stands out from previous crying taxonomies by providing (i) a theoretical framework, (ii) a multivariate test of our assumptions, and (iii) evidence that it is reliable. None of the prior work comprises the exact constellation of categories that we consider crucial. Even though one in four crying episodes was media-related in our studies, this category is only considered in three prior taxonomies (Frey et al., 1983; Kraemer & Hastrup, 1986; Young, 1937). Additionally, some categories of former taxonomies appear thematically heterogeneous to us. Vingerhoets' and colleagues (1997) third factor comprises tears due to physical pain as well as due to seeing other people suffer and making people disappointed. The category 'interpersonal issues' from Frey et al. (1983) also subsumes different triggers. The same applies to Young's (1937) disappointment category, which summarizes tears due to a failed exam and the loss of a loved one.

Another advantage of the FRC lies in the fact that we can draw a theoretical line between emotional crying and crying due to physical pain, which has been considered as a separate category in prior work (Bylsma et al., 2008, 2011; Vingerhoet et al., 1997). As described above, we assume that satisfied/frustrated psychological needs precede emotional crying. This is not necessarily the case for tears associated with physical pain or drug effects. Considering that physical pain is a rare reason for shedding tears in adulthood also speaks against an inclusion in our taxonomy (Vingerhoets et al., 2001).

It is important to note that considering an appraisal-perspective to categorize crying is not a new idea, but has been proposed before (Gračanin et al., 2021; Miceli & Castelfranchi, 2003; Vingerhoets et al., 1997). However, we are the first who consider this idea by developing a theoretically derived taxonomy of crying.

Why do more negative than positive crying categories exist?

Our taxonomy contains more negative than positive categories, which is well in line with a phenomenon described by Alves and colleagues (2017): Good is more alike than bad. The authors argue that the information ecology contains more negative than positive information, which can be illustrated with an example. When lying in the bathtub, the temperature of the water can be either pleasant or unpleasant. While a pleasant temperature is between 36 and 38 °C, the water can be too cold (< 36 °C) or too warm (> 36 °C).

Thus, there are *more* and *more specific* descriptions available to express the uncomfortable temperature of the bath water. This phenomenon seems to reflect a general principle and is observable in various contexts. For example, negative basic emotions outnumber the positive ones. Accordingly, it is not surprising, but even expected, to observe several distinct negative crying categories and only one broad positive one.

FRC and mental disease

Given that we relate the FRC to psychological needs, and considering that the frustration of psychological needs has been related to mental disease (Vansteenkiste & Ryan, 2013), we find it worthwhile to speculate about potential relations between the FRC and mental disease.

Loneliness- and overload-related crying seem related to frustration of needs. Accordingly, we would expect a higher prevalence for loneliness- and overload-related crying within clinical samples. As impotence-related crying is associated with autonomy-frustration and relatedness-satisfaction, the picture is less clear for this category. Harmony-related crying seems associated with need-satisfaction (rather than -frustration), and we would assume a lower prevalence in clinical samples. In the case of media-related crying, we could not come up with a clear assumption. On the one hand, crying from this category seems to be associated with need-satisfaction, which would suggest no elevated prevalence in clinical samples. On the other hand, empirical findings showed that women with depression symptoms reported frequent crying when watching TV/movies (Frey et al., 1983).

Crying is related to various psychiatric conditions (see Bylsma et al., 2021 for a review). A discussion of all pathologies under the lens of the FRC would go beyond the scope of this article. We therefore discuss exemplarily the diagnosis borderline personality disorder (BPD). Patients suffering from BPD cry more frequently than healthy individuals (Peter et al., 2019). Furthermore, meta-analytic evidence suggests that BPD is associated with rejection sensitivity, which in turn seems linked to childhood emotional abuse and neglect (Foxhall et al., 2019). Considering the underlying needs of the FRC, one would expect a particular increase of loneliness-related crying for patients suffering from BPD. As illustrated by this example, the FRC might provide a fruitful approach to better understand crying in the clinical context.

On the relation between crying and well-being

The basic idea of the catharsis thesis is that crying helps one recover from emotional distress. Some researchers assumed that 'non-crying' is associated with decreased well-being, which could not yet be verified (e.g., Hesdorffer et al., 2018). We propose that two aspects received too little consideration in this debate. First, and in line with the premise of the FRC, if individuals did not face any reason to cry, one would hardly expect suffering due to non-crying. Accordingly, future tests of the catharsis thesis should capture whether individuals were exposed to distressing stimuli, possibly by drawing on the FRC. Second, cathartic crying is probably not the only way to overcome emotional distress. If individuals use techniques such as cognitive restructuring (Ellis & Dryden, 2007) to cope with adverse circumstances, non-crying and well-being are most likely unrelated. Hence, future studies should also consider coping mechanisms other than crying when examining the catharsis thesis.

FRC and social support intention

A recent large-scale examination uncovered that observing a tearful individual causes the intention to offer social support (Zickfeld et al., 2021). This effect was stronger when crying was triggered by a negative reason. Moreover, the authors found evidence suggesting that the effect was partially mediated through the perceived helplessness of the crying individual. Considering these findings and Hasson's (2009) idea of tears as a social signal for help-seeking, the FRC might be linked differently to support intentions. Crying due to loneliness, impotence, and overload might be associated with more perceived helplessness and higher support intentions than harmony- or media-related crying.

Pending test of generalizability of the FRC

Given the cultural differences in emotion expression (e.g., Matsumoto, 1990) and in crying (van Hemert et al., 2011), it stands to reason that there are also cultural differences in the prevalence of the FRC, which should be addressed in future studies. Given that we derived our taxonomy from psychological needs, which are assumed to be universal in humans, we expect that the structure—but not the prevalence—of the FRC remains stable across cultures. This assumption, however, requires empirical investigation.

Considering alternative categorizations of emotional crying

We are convinced that a focus on the SDT-needs and the classification of *common* triggers of crying is an appropriate first step. Undoubtedly, future research projects should also focus on less typical antecedents of crying and other needs. A parallel to personality psychology can be drawn. In a first step, it seems appropriate to consider the role the Big5/HEXACO dimensions (i.e., the general construct) when predicting a certain behavior, before adding more specific traits to the equation, such as the dark tetrad dimensions (e.g., psychopathy). In addition, we see several practical benefits

by considering the SDT-needs in a first step. In contrast to other need-approaches (e.g., Denissen & Penke, 2008; McClelland, 1985) established state-measurement tools are available to assess the SDT-needs, which enabled us to conduct Study 1. Moreover, the SDT is a very well-known and frequently studied theory, whereby our work is compatible with the knowledge of many potential readers (e.g., Reeve, 2018). Last, we included an empirical test beyond the SDT-needs in our work by considering "self-esteem" as additional need. The empirical evidence revealed a substantial overlap between self-esteem and competence, which suggests that focusing on the SDT-needs is an appropriate initial step.

Nevertheless, we argue that the FRC is only one way to categorize emotional crying. If another theoretical perspective is applied, researchers might reveal different categories than we did. If one takes a look at personality psychology, for example, different approaches resulted in specific conceptualizations of personality. While lexical approaches such as the HEXACO model (Ashton & Lee, 2007) identified the factors honesty, emotionality, extraversion, agreeableness, conscientiousness and openness, the biologically oriented model proposed by Panksepp contains the factors seeking, play, care, fear, sadness and anger (Panksepp, 2004). Even though the models partially overlap (e.g., seeking corresponds well with openness), there are also points where they seem incompatible (i.e., there is no equivalent for conscientiousness, Marengo et al., 2021). So, in the future it would be exciting to see different models of crying competing, hoping that in the long run the most plausible and parsimonious one with the highest explanatory power will gain general acceptance. It is possible that other analysis strategies might bring alternative crying taxonomies to light. Since our categories partially overlap in their underlying need structure (see Table 10), factor analytical approaches might be especially promising in order to identify the most meaningful model representing crying episodes in a next generation of research. Future work could also investigate whether subcategories can be identified within the media category. In sum, our taxonomy is certainly not perfect, but it represents a theoretically derived and empirically informed step in categorizing antecedents of emotional crying.

Conclusion

We aimed to better understand the phenomenon of crying and therefore developed a reliable taxonomy that captures the most common triggers of emotional crying, the Five Reasons to Cry. We found evidence for our theoretical considerations as we observed relations between loneliness and relatedness-frustration, impotence and autonomy-frustration, overload and competence-frustration, and harmony and relatedness-satisfaction, as well as media and relatedness-satisfaction. By applying a multivariate perspective to our taxonomy, we found evidence for the distinctness of the FRC. Subjective well-being was highest when individuals' last crying episode was related to harmony, and SWB was lowest when related to loneliness, impotence, or overload. These empirical findings attest to our taxonomy's construct and criterion validity. We hope to stimulate further research on crying by providing a valid taxonomy of its most common situational antecedents.

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Data availability Data is available under https://osf.io/ynema/.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval Approval was obtained from the local ethics committee. The procedures used in these studies adhere to the tenets of the Declaration of Helsinki.

Consent to participate Informed consent was obtained from all individual participants included in the studies.

Consent to publication All participants signed informed consent regarding publishing their data.

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