From Ideation to Action

— Analyses of Predictors of Suicidal Ideation and Behavior

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But to die as a way of running away from poverty or love or anything painful
does not belong to a courageous person, but rather to a coward,
for to run away from distressing things is softness,
and such a person does not endure death because it is a beautiful thing,
but as a way of escaping something bad.

Aristotle, Nicomachean Ethics (III, 7)
(Aristotle, 1498/2002, p. 74)

I.   Acknowledgments

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Suizidale Gedanken und suizidales Verhalten, das zu Suizidversuchen oder gar Suiziden führt, sind ein weltweit verbreitetes Phänomen, das bereits vielfach untersucht wurde. Doch wie können suizidale Gedanken frühzeitig erkannt werden, um den Übergang zum suizidalen Verhalten zu verhindern? Diese Frage zu beantworten, hat die vorliegenden Dissertation motiviert, in der die Erforschung von Risikofaktoren suizidaler Gedanken und suizidalen Verhaltens im Zentrum stand. In den vergangenen fünfzig Jahren wurden zwar viele verschiedene distale Risikofaktoren identifiziert, die Suizidversuche jedoch nicht wesentlich besser als Zufall vorhersagen können. Deshalb berücksichtigt die Forschung heute vermehrt proximale Risikofaktoren und integriert diese in sogenannte ideation-to-action Modelle, die zwischen der Entstehung von suizidalen Gedanken und dem tatsächlichen suizidalen Verhalten unterscheiden. Eines dieser Modelle ist das Integrative Motivational-Volitionale Modell Suizidalen Verhaltens (IMV Modell). Für die Entwicklung suizidaler Gedanken stellt das IMV Modell vor allem die beiden Konstrukte Defeat und Entrapment in den Vordergrund. Doch erst in jüngster Zeit konnte gezeigt werden, dass auch interozeptive Defizite sowohl bei suizidalen Gedanken als auch bei suizidalem Verhalten eine Rolle spielen.

Mit ihren drei Studien verfolgte die Dissertation drei, aufeinander aufbauende Ziele: Die erste Studie zielte darauf ab, im Rahmen des IMV Modells eine deutsche ökonomische Skala zur Erfassung der Konstrukte Defeat und Entrapment für die Suizidrisikoabschätzung zu validieren und die Faktorstruktur der Skala zu überprüfen. Konfirmatorische Faktorenanalysen zeigten, dass Defeat und Entrapment zwar miteinander assoziiert sind, aber als zwei separate Konstrukte betrachtet werden müssen. Mit Hilfe dieser Skala ließen sich Personen mit suizidalen Gedanken oder einem Suizidversuch von Personen unterscheiden, die keine suizidalen Gedanken hatten oder keinen Suizidversuch unternommen hatten.

Die zweite Studie zielte darauf ab, die Rolle von *Defeat* und *Entrapment* in der Vorhersage suizidaler Gedanken weiter zu analysieren und dabei den vom IMV Modell postulierten Pfad zur Entwicklung suizidaler Gedanken zu überprüfen. Mehrebenenanalysen zeigten, dass es im Rahmen des IMV Modells notwendig ist, zwischen internalem und externalem *Entrapment* zu differenzieren, da nur *Defeat* und internales *Entrapment* (Veränderungen in) Suizidgedanken vorhersagen konnten.

Die dritte Studie zielte zunächst darauf ab, Interozeption erstmalig im Rahmen eines innovativen Smartphone basierten ambulanten Assessments genauer zu untersuchen. Mehrebenenanalysen zeigten erstmalig, dass interozeptive Sensibilität, interozeptives Bewusstsein und interozeptive Genauigkeit intraindividuellen Schwankungen unterliegen und daher im Klinischen Setting wiederholt erhoben werden sollten. Diese essentiellen Schwankungen, die bereits ebenfalls für suizidale Gedanken und mehrere Risikofaktoren (u. a. *defeat* und *entrapment*) gezeigt werden konnten, können von zentraler, bisher jedoch weitgehend vernachlässigter Bedeutung in der Suizid-Risikoabschätzung sein und liefern wertvolle Informationen über die zeitliche Stabilität interozeptiver Facetten als mögliche Risikofaktoren suizidaler Gedanken und suizidalen Verhaltens. Interozeptive Defizite können als zusätzlicher Prädiktor in das IMV Modell integriert werden.

Die drei Studien bestätigen, dass die Messung von *Defeat* und *Entrapment* im Rahmen der Suizidrisikoabschätzung zu empfehlen ist. Gleichzeitig machen die Ergebnisse jedoch deutlich, dass einerseits die Differenzierung der Konstrukte verbessert werden muss, andererseits sollte Interozeption und ihre Schwankungen innerhalb der Suizidrisikoabschätzung berücksichtigt und in die postulierten Pfade des IMV Modells integriert werden. Beides wird voraussichtlich in Zukunft zu einer verbesserten Früherkennung suizidaler Gedanken und suizidalen Verhaltens beitragen.

Suicidal ideation and behavior that lead to suicide attempts or even to suicide are worldwide phenomena that have been intensively studied. But how can suicidal ideation be recognized early, and what exactly characterizes the transition from suicidal ideation to actual suicidal behavior? Answering these questions motivates the present dissertation, which focuses on investigating risk factors of suicidal ideation and suicidal behavior. Although many different risk factors have been identified over the past 50 years, suicide attempts cannot be predicted any better than a random event. For this reason, research is increasingly taking into account proximal risk factors and integrating them into so-called ideation-to-action models. These models distinguish between the development of suicidal ideation and actual suicidal behavior. One of these models is the integrated motivational–volitional model of suicidal behavior (IMV model). For the development of suicidal ideation, the IMV model focuses on the two constructs *defeat* and *entrapment*. But recent research has shown that interoceptive deficits may also play a role in suicidal ideation and suicidal behavior.

With its three studies, this dissertation pursued three consecutive objectives. The first study aimed to validate an economic German scale for detecting the constructs *defeat* and *entrapment* for the assessment of suicide risk in the IMV model and to review the factor structure of the scale. Confirmatory factor analyses showed that *defeat* and *entrapment* are associated with one another but must be considered as two separate constructs. This scale could distinguish persons with suicidal ideation or one or more suicide attempts from persons who had no suicidal ideation or did not attempt suicide.

The second study aimed to further analyze the role of *defeat* and *entrapment* in predicting suicidal ideation and, in doing so, to examine the path postulated by the IMV model for the development of suicidal ideation. Multilevel analyses showed that it is imperative to differentiate between internal and external *entrapment* in the IMV model, which has not yet been done, even though only *defeat* and internal *entrapment* were predictive of (a change in) suicidal ideation.

The third study aimed to further examine interoceptive facets and their assessment in the framework of an innovative smartphone-based ambulatory assessment (ecological momentary assessment), which allows data collection in real time and in the private environments of participants. Multilevel analyses showed for the first time that interoceptive sensitivity, interoceptive awareness, and interoceptive accuracy are subject to intraindividual fluctuations and

therefore have to be repeatedly collected in clinical settings. These essential fluctuations, which have also been shown for suicidal ideation and for several risk factors (e.g., *defeat* and *entrapment*), might be of central importance in assessing suicide risk but have largely been neglected, even though they deliver valuable information about the temporal stability of interoceptive facets as risk factors for suicidal ideation and behavior. Interoceptive deficits could be integrated into to the IMV model as an additional risk factor.

The three studies confirm how important it is for suicide prevention to assess the constructs *defeat* and *entrapment* in clinical practice. At the same time, the results make clear that the constructs need to be better differentiated and that interoceptive facets and their fluctuations need to be taken into account in the assessment of suicide risk using repeated assessments and should be integrated in the postulated pathways of the IMV model. This will contribute to even more success in the early detection of suicidal ideation and suicidal behavior in the future.

IV.   List of Figures

PTSD   posttraumatic stress disorder

CoP   cry-of-pain model

DS   Defeat Scale

EMA   ecological momentary assessment

ES   Entrapment Scale

HPT   heartbeat-perception task

IMV model   integrated motivational–volitional model of suicidal behavior

IPTS   interpersonal theory of suicide

MM   motivational moderator

SDES   Short Defeat and Entrapment Scale

TSM   threat-to-self moderator

VM   volitional moderator

Every 40 seconds, a person dies by suicide (World Health Organization, 2014), which resulted in 2020 with more than 700,000 deaths by suicide worldwide (World Health Organization, 2021). The number of suicide attempts has been estimated to be even 20 times higher (World Health Organization, 2014). A study by Borges et al. (2014) estimated a life-time prevalence for suicide attempts of 2.7% and for suicidal ideation of 3–33%. With regard to Germany, Forkmann et al. (2012) found that 8% of participants reported serious suicidal ideation during the past two weeks in a representative sample of the general German population. The numbers above demonstrate the great relevance of further research on suicidal ideation and behavior. It is, however, important to differentiate between suicidal ideation and behavior on the one hand and self-harm on the other.

Suicidal ideation is defined "as an example of weighing options" (Silverman et al., 2007, p. 267) and includes an individual's thoughts, concepts, beliefs, and cognitions about intending to end their life (Wenzel et al., 2009). Silverman et al. (2007) differentiate in their revised nomenclature between self-harm with no suicidal intent, undetermined suicide-related behavior (i.e., suicidal behavior) with undetermined suicidal intent, and suicide attempts with suicidal intent. Most importantly, self-harm does not entail a suicidal intent, but when self-harm includes fatal injuries, it can still lead to an unintentional self-inflicted death by suicide. Suicidal behavior with undetermined suicidal intent can also lead to death by suicide when combined with fatal injuries. By contrast, a suicide attempt always entails a suicidal intent and leads, depending on the fatality of the injuries, to death by suicide.

Regarding the high number of deaths by suicide worldwide, it is important to understand what leads an individual to such an act. To determine how to prevent suicidal acts through clinical practice, it is essential to understand the risk factors. Even though a tremendous amount of research has identified many different risk factors underlying suicidal ideation, suicidal behavior, and suicide attempts—such as mental disorders (Goodwin et al., 2003; Nock et al., 2009), previous suicide attempts (Tidemalm et al., 2005), social isolation (Dervic et al., 2008), unemployment (Abe et al., 2004), physical illness (Bastia & Kar, 2009), and childhood abuse (Schönfelder et al., 2019)—Franklin et al. (2017) state that, despite this effort, the common risk factors cannot predict suicidal ideation and behavior better than chance and thereby criticize the past 50 years of suicide research. The predictors taken into account in this meta-analysis were more or less exclusively distal risk factors. Instead of integrating

proximal risk factors from newer theoretical approaches such as defeat, entrapment, and relatively new evidence for interoception, suicide research has more or less examined the same cluster of distal risk factors over and over again for the past 50 years. Given these results, it still remains unclear what the underlying processes of suicidal ideation and suicidal behavior actually are, especially with regard to proximal risk factors. It is therefore important to intensify divergent research and to integrate newer constructs to gain a better understanding of the psychological mechanisms underlying these processes so as to develop effective prevention tools. Three psychological models explaining the development of suicidal ideation and behavior will be introduced in the following.

1.1   The Cry-of-Pain Model

One of the models for explaining the development of suicidal ideation and behavior is the cry-of-pain model (CoP), which is a cognitive-behavioral model developed by Williams (2001). It expands on other existing theories such as arrested flight (Gilbert & Allan, 1998) by stating that persons are most likely to develop suicidal ideation, suicidal behavior, or to actually commit suicide when they have experienced negative life events that lead to feelings of defeat and entrapment and, consequently, to hopelessness and helplessness (see Figure 1).

Defeat is defined as a loss of social status, the feeling of powerlessness, and the incapability of reaching personal goals (Gilbert & Allan, 1998), whereas entrapment describes the lack—due to internal or external circumstances—of a possibility to escape an unpleasant or stressful state or situation despite the will to do so (Gilbert & Allan, 1998). Additionally, Gilbert and Allan (1998) propose that entrapment can be differentiated into internal and external entrapment. Internal entrapment describes being trapped by internal processes such as rumination (Owen et al., 2018), whereas external entrapment is defined as the feeling of being trapped by external circumstances such as problems at work or relationship problems (Taylor, Gooding, Wood & Tarrier, 2011). The two-dimensional structure of entrapment has been confirmed by Forkmann, Teismann, et al. (2018) via network analyses. The CoP further assumes that feelings of defeat and entrapment lead to hopelessness and helplessness, which are influenced by individual coping skills and information processing, and result in either suicidal ideation or behavior, without further specifying under what circumstances either should be expected.

Figure 1 *The Cry-of-Pain Model (adapted from Williams, 2001)*

Stress: especially defeat/rejection → No escape & entrapment → Psychobiological „helplessness script" → Suicidal ideation or behavior

Judgement by individual:
How stressful?
How escapable?
How much support available?
Affected biases in information processing and memory biases

Rescue Factors:
social support and positive future thinking
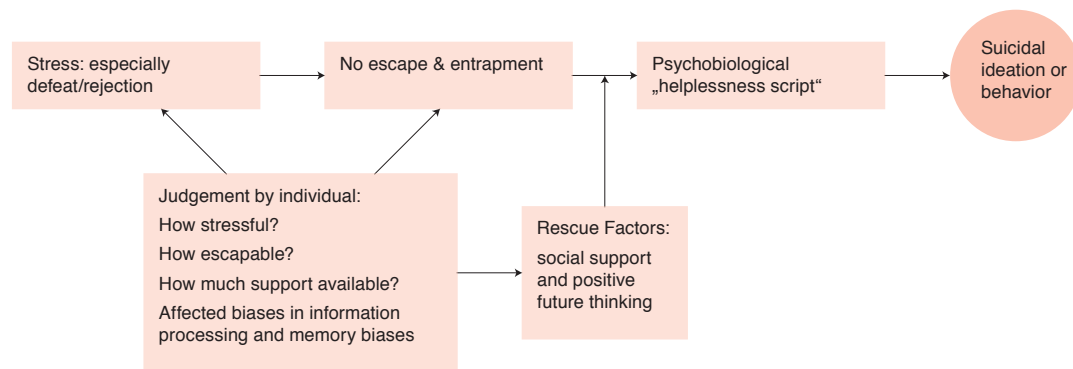
1.1.1 Empirical Findings

The constructs of the CoP and their associations with mental disorders have been examined multiple times. According to a study by Gilbert and Allan (1998), defeat and entrapment are significantly correlated with depression. Furthermore, defeat and entrapment have been associated with anxiety and posttraumatic stress disorders (PTSD; Siddaway et al., 2015). With regard to suicidal ideation and behavior, Taylor, Gooding, et al. (2010) found that, conceptualized as a single variable, defeat and entrapment together explained 31% of variance in suicidal ideation and behavior in 78 patients with schizophrenia-spectrum disorders. Additionally, the suicidal behavior of 56 patients with PTSD was positively associated with defeat and entrapment as well as hopelessness, even when controlling for the severity of PTSD symptoms (Panagioti et al., 2012). Regarding the prediction of suicidal ideation and behavior, O'Connor et al. (2013) showed in a 4-year prospective study that defeat and entrapment served as predictors for suicide attempts in a sample of 70 patients who had been admitted to a psychiatric ward after a suicide attempt. Additionally, the main assumptions of the CoP were confirmed by O'Connor (2003), who showed that suicidal patients reported higher levels of defeat and entrapment than matched hospital controls. However, there are crucial deficiencies within the CoP.

1.1.2   Deficiencies of the CoP

Even though constructs of the CoP and their associations to suicidal ideation and behavior have been empirically confirmed, some weaknesses of this model have to be considered.

First, the CoP does not clearly define the constructs of hopelessness and helplessness. O'Connor (2003) referred to the constructs as "no rescue" in his study and measured it via the level of social support. Even though this led to significant effects, the definition of the construct is still not sufficiently specific (Johnson et al., 2008).

Second, Johnson et al. (2008) criticized how hopelessness has not been cognitively separated from entrapment, despite the fact that these concepts seem to be related. In addition, defeat, entrapment, hopelessness, and helplessness are based as risk factors in the model on cognitive and behavioral assumptions. This does not reflect the complexity of risk factors for suicide that cannot be ascribed to cognitive and behavioral symptoms and ignores sociological and biological factors (Turecki & Brent, 2016).

Third, and most importantly, the CoP leaves out the exact distinction between suicidal ideation and behavior and therefore cannot differentiate between individuals with suicidal ideation and those with suicidal behavior. The question of what is decisive in the transition from suicidal ideation to actual suicidal behavior thus still remains open, leaving an "ideation-to-action gap".

1.2   The Interpersonal Theory of Suicide

One of the models that addresses the ideation-to-act gap is the interpersonal theory of suicide (IPTS; Joiner, 2005; Van Orden et al., 2010), which differentiates between the formation of suicidal ideation and suicidal behavior. In the context of the IPTS, Joiner (2005) postulated that the occurrence of one of two interpersonal constructs—namely, thwarted belongingness or perceived burdensomeness—predicts passive suicidal ideation, whereas active suicidal ideation emerges from both interpersonal constructs together with a feeling of hopelessness about the changeability of those states.

Thwarted belongingness describes the feeling of alienation, whereas perceived burdensomeness describes the feeling of being a burden to someone. A third component then leads to suicidal behavior: the capability for suicide that

distinguishes between the desire to engage in suicidal behavior and actually engaging in suicidal behavior (see Figure 2). This capability emerges from habituation processes that are expected to lead to an increased tolerance for physical pain and a reduced fear of death, such as exposure to fear-inducing or painful experiences or repeated self-harm (Van Orden et al., 2010). However, newer evidence suggests that the capability for suicide does not necessarily have to be acquired; vulnerabilities—such as low levels of serotonin, a more rapid habituation process, genetic influences (e.g., perceiving pain and fear), and suicide in the family history—can also play an important role (Smith & Cukrowicz, 2010).

Figure 2 *The Interpersonal Theory of Suicide (adapted from Joiner, 2005)*

Thwarted belongingness:

I am alone

Desire for suicide

Lethal (or near lethal) suicide attempt

Perceived burdensomeness:

I am a burden

Capability for suicide
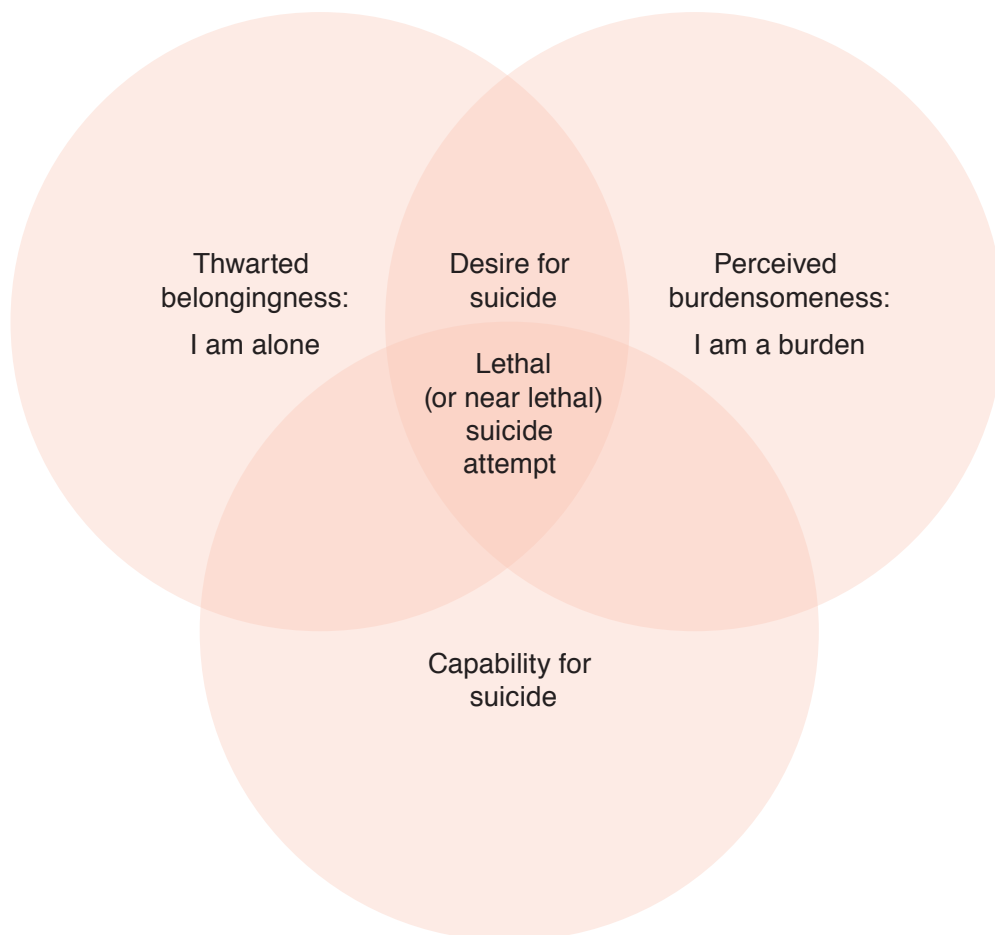
In conclusion, the theory postulates that the desire to die is not sufficient to actually result in suicidal behavior because from an evolutionary perspective, humans are scared of actions that could cause themselves harm (Öhman & Mineka, 2001) and the capability to cause oneself harm is necessary to engage in suicidal behavior.

1.2.1 Empirical Findings

The evidence for the IPTS has exhibited mixed results. Wachtel and Teismann (2013) supported the association between perceived burdensomeness, thwarted belongingness, the capability for suicide, and suicidal ideation and behavior in their systematic review. In contrast, in their meta-analysis, Chu et al. (2017) only found in one part of the studies a weak correlation between the capability for suicide and suicidal ideation and attempts. These results do not suggest any generic effects that can be reliably replicated, and they indicate that there are other factors influencing suicidal behavior. They suggest to focus strongly on acute risk factors, which occur right before actual suicidal behavior. Additionally, the results of another systematic review investigating the predictions of the IPTS (Ma et al., 2016) revealed that the main effect of the capability for suicide on suicide attempts could not be confirmed and that the predictors of the IPTS could only be partly supported. They found the most evidence for the effect of perceived burdensomeness on suicidal ideation. Considering these mixed findings, there are some crucial limitations to keep in mind when using the IPTS to explain suicidal ideation and behavior.

1.2.2 Deficiencies of the IPTS

Due to the mixed results, the gain of knowledge through the IPTS remains limited. Even though it contains clearly testable hypotheses in contrast to the CoP, its hypotheses could only be partly confirmed.

The primary limitation is that only three constructs are the main focus of this theory. It thus leaves out other potentially relevant risk factors for suicidal ideation and behavior. As mentioned above, hopeless views of the future, as postulated in Beck's theory of suicide (Beck et al., 1985), and other relevant proximal risk factors seem to be important for the development of active suicidal ideation but are not explicetly named in the IPTS. Such risk factors should be integrated into the IPTS (Kleiman et al., 2014). Kleiman et al. (2014) argued that including risk factors from multiple models would be necessary to reflect the complexity of suicidal ideation and behavior. Gunn and Lester (2015) followed this position by criticizing the components of the IPTS for oversimplifying suicidal behavior. Hjelmeland and Knizek (2018) even took this a step further by arguing that Joiner (2005) underestimated the complexity of suicide by giving a universal explanation that ignored "historical, social, ideological, political, economical, cultural, or gender-related contexts" (p. 169). In a direct negation of Joiner's (2005) title, they state that "people are treated as artificial theoretical constructs" (p. 169) and that

a "reductionistic outset" (p. 177) and "linear causal thinking" (p. 177) are not sufficient for explaining why people commit suicide. The IPTS might thus be incapable of capturing the complex nature of the development of suicidal ideation and behavior; a theory is needed that includes additional risk factors.

The integrated motivational–volitional model of suicidal behavior (O'Connor & Kirtley, 2018) is such a model that includes by far more risk factors than the CoP or the IPTS and will be introduced in the following.

1.3 Integrated Motivational–Volitional Model of Suicidal Behavior

Including risk factors from the CoP and the IPTS, the integrated motivational–volitional model of suicidal behavior (IMV model; O'Connor & Kirtley, 2018) expands our knowledge of the development of suicidal ideation and behavior by considering other cognitive, behavioral, sociological, and biological factors. It is a more recent ideation-to-action framework that aims to fill in the gap of the transition from suicidal ideation to suicidal behavior. It explains the development of suicidal ideation and behavior in three phases (see Figure 3).

Figure 3 *The Integrated Motivational–Volitional Model of Suicidal Behavior (adapted from O'Connor & Kirtley, 2018)*
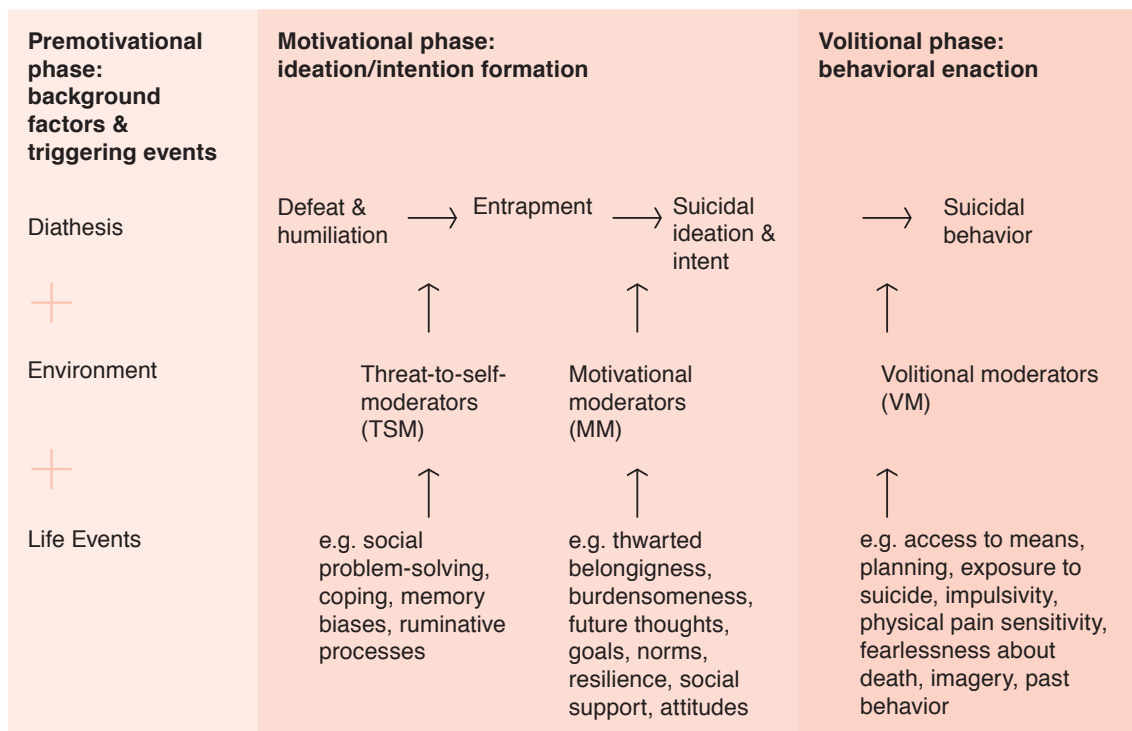
The premotivational phase is based on the diathesis-stress models of suicide (Mann et al., 1999) and includes background factors and triggering events. The IMV model assumes that the interaction between diathesis, environment, and life events in the premotivational phase continues to influence the risk of suicide in the motivational and volitional phases (O'Connor & Kirtley, 2018).

The motivational phase explains the formation of suicidal ideation and integrates the cognitive constructs of the CoP and the IPTS. In defining this phase, the authors assume that defeat and humiliation lead to entrapment and that entrapment leads to suicidal ideation. The transition from defeat and humiliation to entrapment is moderated by threat-to-self moderators (TSMs) such as social problem-solving, coping, memory biases, and ruminative processes; these TSMs thus include rescue factors already named in the CoP (see Chapter 1.1). The transition from entrapment to suicidal ideation and intent is moderated by motivational moderators (MMs) such as thwarted belongingness and perceived burdensomeness (constructs of the IPTS) as well as future thoughts, goals, norms, resilience, social support, and attitudes.

Actual suicidal behavior takes place in the volitional phase. The transition from suicidal ideation to suicidal behavior is moderated by volitional moderators (VMs) such as access to means, planning, exposure to suicide, impulsivity, sensitivity to physical pain, fearlessness about death, imagery, and past behavior, which are similar to how the IPTS defines capability for suicide in the IPTS.

1.3.1   Empirical Findings

In the following, the empirical findings will be presented separately for each of the three phases.

1.3.1.1 The Premotivational Phase

The premotivational phase is especially important to the model because it includes distal biosocial risk factors associated with suicide. Background factors such as biological or genetic predisposition (e.g., decreased serotonergic neurotransmission; Turecki, 2014) and negative life events such as intrafamilial problems (Serafini et al., 2015) and childhood abuse (Schönfelder et al., 2019) have been shown to be associated with suicidal behavior. Unrealistic high

expectations and perfectionism are also associated with suicide risk (Smith et al., 2018) as they might increase feelings of defeat (O'Connor & Kirtley, 2018), which are important for the development of suicidal ideation.

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1.3.1.2 The Motivational Phase

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In addition to the existing evidence for defeat and entrapment as predictors for suicidal ideation and behavior (presented in Chapter 1.1.1), the pathways of the motivational phase have been empirically examined. The predictive power of defeat could be partly and prospectively confirmed in a study by Taylor, Gooding, Wood, Johnson, et al. (2011). Seventy-nine participants were assessed for defeat, entrapment, depression, and suicidal ideation in a baseline assessment and 12 months later. The more defeat participants experienced in the baseline assessment, the more suicidal ideation they reported over the 12 months. By contrast, suicidal ideation in the baseline was not able to predict defeat in the follow-up, so the assessment confirmed a unidirectional relationship between defeat and suicidal ideation. There were not, however, any prospective effects of entrapment on suicidal ideation and vice versa. Contrary to these findings, Ng et al. (2016) evaluated 82 suicidal and 80 nonsuicidal participants for suicidal ideation, suicidal flash-forwards (vivid images of suicide or of the repercussions of death; Crane et al., 2012), defeat, and entrapment in a baseline assessment and 7 weeks later, and found that participants with recent suicidal ideation reported higher levels of entrapment and defeat. Additionally, the interaction between the presence of suicidal flash-forwards and entrapment predicted suicidal ideation, which highlights the importance of entrapment in the IMV model. Branley-Bell et al. (2019) assessed 299 adults in a baseline assessment and two follow-ups (after 1 and 6 months) and found that defeat and entrapment predicted suicidal ideation cross-sectionally, but defeat only had an indirect prospective effect on suicidal ideation through entrapment, which is in line with the pathway in the motivational phase of the IMV model. Regarding moderators, in a prospective study with 237 patients admitted due to one or more suicide attempts, O'Connor, O'Carroll, et al. (2012) found that difficulties in reengaging in new goals (a MM) were predictive of self-harm in a follow-up two years later. In a clinical and an online sample, Teismann and Forkmann (2017) showed cross-sectionally that the association between rumination (a TSM) and suicidal ideation is influenced by the extent of perceived entrapment. Furthermore, Branley-Bell et al. (2019) showed in a prospective study that defeat effected suicidal ideation only indirectly through entrapment.

1.3.1.3 The Volitional Phase

The volitional phase emphasizes volitional moderators such as pain sensitivity and fearlessness about death. In a cross-sectional study, O'Connor, Rasmussen, et al. (2012) compared a large sample of adolescents who deliberately harmed themselves with or without suicidal intent (n = 628) with adolescents who only thought about self-harm (n = 675) and with adolescents who did not have any self-harm history (n = 4219). They found that adolescents who acted out self-harm differed from those who only thought about it in all volitional factors. This is also in line with the findings of Dhingra et al. (2015), who found in a cross-sectional, anonymous self-report survey that individuals with one or more suicide attempts significantly differed from individuals with suicidal ideation only in all volitional factors. Wetherall et al. (2018) even showed that the motivational factors differentiated both individuals with only suicidal ideation and individuals with one or more suicide attempts from a control group, but only volitional factors were able to differentiate between individuals with suicide attempts and those with only suicidal ideation.

In conclusion, the three phases of the IMV model postulate the development of suicidal ideation and the transition from suicidal ideation to suicidal behavior through multiple pathways. Parts of the IMV model have already been empirically confirmed. But further risk factors for suicidal ideation and behavior have only recently been identified, and they have not yet been integrated into the IMV model. The deficiencies of the IMV model will be discussed in the following.

1.3.2 Deficiencies of the IMV Model

Despite the amount of research on the IMV model and the constructs it encompasses such as defeat and entrapment, the pathways of the IMV model have not been fully able to reliably predict suicidal ideation and behavior. There are several potential reasons for that.

First, there has been an ongoing debate about the one- or two-dimensionality of the constructs defeat and entrapment (e.g., Gilbert & Allan, 1998; O'Connor et al., 2013; Taylor, et al., 2009). Until a few years ago, defeat and entrapment have been assessed with the Defeat Scale (DS) and the Entrapment Scale (ES) (Gilbert & Allan, 1998), each of which consist of 16 items. Both the DS and the ES have been shown to be positively related to depression, hopelessness, and suicidality in different samples (Taylor, Gooding, Wood & Tarrier, 2011)

and exist in validated German versions with good psychometric properties (Forkmann, Stenzel, et al., 2018; Trachsel et al., 2010). However, brief measures are of central importance in clinical practice in order to assess risk factors more quickly and with less burden on patients. Because of the necessity of brief measures, Griffiths et al. (2015) developed the Short Defeat and Entrapment Scale (SDES), which measures both defeat and entrapment within one scale and combines items of the DS and the ES. This seems ideal for clinical practice. However, the SDES is not available in the German language, so to date defeat and entrapment are still assessed with the DS and ES in German-speaking countries. Assessing defeat and entrapment is therefore possible but relatively burdensome and time-consuming.

Second, the IMV model has been criticized for proposing entrapment as a unidimensional construct, even though this is contrary to the conclusions of Forkmann, Teismann, et al. (2018) and Gilbert and Allan (1998), who distinguished between internal and external entrapment. With regard to the assumptions of the IMV model, a cross-sectional study by Carvalho et al. (2013) with depressed patients and a control group from the general community population revealed that internal and external entrapment are both associated with defeat. Furthermore, Owen et al. (2018) conducted a prospective study with a baseline and a 4-month follow-up assessment with 80 bipolar participants with suicidal ideation or one or more suicide attempts in the past. They found that the relationship between defeat and suicidal ideation was mediated by total entrapment and internal entrapment but not by external entrapment. This is in line with the findings of O'Connor and Portzky (2018), who also did not find an effect for external entrapment in their review. Wetherall et al. (2021) confirmed this in a large Scottish wellbeing study with a baseline (n = 3508) and a 12-month follow-up assessment (n = 2420) finding only an association between internal entrapment and suicidal ideation but not external entrapment. By contrast, Lucht et al. (2020) showed that the relationship between suicidal ideation and defeat was cross-sectionally mediated by both internal and external entrapment in a highly suicidal inpatient sample, which is in line with the postulated pathway of the IMV model.

In sum, even though these three theoretical frameworks build on one another and even though the IMV model integrates all of the relevant predictors and proposes more complex pathways than the CoP and the IPTS, the findings are inconsistent. These models do not make it possible to predict suicidal ideation and behavior in a fully reliable manner, which suggests that there are other risk factors affecting the development of both.

These uncertainties suggest that a short, economic, and convenient measure for defeat and entrapment would be advantageous, that the influence of internal and external entrapment on the development of suicidal ideation and behavior needs to be better understood, and, last but not least, that further risk factors that have not yet been integrated into the IMV model should be considered. Regarding this last aspect, a relatively new line of research suggests that deficits in interoception might be related to heightened suicidal ideation and behavior (e.g., Forrest et al., 2015). The following chapter summarizes key results concerning this relation and develops potential links to the IMV model.

1.4 Interoception

The ability to sense the physiological conditions of one's own body (Craig, 2003), which is called interoception, has been intensively investigated with regard to its potential relation to psychopathology. For instance, it was shown to be associated with panic disorder already in the last century (Ehlers, 1993). More recently, it has been well substantiated that interoception contributes to several mental-health conditions such as anxiety disorders, mood disorders, eating disorders, addictive disorders, and somatic disorders (Khalsa et al., 2018). Interoception should not be conceived as a simple, unidimensional construct but rather as a multifaceted phenomenon that at least encompasses interoceptive sensibility, awareness, and accuracy (Forkmann et al., 2016; Garfinkel et al., 2015). Interoceptive sensibility is mostly assessed by self-reports (Mehling et al., 2012), so it consists of an individual's self-evaluation of their interoceptive abilities. Interoceptive accuracy is defined as actual interoceptive performance in an objective task, such as a heartbeat-perception task in which participants are asked to count their heartbeats during randomized time intervals. Interoceptive awareness assesses the metacognitive awareness of an individual's interoceptive accuracy.

Only recently have interoceptive facets come to the fore in suicide research. Since interoceptive sensibility, awareness, and accuracy are independently important and might have different impacts on suicidal ideation and behavior, research findings are summarized separately for these three facets in the following.

With regard to interoceptive sensibility and awareness, Forrest et al. (2015) conducted two studies and were the first to directly examine potential interoceptive deficits in suicidal individuals. In the first study, they compared a control group with individuals with suicidal ideation, individuals with suicide plans, and individuals with one or more suicide attempts, and found that individuals with suicide attempts reported worse interoception than those with suicidal ideation and suicide plans. Overall, participants with suicidality in general reported worse interoception than controls. In the second study, outpatients with and without suicide attempts were compared, and again those with at least one attempt reported worse interoception. Additionally, recent suicide attempts were associated with worse interoception than distant attempts. The impact of interoceptive deficits on the development of suicidal ideation and behavior is obvious because reduced interoception leads to being "out of touch" with one's body (Forrest et al., 2015). This state has been postulated to be necessary for inflicting self-harm (Muehlenkamp et al., 2012), which in turn has been associated with the capability for suicide (see Chapter 1.3.1.3). Similarly, Hagan et al. (2019) found that self-reported interoceptive deficits had an indirect effect on suicide attempts and were associated with suicidal ideation in two samples. Additionally, individuals with one or more suicide attempts reported more interoceptive deficits than individuals with suicidal ideation. This is substantiated by the findings of Smith et al. (2020), who showed that individuals with one or more suicide attempts reported the highest interoceptive deficits followed by individuals with suicidal ideation in comparison to controls. Duffy et al. (2018) even assumed that self-reported low trust in one's body increases suicide risk. Using an online survey, Rogers et al. (2018) found that individuals with lifetime suicidal ideation tended to worry more about their physical sensations and distracted themselves from those sensations. Based on prospective data from self-reported interoceptive deficits, Brausch and Woods (2019) predicted suicidal ideation and its severity 6 months later in a community sample.

In comparison to interoceptive sensibility and awareness, interoceptive accuracy has not been investigated as extensively, but recent studies have suggested that there is an association between deficits in interoceptive accuracy and suicide attempts but not suicidal ideation. DeVille et al. (2020) compared individuals with a history of suicide attempts to a matched psychiatric reference sample of individuals without a history of suicide attempts and found that those with one or more suicide attempts exhibited a significant less accurate perception of their heartbeats than those without suicide attempts. By contrast, Forkmann

et al. (2019) showed that individuals with suicidal ideation and those without it only differed in their interoceptive sensibility but not in their interoceptive accuracy.

These findings suggest that the at least three facets of interoception—interoceptive sensibility, awareness, and accuracy—possess a varying importance in different stages of suicidality. This raises the question of whether and how interoceptive facets are integrable into current theories on the emergence of suicidal ideation and behavior. The IMV model, which aims at postulating exact and generic pathways for the development of suicidal ideation and for the transition to suicidal behavior, does not yet include them. The next section discusses what theoretical implications the research on the associations between facets of interoception and suicidal ideation and behavior might have for the IMV model.

1.4.2 Integration of Facets of Interoception in the IMV Model

Through the lens of the IMV model, it remains unclear where exactly interoception might be decisive in the process of the emergence of suicidal ideation and behavior. However, the IMV model offers several potential links relating interoceptive deficits as moderators to the development of suicidal ideation and behavior. For a better overview of the assumptions regarding interoceptive deficits and their linkage to suicidal ideation and suicidal behavior within the scope of the IMV model see Figure 4.

Figure 4 *The Integrated Motivational–Volitional Model of Suicidal Behavior (adapted from O'Connor & Kirtley, 2018) with the Supplements of Interoceptive Sensibility, Awareness, and Accuracy*

First, Dunn et al. (2007) reported results showing that interoceptive accuracy might be negatively related to depression. However, Eggart et al. (2019) suggested that the direction of the relation might be u-shaped, depending on the severity of depression. Therefore, it has to be acknowledged that the following is only an assumption and that this postulated pathway requires more empirical clarification. Since depression is positively associated with ruminative thinking (Kirkegaard Thomsen, 2006), and since rumination is supposed to be a TSM of the relation between defeat and entrapment in the IMV model, one could hypothesize that deficits in interoceptive accuracy might be related to suicidal ideation through heightened feelings of entrapment and more intense ruminative thinking. This would underline the role of interoceptive accuracy as a TSM. Even though the results of Forkmann et al. (2019) suggested that there are no differences in interoceptive accuracy for suicidal ideators compared to nonideators, the role of interoceptive

accuracy in suicidal ideation needs to be further investigated, considering that Forkmann et al. (2019) is the only study that has assessed the relation between interoceptive accuracy and suicidal ideation to date.

Second, deficits in interoceptive accuracy were shown to be related to difficulties in decision-making processes (Dunn et al., 2010; Werner, Jung, et al., 2009). The IMV model assumes that deficient social problem-solving serves as a TSM between defeat and entrapment, which in turn leads to the development of suicidal ideation. Thus, deficits in interoceptive accuracy could also be related to suicidal ideation via feelings of entrapment and impaired social problem-solving, which again suggests that interoceptive accuracy could be a TSM. This assumption corresponds with the somatic marker hypothesis, which states that reasoning, social behavior, and decision-making are optimized by body-related (somatic) signals in complex situations (Damasio, 1996).

Third, in a study of individuals with a history of suicide attempts and a matched psychiatric reference sample with no history of suicide attempts, DeVille et al. (2020) examined pain tolerance and interoceptive accuracy. They showed that individuals with one or more suicide attempts tolerated pain longer than those without suicide attempts and exhibited significantly lower interoceptive accuracy. These findings suggest that pain tolerance, interoceptive accuracy, and suicidal behavior are somehow associated, which suggests that interoceptive accuracy should also be considered as a VM in the volitional phase of the IMV model.

1.4.2.2 Interoceptive Awareness in the IMV Model

There have been no studies on interoceptive awareness and suicidal ideation or behavior. But evidence that low interoceptive awareness correlates with difficulties in decision-making in moderately depressed individuals (Eggart et al., 2019) indicates that interoceptive awareness could be positively related to suicidal ideation via entrapment, depression, and ruminative thinking as a TSM. Furthermore, Rae et al. (2020) showed that participants with lower interoceptive awareness tended to make faster decisions and to execute faster actions than those with high interoceptive awareness. This result could indicate an inhibition or impulse-control deficit. Interoceptive awareness could therefore be a moderator of the transition from suicidal ideation to suicidal behavior in the volitional phase of the IMV model.

Because there is only little research on the relation between interoceptive deficits and suicidal ideation and behavior, it remains unclear whether (a) the objective performance of perceiving body signals is decisive or whether (b) the subjective conviction to have poor access to one's own body signals leads to a limited use of them. Deficits in interoceptive sensibility are related to a lack of adjustment in emotional processes (Werner, Duschek, et al., 2009). Individuals with high interoceptive sensibility showed less anxiety in a public speech than individuals with low interoceptive sensibility (Werner, Duschek, et al., 2009). Anxiety leads to worries and rumination, so interoceptive sensibility could also play an important role in the motivational phase. The nonacceptance of bodily sensations has also been associated with worry (Mehling et al., 2012), which highlights the potential role of interoceptive sensibility in the development of suicidal ideation as a TSM. Furthermore, mindfulness-based therapy is able to reduce suicidal thoughts (Forkmann et al., 2014), and mindfulness-based therapy partly concentrates on attention to bodily sensations. This suggests that a better interoceptive sensibility could be associated with less suicidal ideation. All in all, low trust in one's body has been associated with anxiety, emotion dysregulation, and alexithymia (Brown et al., 2017; Mehling et al., 2012), all of which have been linked to suicidal ideation (Bentley et al., 2016; Hintikka et al., 2004; Rajappa et al., 2012). In a study by Smith et al. (2020), individuals who had attempted suicide had greater deficits in interoceptive sensibility than those with no suicidality, while suicidal ideators had intermediate scores regarding their self-reported interoceptive deficits. This suggests that deficits in interoceptive sensibility are higher for attempters than for nonattempters, which would also indicate a role as a VM for interoceptive sensibility in the volitional phase. However, both suicidal ideation and one or more suicide attempts were strongly related to deficits in interoceptive sensibility beyond other risk factors such as hopelessness or age (Smith et al., 2020), which suggests that interoceptive sensibility has a role in both the motivational and the volitional phases of the IMV model.

In summary, the current findings regarding various facets of interoception suggest several potential points of linkage in the IMV model for a connection with suicidal ideation and behavior.

Amending the IMV model might be an important step in improving the theory's ability to predict the development of suicidal ideation and behavior. Interoceptive deficits might be a "candidate" construct for adding to the model, which warrants further investigation.

However, the reported findings as well as the posited assumptions are further complicated by recent findings in other studies using smartphone-based ecological momentary assessments (EMAs; Czyz, King, & Nahum-Shani, 2018; Hallensleben et al., 2017; Kleiman et al., 2017). The findings of these studies again alter the picture by emphasizing that the development of suicidal ideation and behavior and of the respective risk factors is a dynamic process with changes over hours or even minutes. The importance of the short-term prediction of suicidal ideation and behavior will be discussed in the following chapter.

1.5   Short-Term Prediction

Studies have shown that suicidal ideation is not a stable construct and fluctuates over time (Hallensleben et al., 2017). This was confirmed by Czyz et al. (2018), who found that the frequency and duration of suicidal ideation as measured with an EMA varied across time in a sample of 34 high-risk suicidal adolescents. Suicidal ideation therefore needs to be monitored closely using repeated assessments in clinical practice. EMA is gaining increasing interest as a method of choice for repeated assessment and can be conducted using smartphones. EMA thus offers the possibility to collect data not only in real time but also independently of location. One further significant advantage of EMA is that it avoids potential memory bias due to retrospective assessments. Data is collected in real time and includes moment-to-moment information. Forkmann, Spangenberg, et al. (2018) have already shown that the compliance of participants with EMA in suicide research is excellent.

Two EMA studies with suicidal participants by Kleiman et al. (2017) revealed that suicidal ideation varied dramatically within hours. Additionally, in both studies, common risk factors for suicidal ideation, such as hopelessness, perceived burdensomeness, and loneliness, fluctuated considerably over the course of only a few hours. Using an EMA, Stenzel et al. (2020) recently found that defeat and entrapment, the core constructs of the IMV model, were also temporally unstable in a community sample of 61 participants. A systematic Review of Sedano-Capdevila et al. (2021) concluded that EMA is a good method to assess suicidal ideation and respective risk factors in clinical practice and again emphasize the wide fluctuations within very short periods of time. These results emphasize the importance of repeatedly assessing the risk factors of suicidal ideation and behavior and of examining their temporal course. Although it has been shown that interoceptive deficits are associated

with suicidal ideation and behavior, we know virtually nothing about their temporal course, which further complicates the evaluation of their exact role and their temporal connection to suicidal ideation and behavior.

The current state of research and the complex and dynamic interplay of suicidal ideation, behavior, and the respective proximal risk factors now appear to raise more questions than answers. This dissertation seeks to contribute to answering some of these questions. The following chapter presents the aims of the dissertation.

1.6   Aims of this Dissertation

The current state of research shows that the models used in suicide research exhibit considerable deficiencies. These deficiencies should be remedied. In summary, defeat and entrapment are very important constructs in predicting suicidal ideation and behavior. Nevertheless, recent research has suggested that interoceptive sensibility, awareness, and accuracy might help improve our understanding of the development of suicidal ideation and behavior.

This dissertation therefore had three superordinated, consecutive goals, which were addressed in three separate studies.

1) Validation and clarification of the dimensionality of a German short, economic, and convenient measure to assess defeat and entrapment

As mentioned in Chapter 1.3.2, defeat and entrapment are assessed uneconomically with 16 items each since the SDES has not yet been validated in the German language. The first study of this dissertation therefore concentrated on validating this measure in German in a community and in an outpatient and an inpatient sample for its use in clinical practice. Due to the ongoing debate about the one- or two-dimensionality of the constructs defeat and entrapment and the evidence from Forkmann, Teismann, et al. (2018) contradicting the assumption that defeat and entrapment are one construct, the first part of the study concentrated on examining the factor structure of the SDES before pursuing further analysis concerning its reliability and validity. In sum the goal was to provide not only a validated short, economic, and convenient measure to reduce the test burden on patients in clinical practice but also a suitable tool for EMA research.

2) Prospective examinations of associations between defeat, internal and external entrapment, and suicidal ideation in a high-risk suicidal sample

The second study concentrated on the motivational-phase pathways postulated in the IMV model and its core constructs, defeat and entrapment. Previous findings on the pathways have been mixed and are mostly from cross-sectional studies, so the main goal was to examine the pathways from defeat to entrapment and from entrapment to suicidal ideation. To the best of my knowledge, this was the first study to examine these pathways cross-sectionally and prospectively while distinguishing between internal and external entrapment in a high-risk-for-suicide sample that had been assessed for the relevant constructs four times within 12 months.

3) Examinations of the temporal course of facets of interoception in an innovative EMA setting.

Since interoception has recently come to the fore in suicide research, the focus of the third study was on three facets of interoception (interoceptive sensibility, awareness, and accuracy). Even though suicidal ideation and most of its proximal risk factors have been shown to underly considerable fluctuation over minutes to hours, virtually nothing is known about the temporal course of interoception. To the best of my knowledge, this was the first study to examine interoceptive facets in an innovative EMA setting. For that reason, the potential influence of repetitive assessments on interoceptive abilities was also examined. The main goal of this study was to investigate whether such an assessment of interoceptive sensibility, awareness, and accuracy is feasible and whether these facets of interoception underly fluctuations over time. This was an important step for a possible future integration of interoception into current theoretical frameworks. To protect suicidal patients from unnecessary burden when first testing the technical possibilities, a pilot study with a community sample was conducted.

In the following, all three consecutive studies of this cumulative dissertation will be presented. All three studies have been published in peer-reviewed journals:

Study 1:

Höller, I., Teismann, T., Cwik, J. C., Glaesmer, H., Spangenberg, L., Hallensleben, N., Paashaus, L., Rath, D., Schönfelder, A., Juckel, G., & Forkmann, T. (2020).
Short defeat and entrapment scale:
A psychometric investigation in three German samples.
Comprehensive Psychiatry, *98*, 152160.

Publication Date: April 2020

Impact Factor (2020): 3.74

Study 2:

Höller, I., Rath, D., Teismann, T., Glaesmer, H., Lucht, L., Paashaus, L., Schönfelder, A., Juckel, G., & Forkmann, T. (2021).
Defeat, entrapment, and suicidal ideation: Twelve-month trajectories.
Suicide and Life-Threatening Behavior.

Publication Date: June 2021

Impact Factor (2020): 3.87

Study 3:

Höller, I., Stenzel, J. S., Rath, D., & Forkmann, T. (2021).
Listen to your heart–Ecological momentary assessment of interoceptive accuracy, awareness and sensibility: A pilot study.
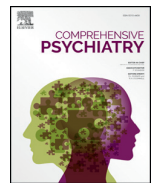*International Journal of Environmental Research and Public Health*, *18*(9), 4893.

Publication Date: May 2021

Impact Factor (2020): 3.39

All three studies will be presented one after the other in the next chapters.

Short defeat and entrapment scale: A psychometric investigation in three German samples

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ABSTRACT

Background: The present study aimed to validate the German version of the Short Defeat and Entrapment Scale (SDES).
Methods: Validity and reliability were established in an online ($N = 480$), an outpatient ($N = 277$) and an inpatient sample ($N = 296$). Statistical analyses included confirmatory factor analyses (CFA) and group differences in defeat and entrapment.
Results: For the online and the inpatient sample, the CFA indicated a two-factor solution, whereas for the outpatient sample both one- and two-factor solutions fitted the data equally well. Scale properties for the two-factor solution (defeat and entrapment subscale) were excellent. Thus, further analyses were based on this solution. For the online and the outpatient sample, suicidal ideators and suicide attempters scored significantly higher in defeat and entrapment than non-ideators and non-attempters.
Limitations: Limiting factors of the study were the different measures across the samples and the cross-sectional design of the study.
Conclusion: Though results were partly mixed, we found support for a two-factor solution of the instrument showing excellent psychometric properties in all three samples. The two-factor solution is further expected to have higher clinical utility than a one-factor solution. Suicidal ideators and suicide attempters in the online and outpatient sample showed higher scores in defeat and entrapment than non-ideators and non-attempters, emphasizing these two concepts as predictors for suicidal ideation. All in all, the present study supports the general validity and reliability of the SDES. However, future investigations based on prospective data are warranted.

1. Introduction

Gilbert and Allan [1] proposed two constructs that they assumed to have central relevance in the development of depressive disorders: defeat and entrapment. Experiences of defeat have been described as the perception of a failed struggle, feelings of powerlessness and a sense of losing social status or missing personal goals [1]. Entrapment has been defined as a desire to escape from an unbearable situation, tied with the perception that all escape routes are blocked [1]. There has been a debate about the conceptual overlapping of defeat and entrapment with other theoretical constructs such as helplessness, however, the significance of defeat and entrapment on psychopathology has been assured independent of related constructs [2].

In recent years, research showed the transdiagnostic relevance of defeat and entrapment in the development of depressive, anxiety, and post-traumatic stress disorders [3]. Furthermore, three contemporary theoretical models of suicidal behavior – the *Cry of Pain (CoP)-Model* [4], the *Schematic Appraisal Model* (SAMS) [5], and the *Integrated Motivational and Volitional (IMV)-Model* [6,7] – have highlighted defeat and entrapment as core components of the psychological mechanisms underlying suicidal ideation and behavior. The IMV model consists of three different phases [8]: the premotivational phase, where the main focus is on the individual's biopsychosocial context, the motivational phase, where it comes to suicidal ideation, and the volitional phase, in which the suicidal behavior takes place. Feelings of defeat followed by feelings of entrapment lead to suicidal ideation and are thereby the core components of the motivational phase. The transition from entrapment to suicidal ideation is moderated

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by motivational moderators [7] such as thwarted belongingness and perceived burdensomeness, which are both constructs originally proposed by the Interpersonal-Psychological Theory of Suicidal Behavior (IPTS; [9]). The IPTS [9] postulates that suicidal ideation is created when thwarted belongingness and perceived burdensomeness occur simultaneously. According to the IPTS a third component, the acquired capability for suicide, is needed to actual engage in suicidal behavior. However, the IPTS could only be partially supported [10,11].

In line with the SAMS, CoP, and IMV models, a growing number of studies documented a strong positive association between perceptions of defeat and entrapment, suicidal ideation, and behavior in a range of different populations such as students [12], prisoners [13], parasuicidal individuals [14], as well as individuals diagnosed with psychosis [15], posttraumatic stress disorder [16], and bipolar disorder [17]. In a four-year prospective study, entrapment and frequency of past suicide attempts were the only significant predictors of subsequent suicide attempts in a sample of seventy patients hospitalized after a suicide attempt – even after controlling for suicidal ideation, hopelessness, and depression [18].

Defeat and entrapment are usually assessed with the Defeat Scale (DS) and the Entrapment Scale (ES), both developed by Gilbert and Allan [1]. The two scales consist of 16 items each using a five-point Likert scale. Both scales showed good internal consistency and good convergent and criterion validity in terms of positive relations with depression, hopelessness, and suicidality in various samples [2]. There are validated German versions of both scales showing good psychometric properties [19,20]. While the two instruments were originally designed and applied as being two separate scales, research suggests that they might represent facets of the same construct [21–23] – although there is a controversial debate about this issue with recent research suggesting that defeat and entrapment are best viewed as two distinct but correlated constructs [24].

Consequently, Griffiths et al. [22] developed the Short Defeat and Entrapment Scale (SDES). The SDES consists of eight items, four measuring defeat and four entrapment. By means of a principal-axis exploratory factor analysis (EFA), eight items of the SDES with highest loadings were selected from the 32 items of the original DS and ES. Data of $N = 262$ participants from the community were used. The authors then presented a series of analyses supporting unidimensionality, which is inconsistent with recent findings [24], internal consistency, and validity of this set of eight items building the SDES.

Short measures are of central relevance for usage in clinical settings – especially when conducting suicide risk assessments because defeat and entrapment can be assessed more quickly and with less test burden to the patients. The main goal was, therefore, to provide a shorter, and thus more convenient, validated measure of the main constructs of the motivational phase of the IMV model in German.

In regard to the controversial debate regarding the distinguishability of defeat and entrapment, it is important to show whether the constructs are indeed empirically distinct [24] so that the theoretically suggested functional relations between the constructs (e.g. entrapment being a mediator between defeat and suicidal ideation) could be corroborated. Clinically, it is important to know whether defeat and entrapment are parts of the same construct or rather two distinct constructs that affect each other and may have differential relations to suicidal ideation. Thus, the aims of the current study were to examine (1) the factor structure as well as (2) scale properties of the German version of the SDES within a non-clinical sample, an outpatient sample, and an inpatient sample for suicidal ideation and suicide attempts. Additionally, the present study extends prior work on the SDES [22] by analyzing (3) differences in SDES scores between participants with vs. without suicidal ideation and with vs. without suicide attempts.

2. Methods

2.1. Participants

Data was derived from three samples in Germany.

2.1.1. Sample 1 (online sample)

The online sample comprised $N = 480$ participants. Three hundred fifty-five participants (74%) were female. The mean age was 28.5 years ($SD = 11.1$) ranging from 18 to 80 years. Forty-one participants (8.5%) reported at least one suicide attempt in their lifetime. Sixty-eight participants (14.1%) reported to currently be diagnosed with mental disorders, 52 participants (10.8%) declared that they currently undergo psychological treatment. The most common self-reported diagnoses across the whole sample were affective disorders (9.38%) and anxiety disorders (4.58%).

2.1.2. Sample 2 (outpatient sample)

The second sample comprised $N = 277$ patients being treated at an outpatient psychotherapeutic clinic. One hundred seventy-four participants (62.8%) were female. The mean age was 37.2 years ($SD = 12.6$) ranging from 19 to 78 years. Thirty-one patients (11.2%) reported at least one suicide attempt in their lifetime. The most common diagnoses according to the International Classification of Diseases (ICD-10 [25]) across the whole sample were affective disorders (F3; 45.13%), neurotic, stress-related, and somatoform disorders (F4; 42.24%), followed by personality disorders (F6; 6.50%), behavioral syndromes associated with physiological disturbances and physical factors (F5; 4.33%), psychotic disorders (F2; 2.17%), and other disorders (1.44%).

2.1.3. Sample 3 (inpatient sample)

The third sample compromised $N = 308$ patients being treated in a psychiatric ward. One hundred sixty-five (53.4%) participants were female. The mean age was 36.92 ($SD = 14.30$) ranging from 18 to 81 years. Two hundred fifteen (69.81%) reported at least one suicide attempt in their lifetime. The most common diagnoses across the whole sample were affective disorders (F3; 77.30%), neurotic, stress-related, and somatoform disorders (F4; 36.18%), followed by personality disorders (F6; 25.00%) and psychological and behavioral disorders resulting from psychotropic substances (F1; 20.07%), behavioral syndromes associated with physiological disturbances and physical factors (F5; 5.26%), psychotic disorders (F2; 2.63%), and other disorders (1.98%). Due to missing data 296 psychiatric inpatients were integrated into analyses.

There were significant differences between the samples in regard to their diagnoses (F0-F4 and F6; F0: $p < .05$[1]; F1: $\chi^2(2) = 156.68, p < .001$; F2: $= p < .001$[1]; F3: $= \chi^2(2) = 371.57, p < .001$; F4: $\chi^2(2) = 177.02, p < .001$; F6: $= p < .001$[1]).

2.2. Procedure

2.2.1. Sample 1 (online sample)

Sample 1 (online sample) was recruited between December 2015 and April 2016. Data was collected through an anonymous online survey using the SoSci-server (www.soscisurvey.de; [26]). Participants were recruited via postings at two universities (Aachen and Bochum), several psychotherapy outpatient units as well as social media (e.g., Facebook). Participants were provided with useful addresses (i.e., telephone numbers of helplines and contact information for therapy institutions), in case they felt burdened due to the content of the study or had suicidal thoughts in general. At the end of the study, participants had the opportunity to take part in a raffle, where – as an incentive for participation – five Amazon gift cards each valued at 15 euros were raffled. There were no attention checks built into the online data collection.

2.2.2. Sample 2 (outpatient sample)

Sample 2 (outpatient sample) was recruited between April 2017 and October 2017. Participants of this sample underwent psychotherapy at a university outpatient clinic in the Ruhr region in Germany. All

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[1] Fisher's exact test for cell frequencies <5.

participants that started therapy in this clinic were asked to fill out the questionnaires. If patients had agreed to participate, they were asked to fill out the questionnaires on a computer. There were no attention checks built into the online data collection.

2.2.3. Sample 3 (inpatient sample)

Sample 3 (inpatient sample) was recruited between September 2016 and March 2018 in Bochum, between February 2017 and February 2018 in Aachen as well as November 2016 and February 2018 in Leipzig. Participants were recruited in different cooperating psychiatric units in or around Aachen, Bochum, and Leipzig. Patients were eligible if they had attempted suicide or had been admitted for treatment because of an acute suicide crisis and if their admission to the clinic or the acute care had been no longer than two weeks ago. Exclusion criteria were acute intoxication as well as acute psychosis. If patients had agreed to participate they were asked to fill out the paper questionnaires.

Participants in all samples had to be at least 18 years old and German-speaking. Participants in sample 2 and 3 already received therapeutic help. Therefore, participants were informed to turn to the respective therapist in charge in case of suicidal thoughts or impulses.

Prior to assessments, the participants were informed about the purpose of the study, the voluntary nature of their participation, data storage and security. They gave written informed consent before participating. The study was approved by the responsible Ethics Committees (ethics committees of the Medical faculty, RWTH Aachen university: EK 310/13, Medical faculty, University of Leipzig: 042-14-27012014, Medical faculty, Ruhr-Universität Bochum: 4909-14).

2.3. Measures

To get a better overview over the used measures for each sample see Table 1.

2.3.1. Diagnoses of the outpatient and inpatient sample

Short Diagnostic Interview for Mental Disorders (MINI-DIPS [27]). The MINI-DIPS is a structured clinical interview for the diagnosis of mental disorders. It contains most observable mental disorders in the clinical context and allows their classification in accordance with ICD-10 and DSM-IV. The MINI-DIPS was used to assess diagnoses for the outpatient and the inpatient sample. For the online sample, the diagnoses of participants were self-reported.

2.3.2. Defeat and entrapment in all samples

Short Defeat and Entrapment Scale (SDES [22]). The SDES comprises four items to assess perceptions of defeat (e.g., "I feel defeated by life") and four items to assess perceptions of entrapment (e.g., "I

Table 1
Summary of all measures used in this study sorted by sample.

		Online sample	Inpatient sample	Outpatient sample
	MINI-DIPS		x	x
	SDES	x	x	x
Depression	DASS-D			x
	DESC	x	x	
Suicidal ideation	SSEV-SI			x
	DSI-SS	x		
	SITBI		x	
Suicide attempt	SBQ-R	x		
	SITBI		x	
	SSEV-SI			x
	INQ	x	x	x

Note. SDES = Short Defeat and Entrapment Scale; DASS-D = Depression-Anxiety-Stress Scales 42, Depression Subscale; DESC = Rasch-based Depression Screening; SSEV-SI = Suicide Ideation and Behavior Scale, *Suicide Ideation Subscale;* DSI-SS = Depressive Symptom Inventory, *Suicidality Subscale;* SITBI = Self-injurious Thoughts and Behavior Interview; SBQ-R = Suicide Behaviors Questionnaire Revised; INQ = Interpersonal Needs Questionnaire.

would like to get away from who I am and start again"). All items are to be answered on a Likert scale ranging from "0 = *not at all like me*" to "4 = *extremely like me*". The SDES has been shown to have excellent internal consistency (Cronbach's α ≥ 0.90; [22]). For the German Version of the SDES, translations of the Entrapment Scale [20] and the Defeat Scale [19] were used.

2.3.3. Depressive symptoms

Outpatient sample: Depression-Anxiety-Stress Scales 42 – Depression Subscale (DASS-D [28]). The DASS-D is a 14-item self-report measure, showing excellent psychometric properties (Cronbach's α = 0.96; [29]). Participants are asked to indicate to what extent the fourteen statements on depressive symptoms (e.g., "I just couldn't seem to get going.") applied to them over the past week ("0 = *did not apply to me at all*"; "3 = *applied to me very much or most of the time*"). The DASS-D was used in the outpatient sample (sample 2). Internal consistency was excellent (α = 0.96).

Online and inpatient sample: Rasch-based Depression Screening (DESC [30])**.** The DESC assesses depressive symptoms with 10 items (e.g., "how often during the last two weeks did you feel sad?"). Items refer to the last two weeks and participants are asked to mark how often they experienced each symptom on a five-point Likert scale from "0 = "*never*" to "4 = *always*". Total scores range from 0 to 40 with higher scores indicating greater depression. Sum-scores >11 are indicative for a potential depressive episode. The DESC has a good validity in relation to the BDI [31] and was used in the online sample (sample 1) and the inpatient sample (sample 3). Internal consistency was excellent in both the online sample (α = 0.94) and in the inpatient sample (α = 0.92).

2.3.4. Suicidal ideation

Outpatient sample: Suicide Ideation and Behavior Scale – Suicide Ideation Subscale (SSEV-SI [32]). The SSEV-SI assesses the frequency of suicidal ideation in the past four weeks using four items (e.g., "During the past four weeks, I seriously considered killing myself"). All items are to be answered on a six-point Likert scale ranging from "0 = *never*" to "6 = *many times every day*", with higher scores indicating greater severity of suicidal ideation. The SSEV-SI was used to assess suicidal ideation in the outpatient sample (sample 2). Internal consistency was good (α = 0.88).

Online sample: Depressive Symptom Inventory – Suicidality Subscale (DSI-SS [33]). The DSI-SS is a 4-item self-report questionnaire designed to assess the frequency and intensity of suicidal ideation and impulses in the past two weeks (e.g., "I am having thoughts about suicide and have worked out a definite plan"). Scores on each item range from 0 to 3, with higher scores indicating greater severity of suicidal ideation. In a first validation study using a large sample of young adults, Joiner et al. [33] found good internal consistency (Cronbach's α = 0.90). The DSI-SS was used to assess suicidal ideation in the online sample (sample 1). Internal consistency was excellent (α = 0.93).

Inpatient sample: Self-injurious Thoughts and Behavior Interview (SITBI [34], German version [35]). The SITBI is a structured interview to assess recent and life-time non-suicidal self-injury and suicidal ideation and behavior. It contains 169 items in six modules (e.g., "Have you ever had thoughts of killing yourself?", "Have you ever made an actual attempt to kill yourself in which you had at least some intent to die?"), rated on a four-point Likert scale ranging from "0 = *little*" to "4 = *very much/severe*". This interview was used for the inpatient sample to assess suicidal thoughts and behavior.

2.3.5. Suicide attempt

Outpatient sample: Suicide Ideation and Behavior Scale – Suicide Ideation Subscale (SSEV-SI [32]). This scale was additionally used to assess the lifetime history of suicide attempts in the outpatient sample with one item ("How often have you tried to kill yourself?").

Online sample: Suicide Behaviors Questionnaire Revised (SBQ-R [36], German version [37]). The SBQ-R is a questionnaire which assesses suicidal behavior throughout lifetime with four items (e.g., "Have you ever thought about or attempted to kill yourself"). Internal consistency was good in the present online sample ($\alpha = 0.82$). This questionnaire was used to assess lifetime history of suicide attempts for the online sample with one item ("I have attempted to kill myself, and really hoped to die"; this item has been deleted in the latest German version [37]; in this study a pre-published version including this item was used).

Inpatient sample: Self-injurious Thoughts and Behavior Interview (SITBI [34], German version [35]). This interview was used for the inpatient sample to assess the lifetime history of suicide attempts with one item ("Have you ever made an actual attempt to kill yourself in which you had at least some intent to die?").

2.3.6. Perceived burdensomeness and thwarted belongingness in all samples

Interpersonal Needs Questionnaire (INQ [38], German version [39]). The INQ assesses the amount of perceived burdensomeness with six items (e.g., "These days I feel like a burden on the people in my life.") and the amount of thwarted belongingness with nine items (e.g., "These days other people care about me."). All items are to be answered on a seven-point Likert scale ranging from "$1 = not\ at\ all\ true\ for\ me$" to "$7 = very\ true\ for\ me$". The 15-items version of INQ has been shown to have good to excellent internal consistency (perceived burdensomeness: $\alpha = 0.85$–0.90; thwarted belongingness: $\alpha = 0.81$–0.87) with high intercorrelations [40]. Accordingly, internal consistency was excellent in the present online sample (perceived burdensomeness: $\alpha = 0.94$ and thwarted belongingness: $\alpha = 0.90$), good to excellent in the outpatient sample (perceived burdensomeness: $\alpha = 0.92$ and thwarted belongingness: $\alpha = 0.89$), and in the inpatient sample (perceived burdensomeness: $\alpha = 0.92$ and thwarted belongingness: $\alpha = 0.82$).

2.4. Statistical analyses

Based on prior research reporting evidence for both a one- and a two-factor solution (with one factor with four items on defeat and one factor with four items on entrapment), confirmatory factor analyses (CFA) were used to test these two options. In the first step, CFA were separately conducted for the online, the outpatient, and the inpatient sample. In the second step, a CFA was conducted using all data. The models were fitted using the package *lavaan* version 0.5–23 [41] in R 3.5.2. The model fit was determined by the χ^2 test. A good model fit is demonstrated by a non-significant value. Since this test is very sensitive to sample size, it should be interpreted cautiously and only in accordance with further measures of fit. In this study, the comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA) were determined. A good fit is indicated by CFI > 0.95 [42], TLI > 0.95 [43] and RMSEA <0.05 [44]. A factor loading above 0.40 was defined as a reasonable item loading on a factor [45].

Further data analyses were conducted using IBM SPSS 25.0. To calculate scale properties, means, standard deviations, and variances for each item as well as corrected item-total correlations and Cronbach's alpha of the scale, if the item was deleted, items of defeat and entrapment were analyzed.

Cronbach's alpha was calculated to test the reliability of the items of the constructs defeat and entrapment: Scores ≥0.70 are considered as good values [46]. Additionally, inter-item correlations were assessed to evaluate the construct homogeneity.

In order to examine differences in defeat and entrapment scores between suicidal ideators and non-ideators and between suicide attempters and non-attempters, *t*-tests for independent samples were conducted. Additionally, *t*-tests for pooled data of all three samples were conducted. Cohen's *d* was calculated. An effect is considered to be large if Cohen's *d* is ≥0.80 [47]. For the outpatient sample, participants were considered suicidal ideators if they scored ≥1 in the SSEV-SI. Lifetime suicide attempt was also assessed with the SSEV. For the online sample, participants were considered suicidal ideators if they scored ≥1 in the DSI-SS. Lifetime suicide attempt was assessed with the SBQ-R. For the inpatient sample, suicidal ideation and lifetime suicide attempt were assessed with the SITBI. Participants were only part of the group "suicide attempters" if they had attempted at least one suicide attempt. Additionally, suicidal ideation was assessed for the past two weeks, all participants in the group "suicidal ideators" did not have a suicide attempt for the past two weeks.

Missing data were handled with mean value imputation (if only few values were missing, depending on the questionnaire) or listwise deletion.

3. Results

3.1. Confirmatory factor analysis

For the online sample, both a two-factor ($\chi^2(19) = 73.30$, $p < .001$; RMSEA = 0.07; CFI = 0.98; TLI = 0.96) and a one-factor solution ($\chi^2(20) = 121.46$, $p < .001$; RMSEA = 0.10; CFI = 0.96; TLI = 0.94) fitted the data. All items loaded >0.40 on the respective factor (see Table 2). To compare the nested one-factor and two-factor models for the online sample, a simple ANOVA was used. The two-factor model fitted the data significantly better than the one-factor solution ($\chi^2(1) = 48.16$, $p < .001$).

For the outpatient sample, both a two-factor ($\chi^2(19) = 73.56$, $p < .001$; RMSEA = 0.10; CFI = 0.95; TLI = 0.93) and a one-factor solution ($\chi^2(20) = 74.88$, $p < .001$; RMSEA = 0.10; CFI = 0.95; TLI = 0.93) only moderately fitted the data. All items loaded above 0.40 on the respective

Table 2
Standardized factor loadings and fit indices for each sample.

Item	Two-factors CFA				One-factor CFA			
	Online sample	Outpatient sample	Inpatient sample	Overall sample	Online sample	Outpatient sample	Inpatient sample	Overall sample
1	0.84	0.82	0.71	0.85	0.82	0.82	0.70	0.84
2	0.76	0.84	0.84	0.86	0.76	0.84	0.84	0.85
3	0.80	0.79	0.75	0.85	0.79	0.79	0.74	0.85
4	0.80	0.78	0.73	0.86	0.78	0.78	0.72	0.85
5	0.83	0.69	0.49	0.81	0.79	0.69	0.45	0.79
6	0.57	0.47	0.42	0.59	0.54	0.48	0.37	0.58
7	0.77	0.65	0.76	0.83	0.76	0.67	0.64	0.81
8	0.78	0.69	0.68	0.82	0.75	0.71	0.58	0.80
CFI	0.98	0.95	0.98	0.99	0.96	0.95	0.94	0.98
TLI	0.96	0.93	0.97	0.99	0.94	0.93	0.91	0.97
RMSEA	0.07	0.10	0.05	0.05	0.10	0.10	0.09	0.07

Note. All factor loadings *p* < .001. CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root mean square error of approximation, CFA = confirmatory factor analysis.

factor (see Table 2). In regard to results of the ANOVA, there was no difference between the one and two-factor solution ($\chi^2(1) = 1.32$, $p = .25$).

For the inpatient sample, both the two-factor ($\chi^2(19) = 34.58$, $p < .05$; RMSEA = 0.05; CFI = 0.98; TLI = 0.97) and the one-factor solution ($\chi^2(20) = 70.30$, $p < .001$; RMSEA = 0.09; CFI = 0.94; TLI = 0.91) showed good fit to the data. Again, all item loadings were above 0.40 on the respective factors (see Table 2), except for the second item for entrapment "I would like to get away from other more powerful people in my life" in the one-factor solution. The ANOVA showed that the two-factor model fitted the data significantly better than the single-factor solution ($\chi^2(1) = 35.72$, $p < .001$).

Additionally, a CFA was conducted for the pooled data of all three samples ($N = 1053$). Again, both the two-factor solution ($\chi^2(19) = 68.04$ $p < .001$; RMSEA = 0.05; CFI = 0.99; TLI = 0.99) and the one-factor solution ($\chi^2(20) = 132.04$, $p < .001$; RMSEA = 0.07; CFI = 0.98; TLI = 0.97) fitted the data and for both solutions, all item loadings were above 0.40. However, again, the ANOVA for nested models showed that the two-factor model fitted the data significantly better ($\chi^2(1) = 64.00$, $p < .001$).

All in all, results of the CFA indicated that the two-factor solution outperformed the one-factor solution in most of the ANOVAs for nested models. Thus, for all further steps of analyses the two-factor solution was used.

3.2. Scale properties

Means, standard deviations, and variances for each item assessing defeat and entrapment as well as Cronbach's alpha of the defeat and entrapment scale, if the item was deleted, can be found in Table 3. Corrected item-total correlations were calculated as well, to measure whether each item captures a similar construct as the other items. The corrected item-total correlations for defeat for the outpatient sample ranged between 0.72 and 0.77, for the inpatient sample between 0.66 and 0.72, and for the online sample between 0.73 and 0.79, which can be considered as high values [47]. The corrected item-total correlations for entrapment for the outpatient sample ranged between 0.41 and 0.59, for the inpatient sample between 0.40 and 0.55, and for the online sample between 0.53 and 0.74 (see Table 3). The answers for all items ranged from 0 ("never") to 4 ("always").

Reliabilities and mean inter-item correlations can be seen in Table 3. Inter-item correlations can be found in Table 4. None of the items were negatively correlated. All items showed mean to high correlations with the total score of the respective scale.

3.3. Construct validity

There were high positive correlations between defeat and entrapment and related constructs such as depression, perceived burdensomeness, and thwarted belongingness in all samples. All correlations were significant ($p \leq .01$; see Table 5).

3.4. Group differences in defeat and entrapment

For the online and the outpatient sample as well as for the pooled data, the differences between suicidal ideators and non-ideators were significant. Suicidal ideators scored significantly higher for defeat and entrapment than non-ideators in both samples (see Table 6). However, in the inpatient sample, the differences between suicidal ideators and non-ideators were not significant (see Table 6).

The differences in both defeat and entrapment between suicide attempters and non-attempters in the online and outpatient sample as

Table 3
Descriptive values of items and reliabilities of the Defeat and the Entrapment Scale.

No.	Item	M	SD	Variance	Corrected item-total correlation	α, if item deleted	Cronbach's α	$M_{\text{inter-Item Correlation}}$
	Defeat scale							
	Online sample						0.88	0.64
2	I feel defeated by life	0.81	0.97	0.95	0.79	0.82		
4	I feel powerless	1.33	1.01	1.02	0.69	0.86		
6	I feel that there is no fight left in me	0.83	1.02	1.03	0.73	0.84		
8	I feel that I am one of life's losers	0.59	0.96	0.91	0.73	0.84		
	Outpatient sample						0.88	0.65
2	I feel defeated by life	1.38	1.26	1.58	0.76	0.84		
4	I feel powerless	1.81	1.17	1.36	0.76	0.84		
6	I feel that there is no fight left in me	1.94	1.27	1.62	0.72	0.85		
8	I feel that I am one of life's losers	1.63	1.36	1.86	0.72	0.86		
	Inpatient sample						0.85	0.58
2	I feel defeated by life	2.41	1.18	1.38	0.66	0.82		
4	I feel powerless	2.91	1.09	1.18	0.72	0.79		
6	I feel that there is no fight left in me	2.64	1.16	1.36	0.69	0.80		
8	I feel that I am one of life's losers	2.64	1.31	1.70	0.68	0.81		
	Entrapment scale							
	Online sample						0.83	0.55
1	I can see no way out of my current situation	0.94	1.20	1.43	0.72	0.77		
3	I would like to get away from other more powerful people in my life	0.57	1.01	1.03	0.53	0.83		
5	I would like to escape from my thoughts and feelings	1.23	1.40	1.97	0.69	0.77		
7	I would like to get away from who I am and start again	0.88	1.28	1.63	0.74	0.74		
	Outpatient sample						0.72	0.39
1	I can see no way out of my current situation	1.81	1.23	1.50	0.45	0.69		
3	I would like to get away from other more powerful people in my life	1.26	1.31	1.71	0.41	0.72		
5	I would like to escape from my thoughts and feelings	2.32	1.24	1.54	0.61	0.60		
7	I would like to get away from who I am and start again	1.81	1.40	1.96	0.59	0.61		
	Inpatient sample						0.65	0.34
1	I can see no way out of my current situation	3.04	1.19	1.41	0.55	0.50		
3	I would like to get away from other more powerful people in my life	1.85	1.54	2.38	0.35	0.66		
5	I would like to escape from my thoughts and feelings	3.37	1.02	1.03	0.48	0.56		
7	I would like to get away from who I am and start again	3.02	1.30	1.67	0.40	0.60		

Note. α = Cronbach's alpha.

Table 4
Inter-item correlations for defeat and entrapment.

Defeat					
Online sample		2	4	6	8
Item no.	Item wording				
2	I feel defeated by life		0.64	0.69	0.69
4	I feel powerless			0.59	0.59
6	I feel that there is no fight left in me				0.63
8	I feel that I am one of life's losers				
Outpatient sample		2	4	6	8
2	I feel defeated by life		0.70	0.63	0.67
4	I feel powerless			0.67	0.63
6	I feel that there is no fight left in me				0.61
8	I feel that I am one of life's losers				
Inpatient sample		2	4	6	8
2	I feel defeated by life		0.59	0.54	0.56
4	I feel powerless			0.63	0.60
6	I feel that there is no fight left in me				0.59
8	I feel that I am one of life's losers				
Entrapment					
Online sample		1	3	5	7
Item no.	Item wording				
1	I can see no way out of my current situation		0.43	0.61	0.61
3	I would like to get away from other more powerful people in my life			0.43	0.53
5	I would like to escape from my thoughts and feelings				0.67
7	I would like to get away from who I am and start again				
Outpatient sample		1	3	5	7
1	I can see no way out of my current situation		0.25	0.41	0.41
3	I would like to get away from other more powerful people in my life			0.38	0.35
5	I would like to escape from my thoughts and feelings				0.57
7	I would like to get away from who I am and start again				
Inpatient sample		1	3	5	7
1	I can see no way out of my current situation		0.36	0.53	0.33
3	I would like to get away from other more powerful people in my life			0.20	0.24
5	I would like to escape from my thoughts and feelings				0.36
7	I would like to get away from who I am and start again				

Note. All correlations were significant.

well as for the pooled data were significant. Suicide attempters had a significantly higher score for defeat and entrapment than suicide non-attempters (see Table 6). However, for the inpatient sample, the differences in defeat and entrapment between suicide attempters and non-attempters were not significant.

4. Discussion

The aim of the current study was to examine (1) the factor structure underlying the German version of the SDES, (2) scale properties of the SDES, and (3) differences in SDES scores between participants with vs. without suicidal ideation and with vs. without suicide attempts. According to the IMV model [7], defeat and entrapment can be associated with suicidal ideation [12,48]. Therefore, the assessment of the two constructs with a validated and very short scale is of great importance for both research and clinical practice.

4.1. Factor structure of the SDES

Results of CFAs suggest that the two-factor solution that differentiates between defeat and entrapment outperforms the one-factor solution, although differences were marginal. For the online and the inpatient sample, CFA suggested a two-factor solution distinguishing between defeat and entrapment even though RMSEA was not good. However, a reason for that could be the small sample size. For the outpatient sample, these results could not be replicated; both one- and two-factor solutions fitted the data equally well. However, results of the online and the inpatient sample as well as the overall CFA fit provided more evidence for a two-factor solution. Thus, defeat and entrapment seem to represent two distinguished constructs. Therefore, further analyses were based on this solution. Even though the bidimensionality of the SDES is in contrast to previous findings [22,23], it supports findings of Forkmann et al. [24] and the original design of these constructs as being two separate scales [1]. According to the IMV model [7], defeat and entrapment should be seen as two different constructs, which are certainly highly associated but yet distinguished. Thus, both clinically and theoretically, it appears to be advantageous to provide an instrument that allows clinicians and researchers to differentiate between the two constructs.

4.2. Scale properties

The scale properties for defeat and for entrapment were calculated for all three samples. In sum, scale properties were good: each item of defeat and entrapment captured the same construct as the other items. However, the inter-item correlations of the entrapment scale seem to be rather low in comparison to the inter-item correlations of the defeat scale especially in regard to item 3 ("I would like to get away from other more powerful people in my life"). One possible reason could be the translation of this item. Additionally, the original entrapment scale [1] is divided in two subscales: internal and external entrapment. In the SDES, two items for internal and two items for external entrapment were used but combined to one scale. Owen et al. [17] could show for patients with bipolar disorder that internal entrapment mediated the relationship between defeat and suicidal ideation, but external entrapment did not significantly mediate this relation, suggesting

Table 5
Pearson correlations among questionnaires over all samples.

	Online sample	Outpatient sample	Inpatient sample	Online sample	Outpatient sample	Inpatient sample	Online sample	Outpatient sample	Inpatient sample	Online sample	Outpatient sample	Inpatient sample
	2			3			4			5		
1. SDES_D	0.78**	0.82**	0.59**	0.85**	0.72**	0.71**	0.67**	0.61**	0.58**	0.62**	0.57**	0.53**
2. SDES_E				0.83**	0.62**	0.53**	0.66**	0.53**	0.39**	0.59**	0.57**	0.34**
3. DESC/DASS-D[a]							0.78**	0.58**	0.57**	0.70**	0.55**	0.50**
4. INQ_PB										0.62**	0.49**	0.46**
5. INQ_TB												

Note. SDES = Short Defeat and Entrapment Scale; DESC = Rasch-based Depression Screening; DASS-D = Depression-Anxiety-Stress Scales 42, *Depression Subscale*; INQ_PB = Interpersonal Needs Questionnaire, *Perceived Burdensomeness Subscale*; INQ_TB = Interpersonal Needs Questionnaire, *Thwarted Belongingness Subscale*.
  [a] DESC was used for the online and inpatient sample, DASS-D was used for the outpatient sample.
  ** All correlations were significant at a level of $p \leq .01$.

Table 6
Group differences in the scores of defeat and entrapment for both samples.

	Defeat					Entrapment				
	M	*SD*	*t*	*p*	*d*	*M*	*SD*	*t*	*p*	*d*
Online sample										
Suicide attempters	1.62	1.09	4.59	<0.001***	0.84	1.80	1.27	4.79	<0.001***	0.88
Suicide non-attempters	0.82	0.79				0.82	0.93			
Suicide ideators	2.22	0.76	15.74	<0.001***	2.22	2.24	0.94	12.81	<0.001***	1.76
Suicide non-ideators	0.67	0.63				0.69	0.82			
Outpatient sample										
Suicide attempters	2.42	0.93	4.54	<0.001***	0.82	2.38	0.78	4.26	<0.001***	0.75
Suicide non-attempters	1.60	1.07				1.73	0.95			
Suicide ideators	2.73	0.78	12.81	<0.001***	1.89	2.60	0.76	9.92	<0.001***	1.46
Suicide non-ideators	1.15	0.89				1.40	0.88			
Inpatient sample										
Suicide attempters	2.68	0.97	−0.97	0.34	−0.12	2.83	0.91	0.06	0.95	0.00
Suicide non-attempters	2.56	1.02				2.83	0.82			
Suicide ideators	2.72	0.99	−1.62	0.11	−0.20	2.72	0.97	−1.57	0.12	0.18
Suicide non-ideators	2.53	0.95				2.88	0.83			
Overall sample										
Suicide attempters	2.50	1.05	16.97	<0.001***	1.18	2.63	1.02	17.98	<0.001***	1.22
Suicide non-attempters	1.25	1.07				1.32	1.13			
Suicide ideators	2.61	0.93	22.64	<0.001***	1.57	2.69	0.88	22.77	<0.001***	1.48
Suicide non-ideators	1.09	1.01				1.19	1.13			

*** $p \leq .001$.

that internal entrapment might be closer related to defeat than external entrapment [17]. This could indicate that the entrapment scale measures two constructs (internal and external entrapment) whereas the defeat scale only measures one construct. This could account for the differences in inter-item correlations. However, most previous studies did not differentiate between internal and external entrapment but rather used the total score of the entrapment scale (e.g. [2,14,15]). The sum score of this scale seems to be sufficient for the distinction between individuals with and without a history of suicide attempt [14]. Reliability was high for both scales across all samples. The mean inter-item correlation was similar for all three samples for defeat as well as for entrapment. Correlations between defeat and entrapment as well as depression, perceived burdensomeness, and thwarted belongingness were positive and significantly high.

4.3. Differences in defeat and entrapment

As expected, for both the online sample and the outpatient sample, suicidal ideators as well as suicide attempters scored significantly higher for defeat and entrapment than non-ideators and non-attempters, maintaining a strong focus on these two concepts as predictors for suicidal ideation and suicide attempts. However, for the inpatient sample, these results could not be replicated. Both defeat and entrapment did not differ between ideators and non-ideators and between attempters and non-attempters. Descriptively, mean scores tended to be higher for attempters and ideators than for non-attempters and non-ideators for defeat, but this was not significant. The non-significant results could be because patients in the inpatient group were highly stressed and therefore experienced defeat and entrapment at such a high level that an inpatient admission was necessary. This is underlined by the fact that SDES scores of the inpatient group were higher in general in comparison to the online and/or the outpatient sample (see Table 6). Therefore, there were no significant differences in the SDES score for the inpatient sample. This supports the thesis that patients in/after a suicidal crisis have similarly high scores in defeat and entrapment, independently of lifetime suicide attempt status. This result is further in line with findings of Gooding et al. [13] who assessed defeat and entrapment in 65 male prisoners with high suicide risk. All participants scored high for both defeat and entrapment making it appear as if high risk of suicide leads to an overlapping of

defeat and entrapment. Furthermore, a meta-analysis of Siddaway, Taylor, Wood, and Schulz [3] indicated strong perceptions of defeat and entrapment not only for suicidality but also for depression, anxiety problems, and PTSD. Participants in the inpatient sample represent a high-risk group where the distinction between defeat and entrapment seems to blur. SDES scores were higher in this sample than for the other two samples.

4.4. Limitations

Some strengths and weaknesses have to be kept in mind when appreciating the current results. One limitation in regard to the online sample is that only self-reported diagnoses were assessed whereas for the outpatient and inpatient samples a clinical diagnostic interview was conducted. Another limitation of the study was the cross-sectional design. Prospective data is needed for prediction of suicidal ideation and suicide attempts. Furthermore, scale properties of the entrapment scale were not perfect in terms of inter-item correlations. Especially item 3 showed some weaknesses, which have to be kept in mind for future investigations. Another important limitation of the study was the use of different measures for suicidal ideation, aggravating the comparability of the three samples. For future comparison, it would be useful to use same measurements.

However, group comparisons provide evidence for significant differences in both defeat and entrapment scores making it to appear as though it is possible to extrapolate from a high score in defeat and/or entrapment to suicidal ideation and/or behavior.

Another strength of the present study was the large sample size as well as its heterogeneity with one online, one outpatient, and one inpatient sample.

Furthermore, even though inter-item correlations were not perfect, the SDES validation included assessments of reliability, factorial, and construct validity as well as clinical utility with respect to the differentiation between clinical groups ("known-groups-validity").

4.5. Clinical implications

The results of the current study showed satisfying to good psychometric characteristics of the SDES in three samples with different mental symptom burden, suggesting its general applicability in clinical

practice. Some weaknesses of the instrument were found regarding the entrapment scale with item 3 showing poor psychometric quality. If this result was replicated in future studies, especially in different languages to rule out that the effect depends on the German translation, replacing this item by an alternative item measuring internal entrapment would be suggested. However, the sum score showed good validity in terms of high positive correlations between defeat and entrapment and related constructs such as depression suggesting its general utility in clinical practice. Both the defeat and the entrapment subscale could differentiate between suicide attempters and non-attempters in outpatients but not in inpatients hospitalized after a severe suicidal crisis. This suggests that very high mental symptom burden coincides with such high scores in defeat and entrapment that the scale loses its ability to differentiate between attempters and non-attempters. Thus, the SDES utility appears to be higher in outpatients than in inpatients. However, it has to be noted that in inpatients with high symptom burden it could, nevertheless, be informative to assess their individual intensity of defeat and entrapment in order to account for it in individual treatment planning. The SDES could also be used as an accompanying measure to psychotherapy to track changes in feelings of defeat and entrapment across the course of treatment.

5. Conclusion

Since defeat and entrapment have been highlighted as core components of psychological mechanisms underlying suicidal ideation and behavior [4–7], it is important to further analyze how defeat and entrapment can be captured best. We found support for a two-factor solution of the SDES, showing excellent psychometric properties in three large and different samples. On the basis of the results, it should be considered to use the SDES as a two-dimensional instrument. In line with the IMV model [6], defeat and entrapment can be seen as distinct but highly correlated constructs, which do not necessarily develop simultaneously. Therefore, an independent assessment of both constructs is especially important in regard to clinical context. All in all, the present study supports the general validity and reliability of the SDES, justifying its usage in clinical applications and research. For future research, studies should concentrate on prospective data to further ascertain the importance of defeat and entrapment in regard to the prediction of suicidal ideation and behavior.

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Authors' contributions

The idea for conducting CFA on the SDES came from TF, HG, JC, and TT. IH did the analyses. TT and IH participated in writing the manuscript. LS, NH, LP, DR and AS collected the data and participated with GJ in conceptualization of the analyses. All authors approved the final manuscript.

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Conflict of interest

All authors declare that they have no conflict of interest.

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ORIGINAL ARTICLE

Suicide and
Life-Threatening
BEHAVIOR

Defeat, entrapment, and suicidal ideation: Twelve-month trajectories

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Abstract

Background: Defeat and entrapment have been highlighted in the development of suicidal ideation within the Integrated Motivational–Volitional model of suicidal behavior. Research suggests that entrapment has to be differentiated into internal and external entrapment. The aim of this study was to investigate the associations between defeat, internal, external entrapment, and suicidal ideation within and prospectively over measurements.

Methods: A sample of 308 psychiatric inpatients (53% female) aged 18 to 81 years ($M = 36.92$, $SD = 14.30$) was assessed for the four constructs after admission to a psychiatric ward and six, nine, and twelve months later. Multilevel analyses were conducted to examine associations.

Results: Defeat was associated with (a change in) internal and external entrapment. Defeat predicted a change in internal entrapment over time. Defeat and internal, but not external, entrapment were associated with (a change in) suicidal ideation. Internal entrapment was able to predict suicidal ideation. Internal entrapment and defeat predicted a change in suicidal ideation over time.

Conclusion: Results highlight the importance to distinguish between internal and external entrapment, and their specific association with suicidal ideation. Perceptions of internal entrapment are of central relevance when experiencing suicidal ideation and should be considered in clinical practice.

KEYWORDS

defeat, external entrapment, internal entrapment, suicidal ideation

INTRODUCTION

Defeat and entrapment have been proposed as two important clinical constructs with transdiagnostic relevance in the development of depression, anxiety, and post-traumatic stress disorders (Siddaway et al., 2015). Gilbert and Allan (1998) describe defeat as feelings of powerlessness and humiliation, whereas entrapment is characterized by the felt incapability to escape from unbearable situations. They proposed that entrapment consists of two sub-types: internal and external entrapment, whereby external entrapment describes the feeling of being trapped by external circumstances and internal

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entrapment refers to being trapped by internal aspects such as one's own thoughts (Owen et al., 2018). This assumption is in line with findings of Forkmann et al. (2018) who demonstrated via network analyses the two-dimensional structure of entrapment highlighting the importance to distinguish between these two components.

Furthermore, in regard to the transdiagnostic relevance of defeat and entrapment, it has been empirically tested that defeat and entrapment are predictors for suicide attempts (O'Connor et al., 2013) and suicidal ideation (Rasmussen et al., 2010; Wetherall et al., 2018) emphasizing their central role in the development of suicidal ideation and behavior in general despite the differentiation between internal and external entrapment.

Recent suicide research focuses on distinguishing between predictors for suicidal ideation and those for actual suicidal behavior within so called ideation-to-action theories (Klonsky et al., 2018), such as the Integrated Motivational–Volitional model of suicidal behavior (IMV Model; O'Connor & Kirtley, 2018). The IMV model assumes that feelings of defeat and entrapment are of central relevance in the development of suicidal ideation. The IMV model is a relatively new theoretical framework, which consists of three different phases. The pre-motivational phase, including the biopsychosocial context, individual vulnerability, and negative life events, is based on diathesis-stress models of suicide (Mann et al., 1999). The second phase is the motivational phase, explaining the development of suicidal ideation by including the constructs defeat and entrapment. However, the IMV model does not distinguish between internal and external entrapment (O'Connor & Kirtley, 2018). The last phase of the IMV model is the volitional phase, in which the actual suicidal behavior occurs.

The IMV model proposes that feelings of defeat lead to feelings of entrapment and, consequently, to the development of suicidal ideation. However, first longitudinal studies provide heterogenous results. Taylor et al. (2011) could show that participants experiencing high levels of defeat experienced more suicidal ideation over a 12-month period of time. In another study, reduction of suicidal ideation over a 7 week period of time was associated with reduced feelings of entrapment but not defeat (Ng et al., 2016). For both defeat and entrapment, Slade et al. (2014) could show that defeat and entrapment were able to predict self-harm at a four-month follow-up. Branley-Bell et al. (2019) even reported that defeat and entrapment both served as direct predictors for suicidal ideation cross-sectionally, whereas prospectively, defeat had an indirect effect on suicidal ideation through entrapment, emphasizing the postulated pathway of the IMV model.

However, most studies so far did not differentiate between internal and external entrapment due to their close relationship (Taylor, Gooding, Wood, Johnson, et al., 2011) and the postulated pathway of the IMV model also does not distinguish

between internal and external entrapment. In line with the assumptions of the first part of the central pathway of the IMV model that entrapment is associated with feelings of defeat, Carvalho et al. (2013) found that both internal and external entrapment are associated with feelings of defeat, which is also in line with findings of Gilbert and Allan (1998). When examining the second part of the central pathway in the IMV model that assumes that entrapment and defeat lead to suicidal ideation, Lucht et al. (2020) could demonstrate a simple mediation of defeat via both internal and external entrapment on suicidal ideation cross-sectionally in a sample of psychiatric inpatients; however, the effect size was greater for internal entrapment than for external entrapment.

Moreover, Owen et al. (2018) even found only internal but not external entrapment to be a mediator of the relationship between defeat and suicidal ideation. Rasmussen et al. (2010) also emphasize that internal entrapment seems to be more important in regard to suicidal ideation than external entrapment because external entrapment can easier be modified than internal entrapment. They argue that feeling trapped in one's own thoughts and feelings (internal entrapment) while experiencing only few positive future expectations has a more negative influence on suicidal ideation than experiencing entrapment through external circumstances.

As can be seen, results of recent research are heterogenous with more evidence for an association of internal entrapment than external entrapment with suicidal ideation and a general lack of studies investigating the differential relationship of internal and external entrapment with suicidal ideation. Unfortunately, there is a huge lack of prospective data in this area. Only Owen et al. (2018) provided prospective data with the distinction between internal and external entrapment so far. In the light of recent meta-analytic evidence that, even after decades of research, the prediction of suicidal ideation, attempts, and deaths is still insufficient (Franklin et al., 2017), more prospective data are needed that have the potential to shed light on potential causal pathways leading to suicidal ideation and behavior. Thus, further evidence on the causal relationship between defeat, (internal and external) entrapment, and suicidal ideation as proposed by the IMV model based on an appropriate prospective design is desperately needed, which this study will provide. Also, most studies investigated general populations or student samples, but studies with psychiatric inpatients admitted due to a suicidal attempt or severe suicidal ideation are lacking. Thus, this study aimed to fill these two important gaps by not only providing prospective data but also investigating a sample with individuals being at high risk for suicide. The goal was to empirically investigate whether defeat, internal, and external entrapment and suicidal ideation are associated and whether the postulated pathway in the IMV model from defeat to entrapment to suicidal ideation can be prospectively confirmed. In this study, we hypothesize that (1) defeat is associated with internal and external entrapment within measurements in

line with findings of Carvalho et al. (2013) and that (2) defeat can predict internal and external entrapment prospectively from measurement to measurement. Regarding suicidal ideation and in line with findings of Owen et al. (2018) and Rasmussen et al. (2010), we hypothesize that (3) defeat and internal, but not external, entrapment are associated with suicidal ideation within measurements and that (4) defeat and internal, but not external, entrapment can predict suicidal ideation over time.

METHOD

Sample

This study is a secondary analysis of the data of a prospective multicenter study named "Predictors of suicidal ideation and suicidal behavior in a high-risk sample (PRESS)". Further information can be found elsewhere (Forkmann et al., 2020a, 2020b; Lucht et al., 2020). The total sample comprised 308 participants aged 18–81 years ($M = 36.92$, SD $= 14.30$), 54% of participants were female ($n = 165$). One-hundred and sixty-three participants (53%) were admitted to a psychiatric ward due to recent suicide attempt and 145 (47%) due to an acute suicidal crisis (i.e., suicidal intent with intrusive suicidal ideation and an acute suicide threat). The most common disorders according to the International Classification of Diseases (ICD-10; Dilling et al., 1991) were affective disorders (F3; $n = 235$; 77%), neurotic, stress-related, and somatoform disorders (F4; $n = 110$; 36%), and personality disorders (F6; $n = 76$; 25%). Three hundred and two participants aged between 18 and 81 ($M = 36.83$, SD $= 14.25$), and 53.3% female ($n = 161$) provided sufficient data that have been integrated to the multilevel analyses.

Procedure

Participants were recruited in 13 different psychiatric wards in three German cities (Aachen, Bochum, and Leipzig) between September 2016 and March 2018. Participants were eligible if they had been admitted to the psychiatric ward after a suicide attempt or for treatment because of an acute suicidal crisis. Participants were approached and interviewed within 14 days after their admission to the psychiatric ward for the baseline assessments (T0). Exclusion criteria were acute intoxication or psychotic symptoms, age below 18 years, insufficient knowledge of the German language, and cognitive impairments. Participants were informed about the voluntary nature of the study and data storage. They gave written informed consent before participating. The study was approved by the responsible Ethics Committees (Medical Faculty, RWTH Aachen University: EK310/13; Medical Faculty, Ruhr-University Bochum: 4909-14;

Medical Faculty, University of Leipzig: 042-14-27012014) and is in accordance with the Declaration of Helsinki (World Medical Association, 2001). Participants received 20€ per completed assessment (80€ for the completion of all four assessments). They underwent a baseline assessment within two weeks after admission including a structured clinical interview MINI-DIPS (Margraf, 2013) to diagnose the current mental illness and several questionnaires including different theoretical constructs that are potentially relevant to predict suicidal ideation and behavior (baseline assessment T0). Participants were contacted for follow-up assessments after six (T1), nine (T2), and 12 months (T3) via phone, mail, and email in order to examine suicidal ideation and underlying constructs longitudinally. Interviews and questionnaires of T1, T2, and T3 were conducted after discharge. In some cases, patients were readmitted to the psychiatric ward due to suicidal plans. T0 and T3 interviews were conducted in the respective hospital. T1 and T2 interviews were conducted via phone. Questionnaires were sent by mail. In case of acute suicidal intent during a phone interview, interviewers were instructed to interrupt the interview, check for severity, and take further steps; for instance, ask the participant where he/she was and call an ambulance or, in case the participant was in hospital at the time of assessment, call the responsible doctor or ward. If the participant was not at imminent risk of attempting suicide, the participant was encouraged to make an appointment with his/her psychotherapist/psychiatrist and a new interview appointment was arranged. We conducted ANOVAS to examine differences between participants who completed everything (Group 8), participants who only completed T0, T2, T3 (Group 7), participants who only completed T0, T1, T3 (Group 6), participants who only completed T0, T1, T2 (Group 5), participants who only completed T0 and T3 (Group 4), participants who only completed T0 and T2 (Group 3), participants who only completed T0 and T1 (Group 2), and participants who did not complete any follow-up assessments but only T0 (Group 1).

There was no significant difference for the groups in their score of suicidal ideation ($F(7) = 1.22$, $p = 0.293$) at T0. All groups also did not differ in their age ($F(7) = 1.95$, $p = 0.062$). Fisher's exact test for cell frequencies <5 was significant ($p = 0.007$) for gender differences. Further tests showed that only participants in group 6 (T0, T1, T3) differed in regard to gender from the other groups. More men than women only filled out T0, T1, T3. For the other groups, there were no gender differences in completing or not completing follow-up assessments.

Measurements

In the following, only measures relevant for the hypotheses are listed.

Beck scale for suicide ideation

The Beck Scale for Suicide Ideation (BSS; Beck et al., 1979; Beck et al., 1988; German version: Kliem & Brähler, 2016; Spangenberg et al., 2020) is a self-report questionnaire assessing suicidal ideation. It consists of 21 statement groups, each consisting of three response options with increasing severity (ranging from 0 to 2) and referring to the last seven days (e.g., "I have no wish to die/a weak wish to die/a moderate to strong wish to die"). The sum score of the BSS (item 1 to 19) ranges from 0 to 38 with higher values indicating higher suicide risk. Studies on the factorial structure of the BSS revealed inconsistent results (Beck et al., 1979; Ozcelik et al., 2015; Spangenberg et al., 2020). However, the use of the total score is common practice (Forkmann et al., 2016). The internal consistency for the total score in our sample was high for the total score (Cronbach's α = 0.87) and comparable with the psychometric properties (Cronbach's α = 0.88) reported by Kliem and Brähler (2015).

Defeat scale

The Defeat Scale (DS; Gilbert & Allan, 1998; German version: Forkmann et al., 2017) is a self-report measure to assess defeat as a unidimensional construct. The DS comprises 16 items (e.g., "I feel defeated by life.") referring to the last seven days, which are to be answered on a five-point Likert scale from 0 (never) to 4 (always). A sum score was used with higher values indicating higher feelings of defeat. For the original scale as well as its German version, high internal consistencies (Cronbach's α > 0.93) were found (Forkmann et al., 2017; Gilbert & Allan, 1998), which are comparable with our data (Cronbach's α = 0.95).

Entrapment scale

The Entrapment Scale (ES; Gilbert & Allan, 1998; German version: Trachsel et al., 2010) consists of 16 items (e.g., "I would like to escape my own thoughts and feelings.") referring to the perception of being trapped in highly stressful internal circumstances without the perceived possibility to escape. The ES is a self-report measure, which is rated on a five-point Likert scale from 0 (not at all) to 4 (very much) regarding the last week. High internal consistencies were found for both clinical and subclinical samples (Cronbach's α > 0.86; Gilbert & Allan, 1998; Trachsel et al., 2010). In the present study, the sum scores of each of the two subscales internal (6 items) and external (10 items) entrapment were used. In our sample, the internal consistencies were high for internal (Cronbach's α = 0.87) and for external (Cronbach's α = 0.84) entrapment.

Statistical analyses

Due to the nested structure of the data (assessments nested in persons), multilevel analyses were conducted using the statistical software HLM (Raudenbusch et al., 2010) and R (R Core Team, 2015). The dataset consisted of 4 (assessments on level 1) * 302 (persons on level 2) = 1208 observations. Participants completed on average 66.23% of the assessments. Missing data on level 1 were handled with pairwise deletion for each correlation pair and for each observation per person. Through this pairwise deletion, it is possible to include this person for all further observations and for all further correlation pairs.

The power analyses were conducted a priori for the primary analyses of the PRESS project. In Forkmann et al. (2020b), this was described further. For those analyses, the sample was sufficiently powered (α = 0.05, β = 0.95 and f = 0.15, n = 195). For the analyses reported in this manuscript, the sample was underpowered (Kleiman), which increases the risk for a beta error.

Intercept-only models and intraclass correlations (ICC) to indicate the proportion of variance explained by the two different levels for suicidal ideation, defeat, and internal and external entrapment were calculated (Hox, 2010) to examine fluctuations. Additionally, mean squared successive differences (MSSD) were calculated. The MSSD is the sum score of the squared differences between two measurements in time series and is, therefore, used as a measure for point-to-point variability. Higher values represent higher fluctuation (Woyshville et al., 1999). Quasi R^2 (Raudenbush & Bryk, 2002) was calculated to see changes of the outcome's residual variance when adding an additional level 1 predictor to the model (Hox, 2010).

Following suggestions by Kleiman and Nock (2018) and Kleiman et al. (2017), for the following analyses, we differentiated between different types of association between risk factors and outcome depending on the temporal structure of the association examined: (1) Risk factors were considered "associates," if they were related to the outcome variable measured at the same assessment (t); (2) risk factors were considered "associates of change," if they were related to the outcome variable measured at the same assessment (t) while additionally controlling for autocorrelative effects of the outcome variable (at t-1); this analysis reveals how risk factors at t are related to a change in the outcome from t-1 to t. (3) Risk factors were considered "predictors," if their measurements at t-1 were related to the outcome variable measured at t; (4) risk factors were considered "predictors of change," if their measurements at t-1 were related to the outcome variable measured at t, while additionally controlling for autocorrelative effects of the outcome variable (at t-1); this analysis reveals how risk factors at t-1 are related to a change in the outcome from t-1 to t.

To examine whether there is an association between defeat and internal entrapment and whether defeat can predict internal entrapment over time, four models were computed. For the examination of the first part of the first hypothesis of defeat being an associate of internal entrapment within measurements, model 1a included one cross-sectional predictor at level 1 (defeat at t). To find out whether defeat is associated with a change in internal entrapment, model 1b also included defeat at t but this time as an associate of change by adding internal entrapment as a time-lagged predictor (at t-1) to account for autocorrelative effects of internal entrapment (internal entrapment predicting itself over time, from t-1 to t etc.).

To test whether defeat predicts internal entrapment over time from measurement to measurement (second hypothesis), two models were calculated. Model 1c included defeat as a time-lagged predictor (defeat at t-1). To find out whether defeat can predict a change in internal entrapment, model 1d also included defeat at t-1 but this time as a predictor of change by adding internal entrapment as a time-lagged predictor (at t-1).

For external entrapment, model 2a and 2b were identical to model 1a and 1b, and model 2c and 2d were identical to model 1c and 1d (except with external entrapment instead of internal entrapment as outcome variable).

To examine the influence of defeat and entrapment on suicidal ideation, the third hypothesis of defeat and internal, but not external, entrapment being associated with suicidal ideation was tested with two models. Model 3a included defeat and internal as well as external entrapment as associates (at t) at level 1. In model 3b, the model further included time-lagged suicidal ideation (at t-1) to account for autocorrelation of suicidal ideation in the model and to see whether defeat, internal, and external entrapment are associates of change for suicidal ideation. For the fourth hypothesis of defeat and internal, but not external entrapment predicting suicidal ideation over time from measurement to measurement, two models were tested. Model 3c was calculated with defeat and internal and external entrapment as time-lagged predictors (all at t-1) predicting suicidal ideation (at t). Model 3d further included time-lagged suicidal ideation (at t-1) to account for autocorrelation of suicidal ideation and to see whether defeat, internal, and external entrapment are predictors of change for suicidal ideation prospectively. Random slopes should be allowed when applicable; therefore, deviance tests for both random intercept and random slopes models were conducted to reveal whether the random slopes models fit better than the more restrictive random intercept models. If the deviance test was not significant, only results of the random intercept model (fixed effects) would be reported (Snijders, 2011). For suicidal ideation as an outcome variable, data did not provide the possibility to estimate random slope models because the number of observations was not sufficient for allowing random slopes; therefore, only random intercept models (fixed effects) will be reported for the hypotheses including suicidal ideation.

All models were estimated by means of restricted maximum likelihood estimation (REML) since the number of level 2 units is small (Hayes, 2006). Defeat and internal and external entrapment as level 1 predictor (of change) variables were person-mean centered because within-person relationships were of interest (Enders & Tofighi, 2007). In models 1b, 1d, 2b, 2d, 3b, and 3d, the predictors (of change) were time lagged to the previous assessment (t-1). The last value per day was not lagged to evade between-days lags.

RESULTS

Descriptive information for all predictors and suicidal ideation for each assessment can be found in Table 1.

Variability over time

Across all four assessments, 87.7% of all participants reported suicidal ideation. For suicidal ideation around 40% and for defeat around 50% of the variance was accounted for by within-person variability over time (see Table 1). For internal and external entrapment, around 65% of the variance was due to within-person variability.

Multilevel analyses

Results of model 1a showed that defeat was significantly associated with internal entrapment within measurements. Since the deviance test was significant, the random slopes model fitted the data better, meaning that the individual slopes for the association between defeat and internal entrapment varied significantly between participants (see fixed and random effects in Table 2). This association was rather negative (see ratio of slopes >0 in Table 2). Model 1b showed that defeat was significantly associated with a change in internal entrapment since the last measurement (t-1). Since the deviance test was significant, the random slopes model fitted the data better, meaning that the individual slopes for the association between defeat and internal entrapment varied significantly between participants (see fixed and random effects in Table 2). This association was positive for almost all participants (see ratio of slopes >0 in Table 2).

In regard to predicting internal entrapment by defeat over time from measurement to measurement, model 1c showed that defeat at t-1 was not able to predict internal entrapment

T A B L E   1   Descriptive statistics for each assessment and variability indices of the constructs over all assessments

| Constructs | N | M | SD | Min. | Max. | MSSD | | | | ICC |
						M_{MSSD}	SD_{MSSD}	Min_{MSSD}	Max_{MSSD}	
Suicidal ideation T0	298	14.71	9.55	0.00	35.00	271.03	2725.23	0.00	37274.45	0.60
Suicidal ideation T1	175	10.25	9.60	0.00	36.00					
Suicidal ideation T2	169	9.03	9.48	0.00	34.00					
Suicidal ideation T3	157	8.64	9.52	0.00	32.00					
Defeat T0	297	43.05	13.71	3.00	64.00	208.07	330.75	1.00	2704.00	0.53
Defeat T1	176	32.35	16.50	0.00	64.00					
Defeat T2	171	31.32	17.14	1.00	64.00					
Defeat T3	156	30.48	17.42	2.00	64.00					
Internal entrapment T0	298	18.47	5.79	0.00	24.00	77.74	94.31	0.00	508.50	0.35
Internal entrapment T1	175	12.01	8.25	0.00	24.00					
Internal entrapment T2	170	11.61	8.23	0.00	24.00					
Internal entrapment T3	156	11.16	8.44	0.00	24.00					
External entrapment T0	299	25.10	8.45	0.00	40.00	131.49	143.72	1.00	772.00	0.36
External entrapment T1	175	17.33	10.71	0.00	39.00					
External entrapment T2	170	16.10	10.94	0.00	40.00					
External entrapment T3	156	15.98	11.22	0.00	40.00					

Note: Defeat was measured with 16 items resulting in a sum score from 0 to 64; Internal Entrapment was measured with six items resulting in a sum score from 0 to 24, external Entrapment was measured with ten items resulting in a sum score from 0 to 40, and suicidal ideation was measured with 21 items resulting in a sum score from 0 to 38.

Abbreviations: *M*, mean; SD, standard deviation; Min., minimum; Max., maximum; MSSD, mean squared successive difference; ICC, intraclasscorrelation.

at *t*. However, defeat at *t*-1 could predict a change in internal entrapment at *t* (model 1d).

Model 2a revealed that defeat was also significantly associated with external entrapment within measurements. However, individual slopes for this association did not significantly vary between participants; therefore, only fixed effects are reported in Table 3. Model 2b showed that defeat was significantly associated with a change in external entrapment since the last measurement (*t*-1) (fixed effects; Table 3).

In regard to predicting external entrapment by defeat over time from measurement to measurement, model 2c showed that defeat at *t*-1 was not able to predict internal entrapment at *t* and defeat at *t*-1 could not predict a change in external entrapment from *t*-1 to *t* (model 2d).

Model 3a revealed that defeat and internal entrapment were significantly associated with suicidal ideation over all participants within measurements and both were associated with a change in suicidal ideation (see fixed effects in Table 4). However, as model 3b shows, external entrapment was not

significantly associated with suicidal ideation (*t*) or a change in suicidal ideation since the last assessment (*t*-1).

Model 3c showed for the prediction of suicidal ideation over time from measurement to measurement by defeat, internal, and external entrapment that only internal, but not defat and external, entrapment at *t*-1 could predict suicidal ideation at *t* (see fixed effects in Table 4). Model 3d revealed that internal entrapment and defeat, but not external entrapment, could predict a change in suicidal ideation from *t*-1 to *t*.

DISCUSSION

The aim of the current study was to empirically investigate the central pathway of the motivational phase of the IMV model within a prospective study. We hypothesized that (1) defeat is associated with internal and external entrapment and that (2) defeat can predict internal and external entrapment prospectively. Furthermore, we hypothesized that (3) defeat

TABLE 2 Parameter estimates for multilevel models with internal entrapment as outcome variable

Model	Fixed effects					Random effects		Slopes >0[a]	Variance-covariance component test	
	Est.	95% CI (Est.)	SE	t (df)	p	χ^2 (df)	p		χ^2 (df)	p
Model 1a:Slope										
Intercept	15.16	3.60–26.71	0.37	40.76 (297)	<0.001	2092.56 (208)	<0.001		17.78 (2)	0.001[***]
Defeat	0.45	0.22–0.68	0.02	25.42 (297)	<0.001[***]	294.50 (207)	<0.001[***]	0.01%		
Quasi R[2]: Predictor of model 2 accounts for 69.81% of residual variance in internal entrapment at level 1[b]										
Model 1b: Slope										
Intercept	11.62	−2.69–25.93	0.55	21.13 (187)	<0.001	2336.200 (115)	<0.001		17.25 (5)	0.004[*]
Defeat	0.48	0.05–0.92	0.03	14.48 (187)	<0.001[***]	159.078 (115)	0.004[*]	98.47%		
Internal entrapment (t−1)	−0.06	−0.38–0.27	0.03	−1.83 (187)	0.069	125.945 (115)	0.228			
Quasi R[2]: Predictor of model 2 accounts for 83.87% of residual variance in internal entrapment at level 1[b]										
Model 1c: Intercept										
Intercept	11.57		0.55	21.1 (185)	<0.001					
Defeat (t−1)	−0.01		0.03	−0.48 (263)	0.629					
Quasi R[2]: Predictor of model 2 accounts for 46.96% of residual variance in internal entrapment at level 1[b]										
Model 1d: Intercept										
Intercept	11.59		0.55	21.18 (187)	<0.001					
Defeat (t−1)	0.16		0.05	3.46 (262)	<0.001[***]					
Internal entrapment (t−1)	−0.31		0.08	−4.15 (262)	<.001[***]					
Quasi R[2]: Predictors of model 2 accounts for 49.30% of residual variance in internal entrapment at level 1[b]										

Note: N (Level 2) = 302. N (Level 1) = 800. All level 1 predictors were person-mean centered.

Abbreviations: Est, Estimate (unstandardized regression coefficient; 95% CI (Est.), 95% confidence interval for Est; SE, standard error.

[a]This value indicates the percentage of slope coefficients that are positive based on the assumption of normally distributed slope coefficients.

[b]Quasi R[2] indicates the change of the residual variance in internal entrapment when adding the models' level 1 predictors compared to the baseline models.

*$p < 0.05$.; ***$p < 0.001$

and internal, but not external, entrapment are associated with suicidal ideation within measurements and that (4) defeat and internal, but not external, entrapment can predict suicidal ideation over time from measurement to measurement.

Defeat and entrapment

In line with the first hypothesis, results indicated that defeat was associated with internal entrapment at the same measurement (*t*) and with a change in internal entrapment since the last measurement (*t*-1). The slopes for this association varied between participants, meaning that an increase of internal entrapment relative to the increase of defeat seems to be individually different within measurements. Additionally, defeat was also associated with external entrapment at the same measurement (*t*) and with a change in external entrapment since the last assessment (*t*-1).

The second hypothesis could only be partly confirmed. Defeat (*t*-1) could not predict internal entrapment to the next measurement (*t*) but could predict a change in internal entrapment over time. Defeat was neither able to predict external entrapment nor a change in external entrapment over time from measurement to measurement. The association within measurements between (internal and external) entrapment and defeat is in line with assumptions of the IMV model (O'Connor & Kirtley, 2018) and prior empirical research (Carvalho et al., 2013; Gilbert & Allan, 1998). However, the IMV model states that feelings of defeat lead to entrapment in the motivational phase, suggesting a prospective pathway (i.e., defeat at *t*-1 predicting entrapment at *t*). This pathway could only be partly confirmed for internal but not for external entrapment. So far, the IMV model does not distinguish between internal and external entrapment, even though the results of this study together with prior empirical findings (Forkmann et al., 2018) suggest to do so.

TABLE 3 Parameter estimates for multilevel models with external entrapment as outcome variable

Model	Fixed effects			
	Est.	SE	t (df)	p
Model 2a:				
Intercept	20.65	0.50	41.16 (297)	<0.001
Defeat	0.57	0.02	24.72 (492)	<0.001[***]
Quasi R²: Predictor of model 2 accounts for 54.51% of residual variance in external entrapment at level 1[b]				
Model 2b: Intercept				
Intercept	16.56	0.73	22.85 (188)	<0.001
Defeat	0.51	0.04	13.43 (262)	<0.001[***]
External entrapment (t−1)	−0.02	0.03	−0.59 (262)	0.555
Quasi R²: Predictor of model 2 accounts for 70.38% of residual variance in external entrapment at level 1[b]				
Model 2c:				
Intercept	16.42	0.73	22.49 (185)	<0.001
Defeat (t−1)	0.02	0.03	0.65 (263)	.520
Quasi R²: Predictor of model 2 accounts for 50.02% of residual variance in external entrapment at level 1[b]				
Model 2d: Intercept				
Intercept	16.50	0.73	22.71 (187)	<0.001
Defeat (t−1)	0.08	0.05	1.60 (262)	0.112
External entrapment (t−1)	−0.07	0.06	−1.09 (262)	0.278
Quasi R²: Predictors of model 2 accounts for 50.52% of residual variance in external entrapment at level 1[b]				

Note: N (Level 2) = 302. N (Level 1) = 800. All level 1 predictors were person-mean centered.

Abbreviations: Est, Estimate (unstandardized regression coefficient; 95% CI (Est.), 95% confidence interval for Est; SE, standard error.

[a]This value indicates the percentage of slope coefficients that are positive based on the assumption of normally distributed slope coefficients.

[b]Quasi R² indicates the change of the residual variance in external entrapment when adding the models' level 1 predictors compared to the baseline models.

[***]$p < 0.001$.

Prediction of suicidal ideation

In line with our third hypothesis, defeat and internal entrapment were associated with suicidal ideation and were also associated with a change in suicidal ideation since the last measurement (*t*-1). External entrapment was neither associated with suicidal ideation nor a change in suicidal ideation highlighting again the importance of distinguishing between internal and external entrapment. For the fourth hypothesis, that defeat and internal, but not external, entrapment were able to predict suicidal ideation over time, results were mixed.

Internal entrapment but not defeat (and external entrapment) could predict suicidal ideation over time. Internal entrapment and defeat, but not external entrapment, could predict a change in suicidal ideation over time. Interestingly, the association at the same measurement between internal entrapment and suicidal ideation was positive. Thus, over short periods of time (such as days or hours as the questionnaires asked for feelings of defeat or entrapment and suicidal ideation within the past days), high levels of internal entrapment coincided with high levels of suicidal ideation, which is in line with the assumptions of the IMV model. However, in this sample, suicidal ideation and all other assessed constructs decreased over time. In other words, participants felt increasingly better on all variables over the course of the study, showing the highest scores on the baseline assessment and the lowest scores on the final assessment. In our prospective analyses, this has the effect that suicidal ideation itself was negatively associated with suicidal ideation over time, meaning that high scores in suicidal ideation at time *t*-1 predicted lower scores in suicidal ideation at time *t*. The same applied to internal entrapment. Thus, although negatively related across time, internal entrapment simultaneously processed with suicidal ideation. As suicidal ideation decreased, internal entrapment decreased, too.

It has to be noted that for external entrapment, there was neither a significant association with suicidal ideation at the same measurement nor prospectively. Thus, the association between suicidal ideation and internal entrapment seems to be closer than the association between suicidal ideation and external entrapment and appears to be most relevant for short time intervals. Due to the general negative trend in our data, the long-term prediction of suicidal ideation should be interpreted with caution. Therefore, future research is needed in samples at high suicide risk with shorter intervals between measurements for a better understanding of the direction of the association between suicidal ideation and internal entrapment.

These results generally corroborate findings of Rasmussen et al. (2010) and Owen et al. (2018) who found that the pathway from defeat to suicidal ideation was only mediated by internal entrapment but not by external entrapment. In the light of these results, it should be considered to include the differentiation between internal and external entrapment in current theories on the development of suicidal ideation, such as the IMV model.

Concerning this differentiation, Taylor et al. (2011) accentuate the diversity in the experienced feelings of internal and external entrapment. Since internal entrapment is attributable to internal circumstances (e.g., unwanted thoughts and rumination (Gilbert & Allan, 1998)) and external entrapment is caused by external circumstances (e.g., job difficulties; Taylor, Gooding, Wood, & Tarrier, 2011)), it appears that the escape from external entrapment is more modifiable by

TABLE 4 Parameter estimates for multilevel models with suicidal ideation as outcome variable

Model	Fixed effects			
	Est.	SE	t (df)	p
Model 3a:				
Intercept	12.20	0.52	23.70 (297)	<0.001
Defeat	0.27	0.03	8.27 (486)	0.001***
Internal entrapment	0.06	0.06	0.94 (486)	0.003**
External entrapment	0.13	0.04	3.03 (486)	0.348
Quasi R² : Predictors of model 2 accounts for 46.39% of residual variance in suicidal ideation at level 1[b]				
Model 3b: Intercept				
Intercept	9.67	0.67	14.42 (187)	<0.001
Suicidal ideation (t−1)	−0.09	0.04	−2.56 (259)	0.011**
Defeat	0.17	0.05	3.63 (259)	<0.001***
Internal entrapment	0.24	0.08	3.22 (259)	0.001***
External entrapment	0.05	0.05	0.95 (259)	0.341
Quasi R² : Predictors of model 2 accounts for 67.29% of residual variance in suicidal ideation at level 1[b]				
Model 3c:				
Intercept	9.52	0.67	14.18 (185)	<0.001
Defeat (t−1)	0.07	0–04	1.69 (260)	0.092
Internal entrapment (t−1)	−0.21	0.09	−2.52 (260)	0.013*
External entrapment (t−1)	0.08	0.05	1.54 (260)	0.124
Quasi R² : Predictors of model 2 accounts for 53.08% of residual variance in suicidal ideation at level 1[b]				
Model 3d: Intercept				
Intercept	9.58	0.667	14.37 (186)	<0.001
Suicidal ideation (t−1)	−0.18	0.056	−3.22 (260)	0.001***
Defeat (t−1)	0.13	0.044	2.84 (260)	0.005**
Internal entrapment (t−1)	−0.20	0.084	−2.39 (260)	0.018*
External entrapment (t−1)	0.10	0.052	1.96 (260)	0.051
Quasi R² : Predictors of model 2 accounts for 54.25% of residual variance in suicidal ideation at level 1[b]				

Note: N (Level 2) = 302. N (Level 1) = 800. All level 1 predictors were person-mean centered.

Abbreviations: Est, Estimate (unstandardized regression coefficient; 95% CI (Est.), 95% confidence interval for Est; SE, standard error.

[a]This value indicates the percentage of slope coefficients that are positive based on the assumption of normally distributed slope coefficients.

[b]Quasi R² indicates the change of the residual variance in suicidal ideation when adding the models' level 1 predictors compared to the baseline models.

*p < 0.05.; **p < 0.01; ***p < 0.001

an individual (Rasmussen et al., 2010), even though the individual must take concrete actions. Escaping from internal entrapment, on the other hand, probably needs more psychotherapeutic support as it includes ruminative processes (Gilbert & Allan, 1998).

Rumination itself has also been shown to be significantly associated with suicidal ideation (Morrison & O'Connor, 2008), and this association is mediated via feelings of entrapment (Teismann & Forkmann, 2017). In the IMV model (O'Connor & Kirtley, 2018), rumination serves as a so called "threat to self-moderator (TSM)" and, therefore, moderates the transition from defeat to entrapment. As stated above, the emergence of internal entrapment is expected to occur through rumination (Gilbert & Allan, 1998), whereas the emergence of external entrapment is expected to occur through external circumstances (Taylor, Gooding, Wood, & Tarrier, 2011). This could suggest that rumination is not associated with total entrapment but mainly with internal and

not external entrapment; therefore, it could be possible that rumination only actually moderates the transition from defeat to internal but not external entrapment. For future studies, this emphasizes the need to examine the other moderators proposed in the IMV model.

Following this line of argumentation, other proposed TSM (O'Connor and Kirtley, 2018) such as coping, which has been shown to incorporate cognitive processes (e.g., Cheng & Cheung, 2005) and memory biases, which essentially is a cognitive process (e.g., Marchetti et al., 2018) might also be more relevant for the transition from defeat to internal rather than external entrapment. The TSM social problem-solving can include impersonal, personal or intrapersonal, interpersonal, and broader community and societal problems (D'zurilla et al., 2004) and can, therefore, not solely be reduced to cognitive processes since it also includes behavioral processes. It could be possible that this moderator is relevant for the transition from defeat to both internal and external entrapment depending on the actual problem that has to be solved.

The development from entrapment to suicidal ideation in the IMV model (O'Connor & Kirtley, 2018) is moderated by "motivational moderators (MM)." One might speculate that moderators such as thwarted belongingness, perceived burdensomeness, and social support could rather emerge through external than internal circumstances since they are strongly connected to the social surrounding (Joiner, 2007). However, perceived burdensomeness for example probably depends at least to some extend on the subjective cognitive representation of interpersonal relations ("*perceived*" burdensomeness) and could just as well be related to internal entrapment. Therefore, future research is needed to find out more about which of the moderators affect either internal and/or external entrapment to further specify these pathways in the IMV model.

Clinical implications and future studies

Internal entrapment and defeat seem to be strongly related to suicidal ideation. Thus, these constructs should be considered in clinical risk assessments as factors that potentially heighten the risk for suicidal ideation. As internal entrapment appears to have an even stronger relation to suicidal ideation than external entrapment, targeting internal entrapment in psychotherapeutic interventions addressing suicidal ideation and behavior should be taken into consideration. However, it is unclear whether therapeutically initiated reductions in internal entrapment entail reductions in suicidal ideation or even intent. According to meta-analytic evidence, cognitive-behavioral therapy and dialectical behavior therapy (DBT) reduce the risk of suicide (re)attempts (Hawton et al., 2016). Future studies could aim at investigating whether these interventions may help in reducing internal entrapment and whether this reduction

mediates the effect on suicidal ideation and behavior. Moreover, evidence accumulates that targeted short intervention programs for patients after a suicide attempt such as the Attempted Suicide Short Intervention Program (ASSIP; Gysin-Maillart et al., 2016) or Safety Planning (Stanley & Brown, 2012; Stanley et al., 2018) may reduce the risk of suicide reattempt significantly. Again, future studies could aim at investigating whether the preventive effect of these interventions is (partly) mediated by internal entrapment.

A further aspect relevant for clinical practice is the fact that defeat, internal, and external entrapment are subject to fluctuation (Stenzel et al., 2020), therefore, repeated measurement in clinical practice seems to be necessary. O'Connor and Williams (2014) highlighted that positive future thinking can already be affected by minor fluctuations in defeat and that these effects are higher in individuals with feelings of entrapment. Hence, the time courses of these constructs should be investigated more closely in future studies and potentially need to be monitored repeatedly in clinical practice in order to observe their changes in the course of therapy. A promising method to investigate time courses of constructs and to assess constructs repeatedly in future studies is smartphone-based ecological momentary assessment (EMA), which allows to collect data in real time and in subjects' natural environment within short time intervals from minutes to hours (Santangelo et al., 2014; Trull & Ebner-Priemer, 2009, 2014). It has been established in empirical research to overcome the limitations of questionnaire based retrospective assessments that face memory bias and a lack of ecological validity (Ebner-Priemer & Trull, 2009).

Strengths and limitations

The results of this study should be interpreted in the light of some strengths and weaknesses. Major strengths of the study are the sample of individuals reporting high levels of suicidal ideation, since participants were inpatients admitted to a psychiatric ward due to a recent suicide attempt or an acute suicidal crisis, and the prospective design with four measurements over the course of 12 months. Another strength of the study is the assessment and separate analyses of both internal and external entrapment leading to theoretically and clinically relevant new results.

A potential limitation of the present investigation is the number and timing of the follow-up assessments. Because of the number of follow-up assessments, no random slope models could be computed with suicidal ideation as an outcome. Additionally, follow-ups were conducted after 6, 9, and 12 months. Recent research suggests that defeat and entrapment are subject to intra-individual fluctuation across short time intervals such as minutes or hours (Stenzel et al., 2020)—similar to other risk factors such as thwarted

belongingness, perceived burdensomeness, capability for suicide, interoception, and suicidal ideation itself (Forkmann et al., 2018; Höller et al., 2021; Hallensleben et al., 2019; Kleiman et al., 2017; Spangenberg et al., 2015, 2019). Thus, the timing of the follow-up assessments could have led to the fact that important information about the dynamic nature of the constructs between assessments could not be captured. However, most importantly, our results suggest that internal entrapment is predictive of suicidal ideation and internal entrapment as well as defeat are predictive of a change in suicidal ideation even across long time intervals of several months corroborating its general importance in understanding the development and course of suicidal ideation. It could be speculated that defeat and entrapment would have been even more predictive of suicidal ideation across shorter time intervals, which should be investigated in future studies.

Another point that is important to be discussed is the possible influence of the inpatient setting on the feelings of external entrapment. Patients could have experienced more external entrapment in the T0 assessment than in the follow-up assessments due to their admission to a psychiatric ward. High levels of external entrapment could be interpreted as being caused by the rather closed setting of the psychiatric ward. Alternatively, a high level of external entrapment may have existed prior to admission and may have been partly responsible for the development of the suicidal crisis that ultimately led to admission. The reduction of external entrapment from assessment to assessment, as can be seen in Table 1, could also possibly be due to the participants' discharge from the psychiatric ward. Again, alternatively, the psychosocial crisis, which can be assumed to have occurred prior to admission and may have caused the elevated levels of external entrapment at that time, may have been resolved during inpatient treatment. Thus, lower external entrapment scores were reported at later measurement points.

One could make similar assumptions about the other constructs assessed in this study, because suicidal ideation, internal entrapment, and defeat were also highest at the first assessment (T0). However, the association between suicidal ideation and external entrapment was not significant. This emphasizes the assumption that, even though, participants experienced higher levels of external entrapment in the inpatient setting this might have not contributed to their suicidal ideation.

Last but not least, a major limitation of this study is that the sample is underpowered (Kleiman). Therefore, it could be possible that further effects could not be detected due to the limited power.

CONCLUSION

The aim of this study was to investigate central assumptions of the motivational phase of the IMV model with respect to associations between defeat, internal entrapment, external entrapment, and suicidal ideation. Results showed significant associations of defeat and internal entrapment with suicidal ideation and changes in suicidal ideation suggesting external entrapment to be less relevant than internal entrapment. Moreover, defeat and internal entrapment predicted changes in suicidal ideation over the course of several months. Thus, results corroborate the central assumptions of the motivational phase of the IMV model and highlight the necessity of distinguishing between internal and external entrapment. For clinical practice, it might be important to focus on feelings of internal entrapment in therapy in order to prevent the development of suicidal ideation. Future studies should focus on the assessment of moment-to-moment feelings of defeat, internal, and external entrapment in order to improve our knowledge on the temporal course of these clinically important constructs.

CONFLICT OF INTEREST
All authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT
All relevant data are reported within the paper and are available from the corresponding author upon reasonable request.

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Article

Listen to Your Heart–Ecological Momentary Assessment of Interoceptive Accuracy, Awareness and Sensibility: A Pilot Study

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Abstract: *Background:* Interoception is a multi-facetted phenomenon including interoceptive accuracy, awareness and sensibility. Deficits in interoception have been associated with psychological distress. However, little is known about the course of interoception over time. The present study aimed at examining interoception in an ecological momentary assessment (EMA)-setting. *Methods:* A seven-day smartphone-based EMA was conducted in a community sample of sixty-one participants (age: $M = 24.1$, $SD = 7.00$, $n = 54$ female (88.5%)). To control for potential practice effects of repeated assessments during the EMA phase, participants were randomly assigned to a control ($n = 30$) and an interoception ($n = 31$) group. The latter was assessed for interoceptive accuracy, awareness and sensibility. Before and after the EMA phase, all participants were assessed for interoception in the laboratory. *Results:* Multilevel analyses revealed significant fluctuations for all three interoceptive facets, around 50% of variance was due to within-person variability. There were only practice effects for the subscale "Attention Regulation", measuring interoceptive sensibility. *Conclusion:* The facets of interoception can be assessed in an EMA-setting. Repeated interoceptive assessments do not necessarily lead to an improvement of participants' interoceptive abilities. It could be shown that all interoceptive facets fluctuate, which should be considered in future research.

Keywords: interoception; heartbeat perception; EMA

1. Introduction

Interoception can be described as the ability to sense one's own physiological condition of the body [1]. While some researchers referred to interoception as a single construct [2], others examined different facets of interoception [3]. These inconsistent terminologies and their use have been criticized by Garfinkel et al. [4], who demanded consistent and clear definitions. By examining the structure of interoception, Garfinkel, Seth, Barrett, Suzuki and Critchley [4] showed that interoception is a multi-facetted phenomenon including (at least) interoceptive accuracy, awareness and sensibility.

Interoceptive sensibility can be described as the self-evaluation of someone's subjective interoception assessed by using self-reports [5]. Interoceptive accuracy describes someone's actual performance in an objective interoceptive task, e.g., a heartbeat perception task, whereas interoceptive awareness comprises the metacognitive awareness of one's own interoceptive accuracy. Garfinkel, Seth, Barrett, Suzuki and Critchley [4] showed that interoceptive awareness and sensibility could only partly predict interoceptive accuracy. All three dimensions were distinct and separable. Since there was a relationship between the facets, but only within the group of individuals with the greatest interoceptive accuracy, interoceptive accuracy has been highlighted as the core construct of interoception. The authors suggested that the relationship between the interoceptive facets is stronger for individuals with high interoceptive accuracy compared to those with low interoceptive accuracy. In a pilot study of 24 healthy students, Meessen et al. [6], in fact, demonstrated that all three facets of interoception are uncorrelated. Forkmann et al. [7] confirmed the

three-dimensionality of interoception by reporting no correlations between the facets when accuracy was measured with the heartbeat perception task [8] and moderate correlations when accuracy was measured with the heartbeat discrimination task.

Research suggests that the facets of interoception seem to be associated with psychological distress, e.g., depression and anxiety [9–11]. For anxiety, mixed results have been reported [12]. While Garfinkel et al. [13] and Dunn et al. [14] found that interoceptive accuracy independently contributed to anxiety symptoms, other studies state that patients with panic disorder show similar or even better interoceptive accuracy [3,15,16] but worse interoceptive sensibility [3] compared to a control group. Interoceptive awareness was positively related to trait anxiety [17]. For depression, deficits in interoceptive accuracy generally seem to be associated with depressive symptoms [11,18]. A review by Eggart et al. [19] suggested a u-shaped relationship between depression and interoceptive accuracy, with largest interoceptive deficits coinciding with moderate depression severity.

Only recently, it has been proposed that interoceptive deficits might also be related to suicidal ideation and behavior [20]. Interoceptive sensibility measured with the self-report measure Multidimensional Assessment of Interoceptive Awareness (MAIA) [5] and assessed with the subscale "interoceptive deficits" from the Eating Disorder Inventory (EDI-3) [21] was negatively associated with current suicidal ideation and past suicide attempts [22–24]. MAIA scores could differentiate between suicide attempters, suicidal ideators and a control group [25]. The EDI even differentiated recent and distant suicide attempters [20,26]. There are only two studies available so far that investigated interoceptive accuracy (i.e., the objective performance in detecting body sensations) in relation to suicidal ideation or behavior. Results showed no differences in interoceptive accuracy (but in interoceptive sensibility) for participants with compared to those without suicidal ideation [27] and lower heartbeat perception accuracy in suicide attempters compared to non-attempters [28]. However, there has been no study investigating associations between interoceptive awareness and suicidality [29].

Regarding the assessment of interoceptive sensibility, there are two critical points: on the one hand, many studies assessed interoceptive sensibility with a subscale of the EDI [20,26], which was originally developed for participants with eating disorders and assesses interoception in relation to food intake and the gastrointestinal system [21]. Thus, it appears at least questionable whether conclusions based on EDI-data can be generalized to patients with no eating but other mental disorders. On the other hand, in self-report questionnaires, interoceptive sensibility was usually assessed retrospectively and the timeframe respondents are asked to refer to was not specified. For example, the MAIA refers to "the general daily life" [5], while the EDI refers to how often each statement applies with no time frame at all [21]. It has been argued that questionnaire-based retrospective assessments are compromised by memory bias and a lack of ecological validity [30].

It is unclear whether interoception is best understood as being state-like or trait-like. There is evidence from few studies suggesting within-person change in interoception across time. A study by Wittkamp et al. [31] using latent state-trait analysis of interoceptive accuracy assessments on three consecutive measurement occasions showed that 40% of variance in one single interoceptive accuracy measurement could be explained by trait, whereas 27% was traced to effects of situation and person-situation interactions–suggesting some variability in interoceptive accuracy over time. Some further evidence comes from studies that investigated whether facets of interoception could be trained. Studies showed that interoceptive awareness trained by daily practices of "Body Scans" and "Breath Meditation" [32] and accuracy trained by daily "Body Scans" over eight weeks [33] and by contingent cardiac feedback [34] could be improved, suggesting that interoception can generally be affected by situational or behavioral manipulations (i.e., training), which implies a certain temporal variability. Only interoceptive sensibility appeared not to be affected by "Body Scan" interventions [33]. It is unclear, however, whether the mere repeated execution of the various interoception measurements already results in a practice effect as the studies mentioned above explicitly trained the facets through interventions.

It is also unclear how the facets of interoception behave over time and whether they are measurable over short time intervals of minutes or hours.

A viable alternative assessment method that promises the possibility to overcome memory bias, lack of ecological validity and allows for the assessment of within-person variation across short time frames, is Ecological Momentary Assessment (EMA). EMA refers to the repeated sampling of subjects' current behaviors and experiences in real time and in their natural environments [35], for example, via smartphones [36,37]. There is empirical evidence on the within-person variation and temporal trajectories of clinical variables such as suicidal ideation, depression and anxiety [38–41]. Although as noted above, interoception has been shown to be related to all these clinical variables, to date, we know virtually nothing about the temporal course of the facets of interoception across short intervals of minutes or hours.

While interoceptive sensibility is usually assessed via self-report, which can rather easily be adopted to the EMA-setting (such as already implemented for, e.g., suicidal ideation or negative affect [42]), the assessment of interoceptive accuracy and awareness is more challenging, since it requires the collection of both self-reported information and the number of heartbeats in given time-frames.

Therefore, the aim of this study was to measure interoceptive accuracy, awareness and sensibility using EMA. Since the facets of interoception have never been investigated in such a study design, this study should be treated as a pilot study. The main goal of this study was to test the general feasibility of such a study design and to find out whether the facets of interoception are subject to intraindividual fluctuations. Because of the novelty of the design and potential test burden associated with repeated EMA, we abstained from including patients with mental disorders but decided to aim for a non-clinical sample to prove the study concept. Based on prior findings on interoception, we hypothesized that (a) all three facets of interoception fluctuate over time. Additionally, we hypothesized that (b) there will be no practice effect for the facets of interoception through mere interoceptive task repetition, since positive practice effects have only been shown for targeted interventions and not solely for mere task repetition.

2. Materials and Methods

2.1. Participants

The final sample consisted of $n = 61$ participants aged between 18 and 51 years ($M = 24.21$, $SD = 6.99$). Participants were eligible if they were at least 18 years old, had sufficient knowledge of the German language, had no current mental disorder and did not abuse drugs or alcohol. In order to keep the study comparable to other studies assessing interoception [4,43,44], participants needed to be physically healthy and showing a body mass index (BMI) between 18.5 and 24, since it has been shown that obesity affects the ability to detect feedback of cardiovascular functions and, thereby, influences an individual's interoceptive abilities [45]. Additionally, they should neither take medication influencing the cardiovascular system nor participate in competitive or endurance sports more than three times a week. Fifty-four participants were female (88.5%). Most participants were unmarried ($n = 57$; 93.4%) and working ($n = 39$; 63.9%). Only ten participants lived alone (16.4%). Twenty participants (32.8%) reported a mental disorder in their past, assessed with the short version of the diagnostic interview for mental disorders (Mini-DIPS) [46]. Three participants (4.9%) reported a suicide attempt in their lifetime. Participants were randomly assigned to one of two groups (interoception vs. control group). The randomization was conducted with www.randomizer.org, accessed on 26 March 2021 by generating a random order of the numbers 1 and 2 (1 = interoception group, 2 = control group). Participants were assigned consecutively to these groups in the randomized order after examining the eligibility criteria. Both groups completed the same EMA with only one difference: the control group ($n = 30$) did not complete interoception tasks during the EMA phase of the study, while the interoception group ($n = 31$) was assessed for all three facets of interoception via EMA.

2.2. Procedure

Participants were recruited between June and December 2019 via postings in Facebook groups as well as with flyers at the University of Duisburg-Essen and other places open to the public (such as public library). Participants who were interested in participating got in touch with the study team via e-mail. The study team then contacted those possible participants for a telephone interview. The telephone interview was conducted to check in and exclusion criteria, such as sufficient knowledge of the German language, no current mental disorder, no drug or alcohol abuse and a BMI between 18.5 and 24. Since this was a pilot study and the main goal was to examine interoception in an EMA-setting, we aimed for participants without a current mental disorder to keep the test burden low. Participants were asked whether they were currently, diagnosed with a mental disorder or were receiving treatment for a mental disorder. In case of current mental disorders, participants were immediately excluded from study participation. For assessing the BMI, participants were asked for their height and their weight. Then, the BMI was calculated. If the BMI was below 18.5 or over 24, participants were excluded from the study. When participants met the eligibility criteria, they were invited to our lab. Prior to the assessments, participants were informed about the purpose of the study, the voluntary nature of their participation, data storage and security. They gave written informed consent before participating. The study was approved by the responsible Ethic Committee of the University of Duisburg-Essen and was in accordance with the Declaration of Helsinki [47]. For their participation, participants received 60 EUR or five hours of study credit and 10 EUR. Participants' recruitment first included a telephone interview. The study included three main assessments (baseline, EMA, post), which are described in detail in the following.

2.2.1. Baseline Assessment

Participants underwent a baseline assessment (T0) in our lab including a structured clinical interview (Mini-DIPS) [46] on mental disorders to verify the participants' report in the prior telephone interview that they were currently not suffering from a mental disorder. The Mini-DIPS was conducted by researchers who had at least a Bachelor Degree in psychology and were familiar with the ICD-10 classification system of mental diseases [48]. Additionally, those researchers had received a training in conducting the Mini-DIPS prior to the start of this study. In case a current mental disorder was diagnosed, participants were excluded right away and were informed about the diagnoses and treatment options at the outpatient clinic for mental health at the local university and additional contacts to get help. All participants without a current mental disorder and/or a mental disorder in the past filled out questionnaires. Additionally, they conducted a heartbeat perception task (pre-HPT) in our lab to assess participants' interoceptive accuracy and awareness. If they reported drug use in the sociodemographic questionnaire, which they had not mentioned before, they were excluded (see Figure 1).

2.2.2. 7-Day EMA

After the baseline assessment, participants were introduced to the EMA method (i.e., overview of the app, charging the phone, carrying the phone at all times). They received an android study smartphone, used for data collection via the app movisensXS, v1.4.8 (movisens GmbH, Karlsruhe, Germany) The study smartphone could only be used for this app; all other applications were blocked. Participants in the interoception group were additionally equipped with a wearable smartwatch (Polar A370; Polar Electro GmbH, Büttelborn, Germany) and were instructed to wear the smartwatch from 8 am to 8 pm for seven days. Additionally, they were reminded to do so every morning via the app movisensXS. Participants then underwent a seven-day EMA with five assessments per day outside of the lab, resulting in a maximum of 35 assessments per participant. These five assessments per day were randomly presented between 8 am and 8 pm with at least two hours between two measurements. A short beep announced the beginning of an assessment. Assessments were randomized in the time of their occurrence throughout

the day. Participants could postpone (15 min) or completely reject a prompt if they were not able to answer. In case the phone battery ran below 20%, participants received a notification to charge the phone. Since the single assessments were short, the overall time of assessments was <30 min per day. Individual results were uploaded from the smartphone to a webserver via mobile data directly after completion of each assessment, allowing the research team to check compliance rates. Each participant received three text messages for motivational purposes or in case their compliance rate dropped below 80% during the course of the entire EMA phase. All participants received the same assessments and where prompted 5 times per day for 7 days. Participants in the control group answered 20 items including several constructs such as mood, context and suicidal ideation. For participants in the interoception group, each assessment additionally included 8 items assessing interoceptive sensibility and an EMA-HPT. Interoception items and the EMA-HPT task were designed specifically for this study by the authors and the movisensXS support team. Participants in the interoception group were instructed not to perform excessive activities before or during the single assessments. All participants were provided with information of a German helpline and also had the possibility to contact the study staff through the messenger option within the app in case of technical questions or in case they felt burdened. Messages were checked at a regular daily basis. No participant reported to feel burdened through the assessments.
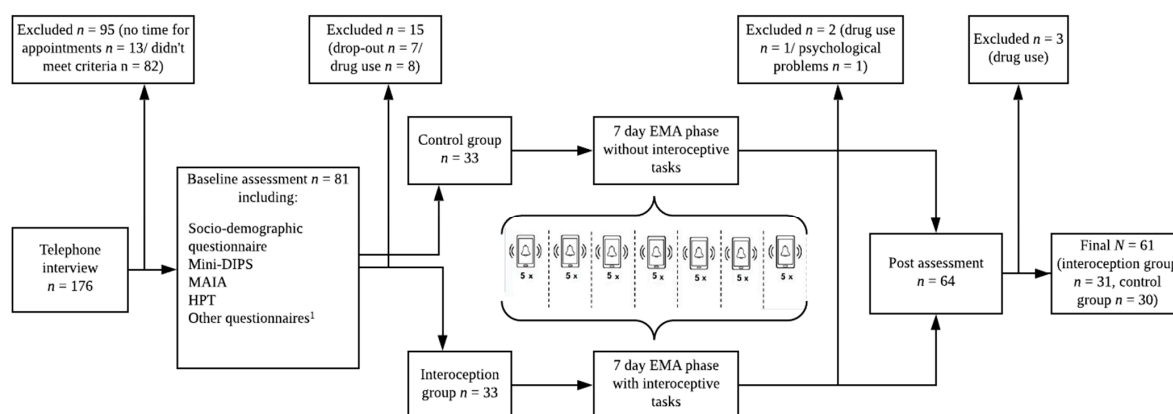
Figure 1. Study Procedure. [1] Other questionnaires, which have not been analyzed for this study; Mini-DIPS = structured clinical interview for *ICD* disorders; MAIA = Multidimensional Assessment of Interoceptive Awareness; HPT = Heartbeat Perception Task; EMA = Ecological Momentary Assessment. Baseline assessment was identical to post assessment.

2.2.3. Post Assessment

After the EMA phase, participants were invited to a post assessment inclusively returning the study smartphone and the smartwatch. Participants had to participate in the post assessment within the latest of 14 days after the EMA phase. The post assessment (T2) took place in the same lab as T0 and was identical to the baseline assessment except for the Mini-DIPS and the sociodemographic questionnaire, which were excluded in the post assessment. Participants received several questionnaires and conducted the post-HPT. Figure 1 provides an overview of the procedure.

2.3. Measures

Measures relevant for the aims of the present study will be described in detail. Further information on the other measures can be found elsewhere [49].

2.3.1. Baseline and Post Assessment Measures
Multidimensional Assessment of Interoceptive Awareness (MAIA)

The questionnaire contains 32 items rated on a six-point scale ranging from "never" (0) to "always" (5) including eight subscales. Mean subscale scores are calculated for

the subscales Noticing, Not-Distracting, Not-Worrying, Attention Regulation, Emotional Awareness, Self-Regulation, Body Listening and Trusting. Higher scores indicate higher interoceptive sensibility. Internal consistencies (Cronbach's α) at T0 for the single scales varied between 0.55 and 0.89, Cronbach's α at T2 varied between 0.64 and 0.93. The MAIA was applied before and after the EMA phase resulting in pre- and post-data [50].

Pre- and Post-Heartbeat Perception Task (HPT)

For the heartbeat perception task, participants were seated in our lab and provided with electrodes. The actual heart rate was recorded via electrocardiogram (ECG) using a BIOPAC MP150 (Biopac, Santa Barbara, CA, USA). Participants were instructed to sit quietly during the entire experiment. First, a five minute baseline was conducted. Then, participants received the instruction of the heartbeat perception task on a computer screen. The heartbeat perception task was programmed with Presentation® software v18.0 (Neurobehavioral Systems, Inc., Berkeley, CA, USA). In line with the Mental Tracking Method described by Schandry [8], participants were asked to silently count their heartbeats in randomized intervals of 25, 35 and 45 s for ten trials. The beginning and end of the counting phases were indicated by a start and a stop tone. Participants were instructed to not take their pulse or to use any manipulations enabling their counting. Additionally, participants had to enter the number of their counted heartbeats and were asked for a confidence judgement of their performance ranging from 0 to 100% ("How sure are you on a scale from 0 to 100 percent that your estimation is correct?". There was a 60 s break between each trial. Participants did not receive any information about the length of the intervals or their performance. After five trials, participants received a break of 5 min for assessing another baseline. For the ten trials, an accuracy score (pre- and post-HPT score) was derived according to Schandry [8]:

$$HPS = \frac{1}{10} * \sum \left(1 - \frac{|recorded\ heartbeats - perceived\ heartbeats|}{recorded\ heartbeats}\right) \quad (1)$$

The score indicates interoceptive accuracy and ranges from 0 to 1 with lower scores indicating poor heartbeat perception. Negative values are possible in case the number of the perceived heartbeats exceeds 200% of the recorded heartbeats [7]. Interoceptive awareness was calculated by computing the differences between judgments of confidence and the respective HPT score. Since the HPT score ranged from 0 to 1 and the confidence judgment ranged from 0 to 100, the variable of the HPT score was transformed by multiplying the HPT score with 100. Then, we subtracted the HPT score from the awareness score. A positive value as a result of this calculation means that a person overestimates his/her own performance, a negative value indicates an underestimation of one's own performance. A value around 0 indicates a good awareness.

2.3.2. Items Used during the EMA Phase
EMA-MAIA

In order to capture interoceptive sensibility entirely by use of MAIA items during EMA, factor loadings of the MAIA items from validation studies were compared [5,51]. One item with the highest factor loading from each of the eight MAIA subscales [5,51] was selected, resulting in a total of eight items. Items were adapted to the moment-to-moment design by adding "At the moment" to the beginning of the respective item and adjusting the item wording to the moment in order to capture the real-time character and the moment-to-moment variability (e.g., Noticing: "At this moment, I notice where in my body I am comfortable; Body Trust: At this moment I feel my body is a safe place" (Supplementary Materials available: detailed list of all items used during EMA). All eight items had to be rated on a five-point Likert scale ranging from "not at all" (1) to "very strong" (5).

EMA-HPT

One trial of the HPT task was used in each assessment. Participants were asked to silently count their heartbeat for a time interval lasting either 25, 35 or 45 s. The time interval was marked by two beep tones from the smartphone indicating the start and the end of the interval ("In the following task you will hear a short beep. After a while a second beep will follow. Your task is to count your heartbeat as accurately as possible in the time between the two beeps. After the second beep, click on the check mark in the upper right corner to enter the number of heartbeats you have counted."). Then, participants were requested to enter the number of counted heartbeats in the MovisensXS app: "Please enter the exact number of your counted heartbeats.". The task was completed with the answer of participants to how sure they were about their estimation on a scale from 0 to 100% (Confidence Judgement; "How sure are you that the number of your counted heartbeats matches your actual heartbeats? (in percent)"). The actual heart rate of participants was recorded with the Polar A370. Polar devices have shown good validity and reliability in measuring heartrate [52–54]. The Polar A370 shows a more reasonable accuracy than other Polar devices [55] and allows a wrist-based heart rate measurement using a technology called optical heart rate monitoring (OHR). Heartrate data were collected every second by the device. The device provides time-stamped HR data allowing matching of the data with the EMA-HPT trial after transferring the data of the Polar A370 to the Polar FlowSync desktop app v3.0.0.1337 (Polar Electro GmbH, Büttelborn, Germany). For the analyses, data of the time intervals of the EMA-HPT were extracted and time-matched. EMA-HPT scores were calculated with these heart rate measurements following the formula of Schandry [8] mentioned above. Interoceptive awareness during EMA was calculated as for T0 and T2.

2.4. Statistical Analyses

Since, to the best of our knowledge, interoception has never been assessed using smartphone-based EMA before, we will first report descriptive statistics of the three facets of interoception measured via EMA and in the laboratory at baseline and post assessment. Especially the assessment of interoceptive accuracy via EMA outside of the laboratory is a new method. We expected that baseline assessments in the laboratory and the day 1 EMA-based assessments of interoceptive accuracy should give similar results, since those assessments were conducted within short time intervals. The same applies to the last day (day 7) of EMA and the post assessment. *T*-tests for dependent samples were implemented to test differences in means between pre-HPT and day 1 EMA-HPT, as well as post-HPT and day 7 EMA-HPT. No differences would indicate validity of interoceptive accuracy assessed via EMA.

2.4.1. EMA-Data (Interoception Group Only)

For the analyses regarding hypothesis a), only the EMA data of the interoception group were used. The dataset consisted of 35 (assessments on level 1) × 31 (persons on level 2) = 1085 observations. On average, participants completed 79.6% of the assessments. Missing data at level 1 were handled with pairwise deletion for each correlation pair and for each beep per person. Through this pairwise deletion, it is possible to include this person for all further beeps and for all further correlation pairs. Because of the nested structure of the data, multilevel analyses using the statistical software HLM v7.03 (Scientific Software International, Inc., Chapel Hill, NC, USA) and RStudio v1.3.1093 (R Team, Boston, MA, USA) software, including the package ggplot2 [56], were conducted.

For examining fluctuations, intercept-only models were calculated for all three facets of interoception. Variance components of these intercept-only models were used to compute intra-class correlations (ICC) as an indicator of the proportion of variance explained by the different levels [57]. For assessing variability across time, Mean Squared Successive Differences (MSSD) were calculated. The MSSD can be described as the sum score of the squared differences between two measurements in time series and, therefore, represents point-to-point variability. Higher values indicate higher fluctuation [58]. To illustrate those

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possible fluctuations of the facets of interoception, we plotted the fluctuations across all 35 assessments points for each participant and separately for each interoceptive facet.

2.4.2. Baseline and Post Assessment Data

For the second hypothesis of the study, stating that there is no practice effect for the facets of interoception through repetition of interoceptive tasks, data from the entire sample were used. Mixed factorial ANOVAs and simple ANOVAs were calculated in SPSS v26 software (IBM Deutschland GmbH, Ehningen, Germany) to reveal differences in interoceptive accuracy, awareness and sensibility (pre-HPT vs. post-HPT) between groups (control group vs. interoception group) and between assessments (baseline vs. post assessment).

3. Results

Descriptive statistics of all study variables can be found in Table 1. *T*-tests for dependent samples revealed no significant difference between mean interoceptive accuracy measured in the laboratory at T0 (pre-HPT: $M = 0.59$; $SD = 0.09$) and mean interoceptive accuracy at day 1 measured via EMA (day 1 HPT-EMA: $M = 0.59$; $SD = 0.27$; $t(28) = -0.064$, $p = 0.95$). In addition, there was no difference between mean interoceptive accuracy measured in the laboratory at T2 (post-HPT: $M = 0.60$, $SD = 0.11$) and mean interoceptive accuracy measured at day 7 via EMA (day 7 HPT-EMA: $M = 0.60$, $SD = 0.23$; $t(27) = 0.138$, $p = 0.89$). This suggests that results of EMA-based assessments of interoceptive accuracy (HPT-EMA) do not differ from assessments of interoceptive accuracy in the laboratory, supporting the validity of assessing interoceptive accuracy based on EMA outside the laboratory.

3.1. Short-Term Variability of Interoception during EMA

For interoceptive awareness, 37% of the variance was accounted for by within-person variability (over time, see Table 1). For the EMA-HPT score (as a measure of interoceptive accuracy), ICCs indicated that 58% of variance was due to within-person variability (over time). Between 38% and 62% of variance in the MAIA subscales as a measure of interoceptive sensibility during EMA was due to within-person variability (over time), depending on the subscale. For "Emotional Awareness" and "Self-Regulation" the proportion of variance due to within-person variability was 38%, while for "Attention Regulation", 62% of variance was due to within-person variability. Additionally, MSSDs, as can be seen in Table 1, demonstrated a wide range, indicating large differences between individuals in intra-individual variability across time. For the MAIA subscales during EMA, attention regulation seemed to have the highest point-to-point variability in comparison to the other scales. Figures 2–4 show the individual trajectories of interoception during EMA for each of the facets separately over 35 assessments for the participants of the interoception group, sorted by subject ID.

3.2. Practice Effects of Interoception from Baseline to Post Assessment

The mixed factorial ANOVA did not show a statistically significant interaction between time (baseline assessment vs. post assessment) and group (interoception group vs. control group) for interoceptive accuracy (pre- vs. post-HPT). There was also no significant main effect for time or group. For interoceptive awareness, there was neither a statistically significant interaction between time and group nor a significant main effect for time or group (see Table 2).

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Table 1. Descriptive statistics and variability indices of baseline, post and ecological momentary assessments.

| Construct and Items	T0 [1]				T2 [1]				EMA [2]				MSSD (EMA Items)				ICC
	M	*SD*	Min.	Max	*M*	*SD*	Min	Max	*M*	*SD*	Min.	Max	*M*	*SD*	Min	Max	
Interoceptive Accuracy (HPT)	0.58	0.10	0.26	0.79	0.60	0.11	0.24	0.82	0.72	0.18	0.12	0.90	0.05	0.05	0.01	0.27	0.42
Interoceptive Awawareness	−7.62	23.62	−52.28	50.56	−7.75	23.25	−58.20	56.03	−21.99	28.15	−62.41	69.06	720.62	493.06	79.85	2006.43	0.63
Interoceptive Sensibility [3]																	
Noticing	3.28	0.79	1.50	5.00	3.52	0.72	1.00	5.00	3.49	0.73	1.97	5.00	0.72	1.08	0.00	5.82	0.56
Not-Distracting	2.24	0.87	0.33	4.33	2.16	0.83	0.67	4.33	4.17	0.61	3.06	4.97	0.87	0.87	0.03	4.79	0.42
Not-Worrying	2.61	0.96	0.33	5.00	2.55	0.94	0.33	5.00	4.46	0.62	2.70	5.00	0.61	0.90	0.00	4.79	0.52
Attention Regulation	2.96	0.75	1.14	4.43	2.95	0.84	1.14	4.71	2.60	0.69	1.29	3.95	1.26	0.91	0.06	4.39	0.38
Emotional Awareness	3.43	0.94	1.20	5.00	3.67	0.77	1.40	5.00	3.40	0.85	1.09	4.97	0.78	0.97	0.00	5.44	0.62
Self-Regulation	2.72	1.07	0.25	5.00	2.77	1.14	0.00	5.00	3.07	0.92	1.20	4.85	0.76	1.07	0.00	6.11	0.62
Body Listening	2.66	0.99	0.00	5.00	2.90	1.02	0.67	5.00	3.28	0.83	1.03	4.58	0.95	1.42	0.00	7.00	0.56
Trusting	3.89	0.93	0.33	5.00	4.05	0.83	1.33	5.00	4.08	0.74	2.50	5.00	0.65	1.35	0.00	7.52	0.61

HPT = Heart Beat Perception Task; [1] *n* = 61 (total sample including interoception and control group), T0 = Baseline assessment, T2 = Post assessment, [2] *n* = 31 (interoception group only), EMA = Ecological Momentary Assessment, *M* = mean, *SD* = standard deviation, Min. = minimum, Max. = maximum, MSSD = mean squared successive difference, ICC = intraclass correlation; [3] Interoceptive sensibility was assessed with the subscale of the Multidimensional Assessment of Interoceptive Awareness, during EMA one item for each subscale was chosen.
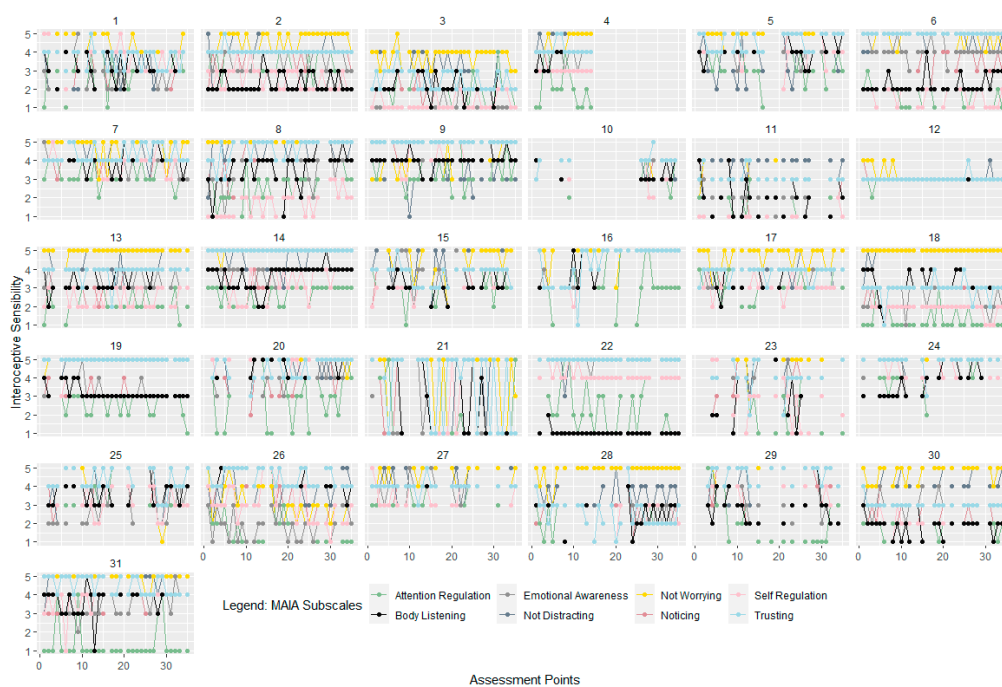
Figure 2. Interoceptive Sensibility. Trajectories of the subscales of the Multidimensional Assessment of Interoceptive Awareness for each of the 31 participants during EMA. Assessment points range from 1 to 35 over a time period of 7 days and interoceptive sensibility ranges from 1 to 5 (total score of each of the subscales).
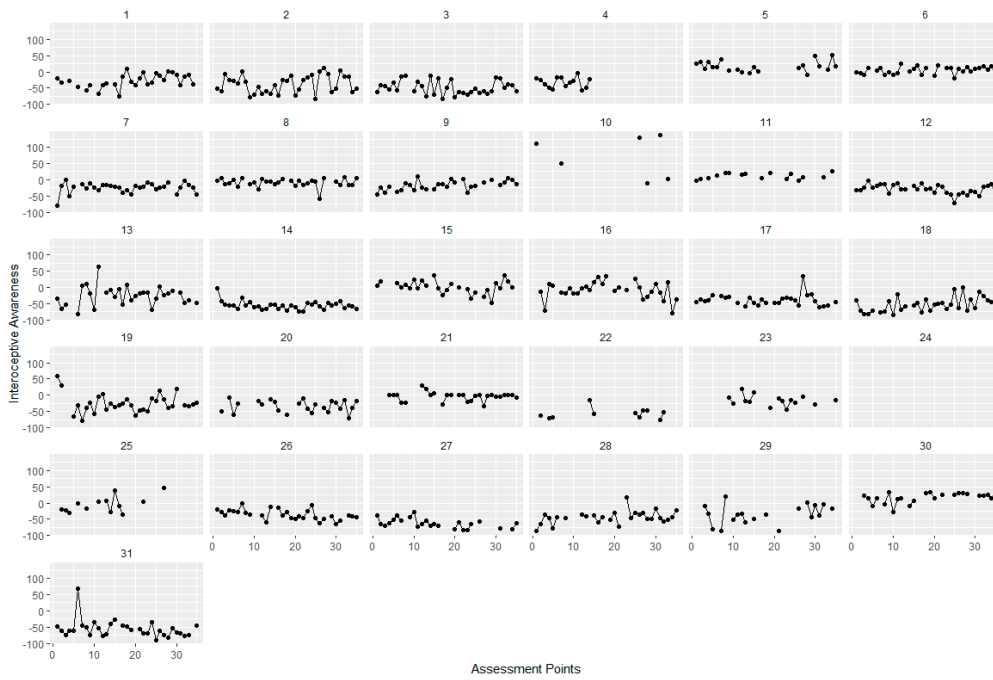
Figure 3. Interoceptive Awareness. Trajectories of interoceptive awareness for each of the 31 participants during EMA. Assessment points range from 1 to 35 over a time period of 7 days, interoceptive awareness ranges from −100 to 100.
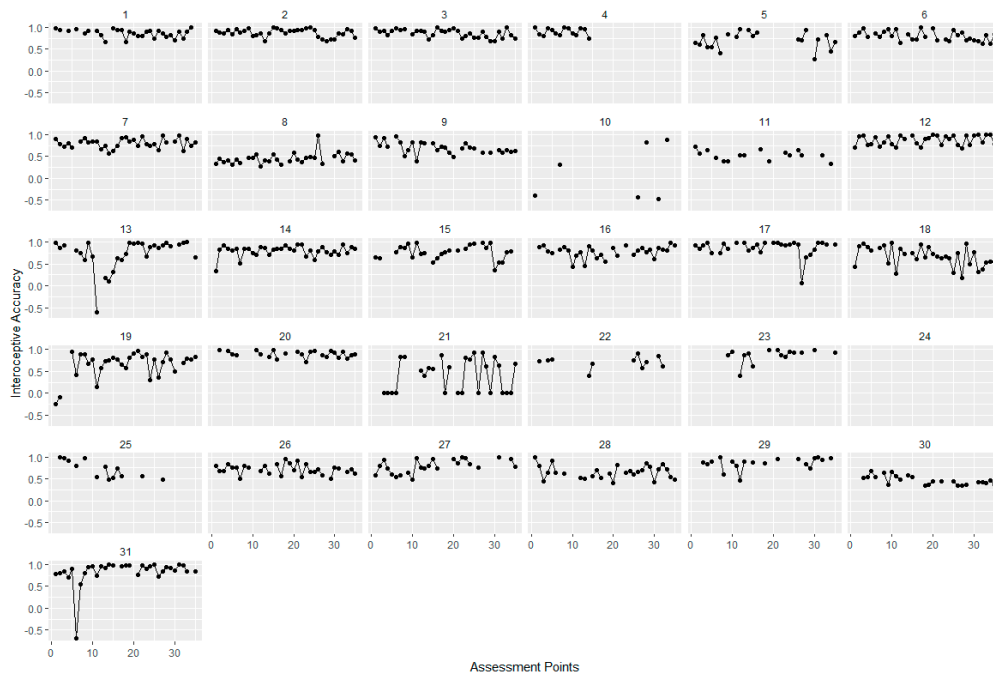
Figure 4. Interoceptive Accuracy (EMA-HPT). Trajectories of interoceptive accuracy measured with the heartbeat perception task for each of the 31 participants during EMA. Assessment points range from 1 to 35 over a time period of 7 days, interoceptive accuracy ranges from −1 to 1.

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Table 2. Results of mixed factorial ANOVAs.

Effects		F	p	η²
Interoceptive Accuracy				
Interaction effect	Time * Group	0.26	0.614	.004
Within-subject effect	Time	1.74	0.193	.029
Between-subject effect	Group	1.13	0.292	.019
Interoceptive Awawareness				
Interaction effect	Time * Group	0.15	0.697	0.003
Within-subject effect	Time	0.00	0.952	0.000
Between-subject effect	Group	0.05	0.828	0.001
Interoceptive Sensibility: MAIA scales				
Interaction effect	Time (Noticing [1]) * Group	0.98	0.327	0.016
Within-subject effect	Time (Noticing [1])	5.17	0.027 *	0.081
Between-subject effect	Group	0.85	0.359	0.014
Interaction effect	Time (Not-Distracting [1]) * Group	0.01	0.937	0.000
Within-subject effect	Time (Not-Distracting[1])	0.96	0.331	0.016
Between-subject effect	Group	3.42	0.070	0.90
Interaction effect	Time (Not-Worrying [1]) * Group	0.15	0.703	0.002
Within-subject effect	Time (Not-Worrying [1])	0.40	0.532	0.007
Between-subject effect	Group	1.81	0.184	0.030
Interaction effect	Time (Attention Regulation [1]) * Group	3.96	0.051 *	0.063
Within-subject effect	Time (Attention Regulation[1])	0.06	0.808	0.001
Between-subject effect	Group	4.13	0.047 *	0.065
Interaction effect	Time (Emotional Awareness [1]) * Group	0.62	0.434	0.010
Within-subject effect	Time (Emotional Awareness [1])	5.48	0.023 *	0.085
Between-subject effect	Group	0.26	0.612	0.004
Interaction effect	Time (Self-Regulation [1]) * Group	1.98	0.165	0.032
Within-subject effect	Time (Self-Regulation [1])	0.23	0.636	0.004
Between-subject effect	Group	2.76	0.102	0.045
Interaction effect	Time (Body Listening [1]) * Group	2.25	0.139	0.037
Within-subject effect	Time (Body Listening [1])	4.04	0.049 *	0.064
Between-subject effect	Group	2.97	0.090	0.048
Interaction effect	Time (Trusting [1]) * Group	1.29	0.261	0.021
Within-subject effect	Time (Trusting [1])	3.09	0.084	0.050
Between-subject effect	Group	1.30	0.260	0.021

Within-subject effect = Time (Performance in baseline assessment and post assessment of the respective measurement); between-subject factor = Group (interoception group (*n* = 31) and control group (*n* = 30), [1] MAIA (= Multidimensional Assessment of Interoceptive Awareness) scales, * *p* < 0.05.

For interoceptive sensibility results of each MAIA scale is reported separately. For four of the subscales, there were significant results. There was a significant main effect of time ($F(1, 59) = 5.17$, $p < 0.05$) for the scale "Noticing". Independently of group, participants improved from the baseline to the post assessment ($M_{\text{BaselineInteroception}} = 3.31$, $SD_{\text{BaselineInteroception}} = 0.79$, $M_{\text{BaselineControl}} = 3.26$, $SD_{\text{BaselineControl}} = 0.81$, $M_{\text{PostInteroception}} = 3.65$, $SD_{\text{PostInteroception}} = 0.74$, $M_{\text{PostControl}} = 3.39$, $SD_{\text{PostControl}} = 0.68$).

For "Attention Regulation", there was a significant interaction effect of time*group ($F(1, 59) = 3.96$, $p < 0.05$). Simple ANOVAs showed that there were only significant differences between the interoception and the control group at the post assessment ($F(1, 59) = 6.65$, $p < 0.05$) but not at the baseline assessment ($F(1,59) = 1.18$, $p = 0.28$). At the post assessment, participants in the interoception group showed significantly higher scores in "Attention Regulation" than participants in the control group ($M_{\text{PostInteroception}} = 3.21$, $SD_{\text{PostInteroception}} = 0.83$, $M_{\text{PostControl}} = 2.68$, $SD_{\text{PostControl}} = 0.78$).

In regard to "Emotional Awareness", there was only a significant main effect of time ($F(1, 59) = 5.48$, $p < 0.05$). Independently of group, participants improved from the baseline to the post assessment in their self-reported "Emotional Awareness" ($M_{\text{BaselineInteroception}} = 3.44$,

$SD_{\text{BaselineInteroception}} = 0.98$, $M_{\text{BaselineControl}} = 3.42$, $SD_{\text{BaselineControl}} = 0.91$, $M_{\text{PostInteroception}} = 3.76$, $SD_{\text{PostInteroception}} = 0.76$, $M_{\text{PostControl}} = 3.58$, $SD_{\text{PostControl}} = 0.79$).

In regard to "Body Listening", there was a significant main effect of time ($F(1,59) = 4.04$, $p < 0.05$). Independently of group, participants improved from the baseline to the post assessment in their self-reported ability to listen to their body ($M_{\text{BaselineInteroception}} = 2.76$, $SD_{\text{BaselineInteroception}} = 0.99$, $M_{\text{BaselineControl}} = 2.56$, $SD_{\text{BaselineControl}} = 0.99$, $M_{\text{PostInteroception}} = 3.18$, $SD_{\text{PostInteroception}} = 0.93$, $M_{\text{PostControl}} = 2.62$, $SD_{\text{PostControl}} = 1.06$).

4. Discussion

The aim of the current study was to assess interoception in an EMA-setting to examine its temporal course. We hypothesized that the facets of interoception fluctuate (a) and that there is no practice effect for the facets of interoception based on repetition of interoceptive tasks (b).

4.1. Fluctuations of Interoception during EMA

Given the current findings, the first hypothesis that interoceptive accuracy, awareness and sensibility fluctuate could be confirmed. Around 50% of the variance in all three facets of interoception was due to within-person variability. It could also be confirmed that this variability differed considerably between individuals, which complements findings of Wittkamp, Bertsch, Vögele and Schulz [31].

The present results that interceptive accuracy, awareness and sensibility fluctuate across time are in line with results of EMA-based studies measuring clinical variables. Similar to the facets of interoception, it has been shown that depression, anxiety, and suicidal ideation fluctuate across time [38–41]. All these variables have been shown to be related to interoception [13,18,20]. Thus, results of this study call for future studies investigating the longitudinal association between clinical variables such as depression or suicidal ideation and interoception across time. The high temporal resolution of EMA facilitates the identification of differential relations between clinical variables and improves the understanding of an individual patient's dynamic symptom change. Since compliance was excellent in the present study and in prior studies investigating clinical samples [42], future EMA-studies assessing interoception in clinical samples are warranted. Results of this study support the general feasibility of assessing interoception in EMA-studies.

4.2. Practice Effects of Interoception from Baseline to Post Assessment

Regarding the second hypothesis of different facets of interoception not being improved by repetitive interoceptive tasks, our findings were mixed. Most importantly, for interoceptive accuracy as well as awareness, there were no significant practice effects. At first glance, this result appears to be contrary to findings of Bornemann, Herbert, Mehling and Singer [32] and Fischer, Messner and Pollatos [33], who showed that interoceptive accuracy and awareness could be improved by training. However, their trainings contained interventions such as the daily practice of "Body Scan" and contingent cardiac feedback during the HPT, which were both specifically targeted at improving interoception, whereas in the present study, no specific training was applied but only the effect of repeated practice was examined. In the interoception group, only the interoception tasks were presented repeatedly compared to the control group. Participants in this study did not receive feedback and, therefore, could not notice whether they improved or not. Conclusively, interoceptive tasks, especially the HPT as a performance task, can be repeated and assessed multiple times without noticeable practice effects. Fluctuations and interindividual differences appear to be interpretable and should not be traced to practice effects only.

For future studies with a similar setup, it would be interesting to examine how such highly repeated contingent cardiac feedback in short time intervals over several days would influence the interoceptive accuracy and awareness. This is especially interesting in regard to clinical practice. Interoceptive EMA interventions would allow patients to autonomously train repetitively by themselves wherever they are, which could also potentially improve

their self-efficacy. In the light of recent studies, the training of interoceptive skills could have a positive impact on e.g., depression [59] and chronic worry [60] and could, therefore, be of high benefit in clinical practice.

For interoceptive sensibility, the MAIA scale "Attention Regulation" showed significant practice effects. Participants in the interoception group showed significantly higher scores at the post assessment than participants in the control group. Since "Attention Regulation" seems to be improvable through practice, one could speculate whether a targeted training of "Attention Regelation" might have beneficial effects on mental and/or physical health. However, it is important to keep in mind that in the current study participants could have only improved in their self-reported "Attention Regulation" because they were forced to give more attention to themselves than usually through the repetitive EMA.

Since there were also significant main effects of time for the scales "Noticing", "Emotional Awareness" and "Body Listening", participants also improved in those scales measuring interoceptive sensibility independently from group. Thus, improvements in interoceptive sensibility should not only be attributed to repeated assessments of interoception in EMA. Instead, only one repetition of these measurements (T0–T2) seems sufficient to increase interoceptive sensibility, at least for certain scales. However, results could be different in a clinical sample and need replication before further conclusions should be derived.

4.3. Strengths and Limitations

The results of the present study should be appreciated in the light of some strengths and limitations. The major strength of the study was being the first to assess the facets of interoception in EMA and, therefore, providing important findings about how the facets of interoception behave over time. Since there were no substantial practice effects for accuracy and awareness, it seems to be valid to measure the facets of interoception repeatedly. Furthermore, *t*-tests did not reveal differences in means between the assessments of interoceptive accuracy in EMA and at the baseline and post assessment supporting the validity of the assessment of interoceptive accuracy outside a laboratory setting. Additionally, for the baseline and post assessment in the laboratory, heartbeats were recorded via electrocardiogram (ECG) using a BIOPAC MP150.

As already stated, the current study is the first to assess interoception in an EMA design. Therefore, the primary aim of the study was to show the feasibility of assessing interoception within EMA and to investigate its temporal course. Since EMA is associated with some test burden in daily life, we deliberately abstained from including participants with mental disorders. We were able to show, in this study, the principal feasibility of the assessment strategy and the temporal fluctuation of interoception. In our view, this pattern of results warrants further investigation, ideally in clinical populations.

The first limitation of this study is that resting heart rate of participants was only assessed before the pre- and post-HPT at the baseline and post assessment. During the EMA phase, we did not control for arousal, which is negatively correlated with interoceptive accuracy [61]. However, participants were familiar with the HPT task and practiced this task in our laboratory. When giving instructions to participants for the EMA phase, we explicitly reminded participants not to perform excessive activities before or during the EMA phase. We also asked participants during EMA what they had been doing before, where they were and if anything noteworthy had happened since the last assessment. There was no statistical control for context effects in the analyses of this study, since answers to these questions were heterogeneous and did not allow quantitative analyses. We did calculate the average heart beats per minute of our sample with $M = 84$ and $SD = 10$ (min. = 65, max. = 112). For future studies, one possibility could be to use bolus infusions of isoproterenol, a non-selective beta adrenergic agonist, which elicits rapid increases in heart rate and has been shown to overcome a major limitation of HPTs [62]. Another possibility would be to instruct participants additionally at the beginning of each assessment to sit

down and rest for 5 min before starting the assessment. However, compliance for such an extended approach might be low, since it would take longer for the participant.

Second, the HPT [8] seems to be influenced by non-interoceptive processes [63] and interoceptive accuracy scores derived from it are potentially problematic [64]. Even though different psychological processes such as emotion regulation capacities [65] and decision-making [66] have been related to interoceptive accuracy scores derived from the HPT highlighting its role in psychological research, Zamariola et al. [64] propose four criticisms, with which Ainley et al. [67] insistently disagreed arguing that three of the four criticisms are not valid (for more detailed information see: Ainley et al. [67]).

(1) Zamariola, Maurage, Luminet and Corneille [64] state that interoceptive accuracy measured with the HPT depends on the error of participants' undercounting of their perceived heartbeats due to their beliefs about their heart rate. Ainley, Tsakiris, Pollatos, Schulz and Herbert [67] counter that participants' beliefs do not explain why participants would rate their heart rates lower than they are and, thereby, their beliefs would not particularly explain their possible undercounting, which is contradictory to the first criticism.

(2) The number of recorded heartbeats and the number of perceived heartbeats does not correlate (in Zamariola, Maurage, Luminet and Corneille's data [64]). However, Ainley, Tsakiris, Pollatos, Schulz and Herbert [67] found that Zamariola, Maurage, Luminet and Corneille [64] made this assumption due to arithmetic misunderstanding, which disproves this second criticism.

(3) Zamariola, Maurage, Luminet and Corneille [64] state that a measure for interoceptive accuracy should not depend on heart condition. However, this should actually be treated in favor of the HPT's construct validity, since it is clear that the perception of interoceptive signals is depending on one's specific physiology [67].

(4) Last but not least, there seems to be a tendency to poorer performance on the longer trials of the HPT. This statement is rejected by Ainley, Tsakiris, Pollatos, Schulz and Herbert [67] arguing that mean recorded heart rates significantly differed between the three lengths of the trials in the data of Zamariola, Maurage, Luminet and Corneille [64], which is in contrast to their assumption that the heart rate is constant across intervals and the poorer performance for longer trials is traced to participants' undercounting.

In conclusion, the HPT is significantly connected to the activity of interoceptive neural networks, which has been shown in multiple studies [68,69], the HPT has been shown to provide information about the associations between an individual's interoceptive accuracy and psychological distress such as depression [11], anxiety [13] and even suicidality [28] and most of its critical points have been disproved. Thus, we feel secure about the use of this measure for assessing interoceptive accuracy.

Third, participants had to complete the post assessment to the latest 14 days after the EMA phase. This was a wide time frame and should be kept shorter in future studies. It could be possible that practice effects already vanish within short periods of time.

Fourth, the results could also be influences by the high percentage (88.5%) of female participants, since men seem to be better in perceiving interoceptive processes [70,71]. However, Pennebaker and Roberts [72] suggest that those sex differences vanish in a non-laboratory setting. For future studies, it would be interesting to examine sex differences in interoception as well as hormonal changes and their influence on interoception during EMA, which is not a typical laboratory setting.

5. Conclusions

The present study is the first to assess interoceptive accuracy, awareness and sensibility repeatedly across time by means of ecological momentary assessments. Results support the general validity of such a measurement approach and revealed considerable within-person variability for all three facets. Practice effects were not found for interoceptive accuracy and awareness, but should be considered for interoceptive sensibility. The results

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call for replication in clinical samples. Increasing general scientific interest in research in interoception and a growing body of evidence suggesting its potential link to mental illnesses [73–76] call for further investigations. Recent research suggests that symptoms of mental disorders such as depression, anxiety, or suicidal ideation show substantial within-person variance and fluctuate across time [38–41]. Thus, future EMA-studies should consider investigating the prospective relations between interoception and symptoms of mental disorders to shed further light on its complex relations and potential interactions.

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This dissertation had three major aims that were pursued in three consecutive empirical studies: first, to validate a short, economic, and convenient scale for measuring the constructs of defeat and entrapment in an independent German sample for use in the assessment of suicide risk in clinical practice; second, to examine the role of defeat and entrapment within the motivational pathways of the IMV model; third, to examine the temporal stability of interoceptive facets for the first time in an innovative ecological momentary assessment (EMA) setting.

Since a short and economic measure of the two constructs defeat and entrapment (O'Connor & Kirtley, 2018) was not available in German for clinical practice, the first study concentrated on validating such a measure of these constructs in German in three independent samples. The main goal was to provide not only a short, economic, and convenient measure that keeps the test burden as low as possible but also a measure that is suitable for use in suicide research such as an EMA setting. Due to the ongoing debate about the dimensionality of the measure and the constructs (Griffiths et al., 2015; Griffiths et al., 2014; Forkmann, Teismann, et al., 2018; Taylor et al., 2009), another subordinated goal of the first study was to examine the factor structure of the measure.

The second study focused on the role of defeat and entrapment within the motivational-phase pathways of the IMV model. The role of internal entrapment has recently been emphasized by O'Connor and Portzky (2018) and Owen et al. (2018), who have suggested that it might be necessary to differentiate between internal and external entrapment within the IMV model. Since most studies examining these pathways did not differentiate between these constructs and examined them in a cross-sectional setting, the main goal of the second study was to examine associations between defeat, internal entrapment, and external entrapment as well as suicidal ideation cross-sectionally and prospectively in a sample with a high risk of suicide.

Despite a large amount of research on suicidal ideation and behavior and respective risk factors, it is still not possible to reliably predict suicidal ideation and behavior. This underscores the role of other risk factors that are not yet part of the newer theoretical frameworks. Because recent research has proposed that interoceptive deficits are related to suicidal ideation and behavior (e.g., Duffy

et al., 2018; Forrest et al., 2015; Rogers et al., 2018), the third study concentrated on exactly this construct. Interoception is a multifaceted phenomenon that includes interoceptive sensibility, awareness, and accuracy (Forkmann et al., 2016). Even though suicidal ideation and respective risk factors are subject to fluctuations (e.g., Hallensleben et al., 2019; Stenzel et al., 2020), literally nothing is known about the temporal course of facets of interoception. The third goal of this dissertation was therefore to examine interoceptive facets and their temporal course within an innovative EMA setting and thereby to test the feasibility of assessing interoception in such a setting for the first time.

5.2   Research Results

In the following, an overview of the results will be given separately for each of the three studies.

5.2.1   Short Defeat and Entrapment Scale (SDES): A Psychometric Investigation in Three German Samples

Confirmatory factor analyses revealed that a two-factor solution differentiating between defeat and entrapment was the best fit for the online and the outpatient samples. For the inpatient sample, by contrast, the one- and two-factor solutions fitted the data equally well. These findings suggest that defeat and entrapment are best represented as two associated but distinct constructs, which is in line with the findings of a network analysis by Forkmann, Teismann, et al. (2018).

Overall, the scale properties were good except for the interitem correlations of the entrapment scale. It should be noted that entrapment was originally designed as a two-dimensional construct, but the entrapment scale in the SDES does not differentiate between internal and external entrapment. As expected, reliability was high in all three samples. The SDES additionally separated participants at different stages of suicidality, except for in the inpatient sample.

5.2.2   Defeat, Entrapment, and Suicidal Ideation: Twelve-Month Trajectories

Multilevel analyses revealed that defeat was associated with (a change in) internal and external entrapment within measurements (cross-sectionally). With regard to the first part of the postulated pathway of the IMV model,

defeat predicted only a change in internal entrapment from measurement to measurement (prospectively) and was not at all predictive of external entrapment. With regard to the second part of the pathway, defeat and internal entrapment were associated with (a change in) suicidal ideation within measurements (cross-sectionally). Internal entrapment was able to predict suicidal ideation and both internal entrapment and defeat were predictive of a change in suicidal ideation from measurement to measurement (prospectively). No results were found for external entrapment.

5.2.3 Listen to Your Heart— Ecological Momentary Assessment of Interoceptive Sensibility, Awareness, and Accuracy: A Pilot Study

Multilevel analyses revealed that interoceptive sensibility, awareness, and accuracy fluctuate, which is an important insight for their assessment in suicide research.

Additionally, there were no practice effects for interoceptive accuracy and awareness. With regard to interoceptive sensibility, however, participants improved in "attention regulation." Improvement was also evident in three other scales assessing interoceptive sensibility, but improvement could not be attributed to repeated assessment because all participants, independent of the group, exhibited improvement from baseline to post-assessment.

5.3 Implications

Given the results of all three studies, these findings have essential methodological and clinical implications for clinical practice and future research with regard to all the constructs. These implications will be discussed in the following.

5.3.1 Methodological Implications

The IMV model supplies a great foundation for a better understanding of suicidal ideation and behavior, but since suicidal ideation and behavior are very complex constructs that include dynamic risk factors, research in this area is making a great effort to identify new proximal risk factors. New research leads to new findings, and these findings should be flexibly integrated into the

IMV model in the hope that the integration of many new findings will enable clinicians to better predict suicidal behavior, will improve interventions for reducing suicidal ideation, and will lead in the end to fewer deaths by suicide.

The results of the studies conducted within this dissertation possess three methodologically important suggestions for the IMV model. These implications will be discussed separately for defeat, internal entrapment, external entrapment, and facets of interoception.

5.3.1.1 Defeat and Internal and External Entrapment in the IMV Model

First, as described in Chapter 1.3.2, defeat and entrapment are the two main constructs in the second phase, the motivational phase, of the IMV model. Even though findings suggest that entrapment should be separated into internal and external entrapment, this is not the case in the IMV model. The results of the second study highlight the importance of distinguishing between the two, as only internal entrapment was predictive of suicidal ideation. The construct "entrapment" as it is currently proposed in the IMV model should therefore be reconsidered. Entrapment probably needs to be distinguished into its two components within the model. The role of external entrapment in the development of suicidal ideation should be reassessed.

5.3.1.2 Interoceptive Sensibility, Awareness, and Accuracy in the IMV Model

Second, although other studies have supported the importance of interoceptive facets in the development of suicidal ideation and behavior (e.g., Brausch & Woods, 2019; DeVille et al., 2020; Forkmann et al., 2019; Smith et al., 2020; Smith et al., 2020), they have not yet been integrated into the IMV model. Results of the third study of this dissertation proved their temporal instability, which is extremely important to consider in assessing suicide risk. The third study also confirmed the feasibility of assessing interoceptive facets in an innovative EMA setting. The setting of this study should therefore be used in a clinical sample that exhibits a high variance of suicidal ideation in order to further examine associations between interoception and suicidal ideation including their temporal instability. The findings could help integrate sensibility, awareness, and accuracy into the IMV model as possible moderators of the transitions from defeat to entrapment, from entrapment to suicidal ideation, and from suicidal ideation to actual suicidal behavior as suggested in Figure 4 and described in detail in Chapter 1.4.2.

Third, another important aspect regarding all the constructs examined in this dissertation are the fluctuations of suicidal ideation and of the respective risk factors, which adds a whole new component to assessing suicide risk. The fact that suicidal ideation and all the constructs associated with it are temporally unstable could be taken as a reason to integrate a time dimension into the IMV model. This is underlined by the fact that acute suicidal syndromes have been postulated by, for example, Tucker et al. (2016). They introduced "Acute Suicidal Affective Disturbance (ASAD)," which is characterized by rapid and drastic increases in suicidality. The aspect of time has not yet been mentioned in the IMV model and should probably be covered in the future.

In sum, the IMV model needs to be revised, and the pathways of the IMV model and the role of interoception and internal entrapment should be further examined.

5.3.2   Clinical Implications

This dissertation proved that defeat and entrapment are important constructs in the development of suicidal ideation and behavior. It also presents, on the one hand, a method for validly assessing interoception in an EMA setting and, on the other, information on the temporal instability of facets of interoception. Seven suggestions for clinical practice can be derived from these results.

5.3.2.1 Clinical Implications for Defeat and Entrapment

First, with the SDES, this dissertation presents a validated short, economic, and convenient measure for assessing defeat and entrapment in clinical practice. As Stenzel et al. (2020) have already shown in a healthy sample, defeat and entrapment dramatically fluctuate, so they need to be assessed repeatedly in clinical practice. EMA is the method of choice to do so, but it requires brief measures to ensure participants' compliance and to minimize the costs and effort for both patients and clinicians in the assessment of suicide risk. The development of the German version of the SDES serves as a suitable short, economic, and convenient measure for repeated assessment in clinical practice and can be used within an EMA with patients who are at a high risk of suicide. A next step to do so would be to validate the SDES items within the EMA setting. Most EMA studies have been criticized for lacking transparency, reproducibility, and replicability (Kirtley et al., 2021). Forkmann, Spangenberg, et al. (2018) set a good example for how to address these criticisms by evaluating

all self-report items used in their DFG multicenter study on the "Ambulatory Assessment of Suicidality (AMBAS)." Kirtley et al. (2019) even took this a step further by starting an ongoing open-science project, which serves as an EMA-item repository where researchers from all over the world can register their EMA items. This not only makes the items accessible to other researchers but also simplifies their psychometric validation. A next step could therefore be to register the SDES in this repository. The same applies to the EMA items used for assessing interoception in the third study. A first step was made made by publishing the SDES and its manual open access (Höller, Teismann, Glaesmer et al., 2021). Both the SDES as well as its manual and the EMA items can be found in the appendices.

Second, the results of the second study suggest that the main focus in clinical practice should be on internal entrapment and defeat and not on external entrapment. It has been suggested that it might be more complicated to escape from feelings of internal entrapment than from feelings of external entrapment since external entrapment is mostly due to external and changeable circumstances (Rasmussen et al., 2010). By contrast, internal entrapment leads to feeling captured in one's own mind (Owen et al., 2018) through, for example, rumination (Gilbert & Allan, 1998). Rumination serves as a threat-to-self moderator during the transition from defeat to entrapment in the IMV model and has been shown to be significantly associated with suicidal ideation and suicide attempts (Rogers & Joiner, 2017). Rumination is also a well-known symptom for depression, which is best treatable through cognitive behavioral therapy (Butler et al., 2006). It still remains unclear whether current therapeutic interventions—such as, in general, cognitive behavioral therapy or, more specifically for suicidality, the "attempted suicide short intervention program (ASSIP)" (Gysin-Maillart & Michel, 2015)—are sufficient to prevent suicides or to reduce suicidal ideation, or whether we need interventions in clinical practice that focus precisely on those proximal risk factors. For the future, an intervention study on reducing suicidal ideation by reducing internal entrapment through reducing rumination with the help of rumination-specific interventions such as the "cognitive-behavioral therapy of depressive rumination" by Teismann et al. (2012) or the "rumination-focused cognitive-behavioral therapy (RFCBT)" by Watkins (2018) would be of high relevance. This would be especially interesting since a relatively new study has revealed that maladaptive thought-control strategies are as important as rumination itself in the development of suicidal ideation (Hallard et al., 2021), so the way individuals encounter their dysfunctional thoughts matters. EMA could serve as the perfect method for monitoring the effects of such specific interventions.

Third, in the third study, the sample consisted of mentally-healthy participants in order to prevent patients from possible unnecessary burdens since this was only a pilot study. For that reason, associations between interoceptive facets and suicidal ideation were not analyzed, but there is adequate evidence for these associations (e.g., Forrest et al., 2015; Rogers et al., 2018). Practice effects should therefore be further examined in a clinical sample, since they could suggest possible intervention implications for clinical practice. Deficits in interoceptive facets could be thereby improved, and improving interoceptive deficits in suicidal patients could potentially reduce their suicide risk. As mentioned above, the treatment of suicidality could benefit from interventions that are more specifically related to proximal risk factors. Training interoceptive facets should therefore be considered as a possible intervention in the psychotherapeutic treatment of patients reporting suicidal ideation and behavior. Such training interventions could possibly be offered within ecological momentary interventions, which would make them available at all times to participants.

Fourth, the third study additionally confirmed the presumed temporal instability of interoception, which is important considering that suicidal ideation and the relevant proximal predictors also fluctuate (Czyz et al., 2018; Hallensleben et al., 2019; Hallensleben et al., 2017; Kleiman et al., 2017). The fluctuations of interoception, an aspect that has never been investigated before, highlight the compelling necessity of repeatedly assessing facets of interoception. Since the results of the third study also accentuate the feasibility of repeated assessing interoception, the dynamic fluctuation of symptoms and constructs related to suicidal ideation and behavior should be examined in a sample with a high risk of suicide.

Fifth, even though deficits in interoceptive sensibility, awareness, and accuracy have been associated with suicidal ideation, interoceptive abilities have not been considered in suicide-risk assessment or in clinical diagnostics. Moreover, the research results are inconclusive on whether there are exact cut-off values for "good" or "bad" interoception, so it remains unclear when we should actually talk about deficits in interoception. We can only say that there is an association between suicidal ideation and behavior and somewhat low interoceptive abilities. Those gaps need to be closed so that interoception can actually be integrated into diagnostic processes in clinical practice.

Sixth, now that we can measure these constructs in EMA, it is possible to build EMA-based symptom networks with network analysis for each patient (von Klipstein et al., 2020). For clinical practice, it could be highly beneficial to use such symptom networks, but further research in this area is warranted.

Seventh, machine-learning (ML) methods have recently come to the fore in suicide research. They offer a new method for predicting suicide by considering complex combinations of risk factors, so they could potentially expand the theoretical frameworks such as the IMV model (Bernert et al., 2020). In a systematic review, Bernert et al. (2020) indicated that ML makes possible to accurately classify (>90%) high levels of risk and the Area under the Curve (AUC) in predicting suicidal behavior. But these ML approaches have rarely integrated proximal risk factors and their fluctuations as well as fluctuations of suicidal ideation. To the best of my knowledge, only Van Mens et al. (2020) included some of these newer proximal risk factors. Even though they did not find that ML was superior to regular logistic regression analyses, internal entrapment, defeat, and perceived burdensomeness were the best predictors for suicidal ideation. The importance of defeat and internal entrapment has also been highlighted in the second study of this dissertation. Van Mens et al. (2020) argued that ML might not have been superior because their data might not have captured the constructs accurately enough and all algorithms assume that there are no classification or assessment errors in these constructs. The use of ML and the integration of proximal risk factors in clinical practice should therefore be further examined, but it should be kept in mind that results from ML algorithms should be viewed as a helpful additional tool and should never replace detailed suicide-risk assessment.

All in all, this dissertation revealed important implications for future research, but all three studies had strengths and limitations, which will be considered in the following.

5.4   Strengths and Limitations

When interpreting the results and drawing conclusions about the possible implications of the three studies of this dissertation for clinical practice, some strengths and weaknesses have to be kept in mind. The detailed strengths and weaknesses of each study can be found in the respective study.

The main strengths of the first two studies were the heterogeneity of the samples, which exhibited a high variance in suicidal ideation and behavior, and the successful validation of the SDES. Additionally, the second study provided prospective data for predicting suicidal ideation, which is highly needed in suicide research. Most importantly, the separate analyses of internal and external entrapment led to new theoretically and clinically relevant results. The third study was the first to assess facets of interoception in an EMA setting, and it provides not only important findings regarding fluctuations in facets of interoception but also a valid method for repetitively assessing interoception.

Where there are strengths, there are also weaknesses. The main limitation of the first study was that the SDES does not distinguish between internal and external entrapment, even though results from the second study confirm the superior importance of internal entrapment in the development of suicidal ideation. The main limitation of the third study was the healthy sample, so statements on associations between interoception and suicidal ideation could not be made. However, it was important to test the feasibility of such a study first before examining it with suicidal patients. Still, this addresses an important aspect in suicide research: the recruitment of adequate samples. This dissertation mainly focused on suicidal ideation and only gave a theoretical outlook on the development of suicidal behavior, so the samples in the first and second studies reported suicidal ideation as an outcome variable with sufficient frequency such that all analyses were feasible. The design of the third study should be used for assessing interoception in a sample with high variance in suicidal ideation.

Overall, the largest limitation of all three studies was the use of self-report measures. One fundamental problem in (suicide) research is the lack of objective markers. In the absence of specific objective markers, clinicians and researchers must rely on the subjective judgment of participants. This is especially disadvantageous in suicide research, since misleading self-report information can actually lead to death. Self-report is problematic in a number of ways: it is influenced by memory biases, cognitive processing, and item interpretation. Even more importantly, it has already been shown that participants answered inconsistently when asked about their lifetime history of suicide attempts (Eikelenboom et al., 2014) and also denied or concealed suicidal ideation because they wanted to avoid hospitalization (Busch et al., 2003; Nock et al., 2010). Relying on subjective self-report alone therefore seems dangerous, so research on objective makers is of high relevance. Newer findings suggest that phasic neurocognitive deficits could possibly serve as such objective markers (Interian et al., 2020). The role of interoceptive accuracy

as a possible measurable biomarker for psychological distress has also been discussed (Khalsa & Lapidus, 2016) and should be further examined in suicide research. The third study adds to this knowledge base.

5.5 Conclusion

The goal of this dissertation was to gain more insights into the development of suicidal ideation and suicidal behavior and related constructs. The first study aimed to validate a brief measure that could be used in clinical practice for assessing the two main constructs in the development of suicidal ideation: defeat and entrapment. The validation of the SDES was successful, and it highlighted the importance of assessing defeat and entrapment in suicidal individuals. Due to its shortness, the SDES can also serve as a suitable economic and convenient measure for repeated assessment in clinical practice and in suicide research. The second study further examined defeat and, separately, internal as well as external entrapment and aimed at investigating the pathways in the IMV model. These pathways could only be confirmed, however, for internal entrapment and not for external entrapment. The results of this study emphasize that it is necessary to distinguish between internal and external entrapment not only in the pathways of the IMV model but also in clinical practice and in the assessment of suicide risk. Predicting suicidal ideation and behavior remains difficult, and interoceptive deficits have gained considerable attention in suicide research. The third study therefore concentrated on facets of interoception. Due to the temporal instability of suicidal ideation and the respective risk factors, the third study aimed to examine interoceptive sensibility, awareness, and accuracy within an innovative EMA setting. Results revealed for the first time that all three facets are subject to fluctuations and that the repeated assessment of interoceptive accuracy and awareness is possible without great practice effects. These are essential insights for assessing interoception in suicide research.

These three studies confirm how important it is to elaborate the constructs of defeat and entrapment and highlight at the same time that the differentiation of these constructs needs to be improved. Moreover, the temporal instability of facets of interoception was detected. This indicates the need for future studies to investigate their importance with regard to early detection in the assessment of suicide risk. In summary, this dissertation accentuates the need for repeatedly monitoring constructs related to suicidal ideation and behavior in clinical practice. The dynamic changes in the symptoms of individuals

with suicidal ideation or suicidal behavior is of great relevance in evaluating suicide risk and should be taken into account in clinical practice to prevent individuals from dying by suicide.

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SDES
Deutsche Version der Short Defeat and Entrapment Scale

Bereitgestellt von

PSYCHOMETRIKON
Psychologisch-medizinisches Testportal

		T	T	M	M	J	J			
Code								Datum		Uhrzeit	:

Defeat Skala

Im Folgenden finden Sie eine Reihe von Aussagen, die beschreiben wie Menschen sich fühlen können. Lesen Sie jede Aussage sorgfältig und wählen Sie die Antwort rechts von der Aussage aus, die am besten beschreibt wie Sie sich **in den letzten 7 Tagen** gefühlt haben. Bitte lassen Sie keine Aussage aus.

Geburtsdatum [T T M M J J]   Geschlecht [m] [w]

		nie	selten	manchmal	meistens	immer
1	Ich fühle mich vom Leben besiegt.	0	1	2	3	4
2	Ich fühle mich machtlos.	0	1	2	3	4
3	Ich habe das Gefühl, dass ich keinen Kampfgeist mehr habe.	0	1	2	3	4
4	Ich habe das Gefühl, zu den Verlierern im Leben zu gehören.	0	1	2	3	4

Entrapment Skala

Im Folgenden finden Sie eine Reihe von Aussagen. Bitte geben Sie bei den folgenden Aussagen an, wie Sie sich während der **letzten Woche** gefühlt haben.

Während der letzten Woche…	überhaupt nicht	ein bisschen	mittelmäßig	ziemlich	sehr stark
1 ... wäre ich gerne nicht mehr ich selbst gewesen und hätte nochmals von vorne begonnen.	0	1	2	3	4
2 ... hätte ich mich gerne von gewissen Leuten ferngehalten, die stärker sind als ich.	0	1	2	3	4
3 ... konnte ich keinen Weg aus meiner momentanen Situation sehen.	0	1	2	3	4
4 ... wäre ich gerne vor meinen Gedanken geflüchtet.	0	1	2	3	4

SDES

Deutsche Version der Short Defeat and Entrapment Scale

Testmanual

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Inhaltsverzeichnis

Kurzbeschreibung des Tests

Ziel

Die Short Defeat and Entrapment Scale (SDES) ist ein Selbstbeurteilungsfragebogen, der zwei zentrale Konstrukte des „Integrativen Motivational-Volitionalen Modells Suizidalen Verhaltens" (IMV Modell) (O'Connor & Kirtley, 2018), *Defeat* und *Entrapment*, erfasst. Defeat beschreibt das Gefühl, vom Leben geschlagen zu sein, während Entrapment sich auf den Eindruck bezieht, durch äußere oder innere Zustände gefangen zu sein und keinen Ausweg zu haben. Beide Konstrukte werden im IMV Modell als Prädiktoren für die Entwicklung suizidaler Gedanken benannt, die beim Vorliegen weiterer Risikofaktoren zu suizidalem Verhalten führen können. Die Bedeutung dieser beiden Konstrukte wurde bereits vielfach empirisch bestätigt (O'Connor, Smyth, Ferguson, Ryan, & Williams, 2013; Owen, Dempsey, Jones, & Gooding, 2018; Panagioti, Gooding, Taylor, & Tarrier, 2013; Rasmussen et al., 2010; Taylor, Gooding, et al., 2010; Taylor, Wood, Gooding, & Tarrier, 2010).

Testbeschreibung

Die SDES besteht aus 8 Items, die zu zwei Skalen zusammengefasst werden: „Defeat Skala" (4 Items; auf Deutsch etwa „sich vom Leben besiegt fühlen") und „Entrapment Skala" (4 Items; auf Deutsch etwa „keinen Weg aus der eigenen momentanen Situationen sehen"). Die Items der Defeat Skala sind 5-stufig skaliert von „nie" (0) bis „immer" (4). Die Items der Entrapment Skala beginnen alle mit „Während der letzten Woche…" und sind 5-stufig skaliert von „überhaupt nicht" (0) bis „sehr stark" (4). Die Testdurchführung dauert in der Regel weniger als fünf Minuten

Anwendungsgebiete

Die SDES ist grundsätzlich in allen Altersgruppen einsetzbar. Es liegen Daten zu Allgemeinbevölkerungs- und klinischen Stichproben unterschiedlicher Zusammensetzung vor. Die SDES ermöglicht die Quantifizierung der oben genannten Konstrukte des IMV Modells. Die Erhebung dieser Konstrukte kann im Rahmen der Abschätzung des Risikos für suizidale Gedanken und suizidales Verhalten sinnvoll eingesetzt und grundsätzlich auch zur Veränderungsmessung genutzt werden.

Theoretischer Hintergrund

Schon in den 90er Jahren stellten Gilbert and Allan (1998) zwei Konstrukte vor, die sie als zentral für die Entwicklung depressiver Erkrankungen nannten: Defeat und Entrapment. Defeat beschreibt das Gefühl, eigene Ziele nicht erreichen zu können und vom Leben „geschlagen" worden zu sein. Entrapment hingegen beschreibt ein Gefühl von Ausweglosigkeit und sich gefangen zu fühlen aufgrund innerer (z.B. Grübeln) oder äußerer (z.B. Beziehungsprobleme) Umstände (Gilbert & Allan, 1998). Die psychopathologische Bedeutung dieser Konstrukte sowie ihre transdiagnostische Relevanz konnten bereits bei depressiven Erkrankungen, Angststörungen, schizophrenen Erkrankungen als auch bei posttraumatischen Belastungsstörungen bestätigt werden (Siddaway, Taylor, Wood, & Schulz, 2015). Empirische Befunde legen außerdem nahe, dass Defeat und Entrapment eine entscheidende Rolle bei der Entwicklung suizidaler Gedanken und suizidalen Verhaltens spielen (z. B. Taylor, Gooding, Wood, Johnson, & Tarrier, 2011).So werden diese Konstrukte in der Suizidforschung berücksichtigt, indem sie in zeitgemäße Theorien, die sich mit der Entstehung suizidaler Gedanken und suizidalen Verhaltens befassen, integriert wurden (Johnson, Gooding, & Tarrier, 2008; O'Connor & Kirtley, 2018; Williams, 2001). Ein solches Modell ist das sogenannte Integrative Motivational-Volitionale Modell (IMV Modell) von O'Connor and Kirtley (2018), das Defeat und Entrapment als Risikofaktoren in die motivationale Phase, in welcher Suizidgedanken entstehen, aufnimmt und anhand von drei Phasen die Entstehung von suizidalen Gedanken und suizidalem Verhalten darstellt.

Obwohl Suizid als Todesursache genauso häufig ist wie Verkehrsunfälle und somit in Deutschland jährlich mehr als 10,000 Menschen durch Suizid ums Leben kommen (World Health Organization, 2019), gelingt die konkrete Vorhersage suizidalen Verhaltens nur unwesentlich besser als auf Zufallsniveau (Franklin et al., 2017). Neuere Forschung konzentriert sich daher vermehrt auf proximale Risikofaktoren. Defeat und Entrapment sind nach dem IMV Modell zentral als proximale Risikofaktoren für die Entwicklung suizidaler Gedanken in der postulierten motivationalen Phase. Die Bedeutung von Defeat und Entrapment bei der Entwicklung suizidaler Gedanken und suizidalen Verhaltens konnte bereits empirisch bestätigt werden (O'Connor et al., 2013; Owen et al., 2018; Panagioti et al., 2013; Rasmussen et al., 2010; Taylor, Gooding, et al., 2010; Taylor, Wood, et al., 2010) Defeat und Entrapment wurden ursprünglich mit der Defeat Skala und der Entrapment Skala erfasst (Gilbert & Allan, 1998), welche bereits in validierter deutscher Form vorliegen (Forkmann, Stenzel, Rath, Glaesmer, & Teismann, 2017; Trachsel, Krieger, Gilbert, & Grosse, 2010). Beide Skalen bestehen jeweils aus 16 Items, was sie für die klinische Praxis nicht unbedingt praktikabel macht. Unabhängig voneinander erfassen die beiden Skalen die beiden Konstrukte, trotz weitreichender Debatte darum, ob Defeat und Entrapment tatsächlich zwei separate, voneinander eindeutig abgrenzbare Konstrukte sind (Griffiths, Wood, Maltby, Taylor, & Tai, 2014; Taylor, Wood, Gooding, & Tarrier, 2009). Aufgrund der Länge der beiden Skalen sowie der Dimensionalitätsfrage entwickelten Griffiths et al. (2015) die Short Defeat and Entrapment Scale (SDES). Die Autor:innen präsentierten eine Reihe von Analysen, die die Eindimensionalität der Skala bestätigten, sodass die ursprüngliche englische Version der SDES nur aus einer Skala mit 8 Items (4 Items für Defeat, 4 Items für Entrapment) bestand. Die Dimensionalität der Konstruke war jedoch nicht abschließend geklärt, denn neuere Befunde von Forkmann, Teismann, Stenzel, Glaesmer, and De Beurs (2018) wiesen deutlich auf die Zweidimensionalität der beiden Konstrukte hin, so wie sie auch in ihrer ursprünglichen Form vorgestellt worden waren (Gilbert & Allan, 1998).

Die SDES ist somit zwar ein valides, für die klinische Praxis geeignetes und ökonomisches Messinstrument, steht jedoch in ihrer momentanen Form ausschließlich für die englischsprachige Bevölkerung zu Verfügung. Außerdem ist die Dimensionalität der SDES

unter Berücksichtigung der uneinheitlichen Befunde über die beiden Konstrukte (Forkmann et al., 2018; Griffiths et al., 2015) nicht abschließend geklärt. Vor diesem Hintergrund wird hier die Entwicklung einer deutschsprachigen Version der SDES vorgestellt, deren Rahmen eine ausführliche Dimensionalitätsklärung der Konstrukte innerhalb der SDES durchgeführt wurde.

Testkonstruktion

Zur ökonomischen Erfassung von Defeat und Entrapment entwickelten Griffiths et al. (2015) auf Grundlage der Defeat Skala und der Entrapment Skala (Gilbert & Allan, 1998) die SDES.
Eine psychometrische Untersuchung der SDES in verschiedenen klinischen und nicht-klinischen Stichproben konnte zeigen, dass die beiden Konstrukte auf einen gemeinsamen Faktor laden und so ein Gesamtkonstrukt von Defeat und Entrapment reliabel erfasst werden kann. Die Retest-Reliabilität sowie die Validität konnten ebenfalls bestätigt werden.

Neuere Befunde (z.B. Forkmann et al., 2018) legten jedoch nahe, dass Defeat und Entrapment ggf. nicht als ein eindimensionales Konstrukt betrachtet werden sollten, sodass im Rahmen der Entwicklung der deutschen SDES auch deren faktorielle Validität empirisch überprüft wurde.

Itemgenerierung

Die Items der SDES wurden mittels Explorativer Faktoranalyse von Griffiths et al. (2015) aus den bereits existierenden Defeat Skala und Entrapment Skala abgeleitet.
Die endgültige SDES enthielt 8 Items, wovon 4 Items Defeat und 4 Items Entrapment erfassten. Laut Ergebnissen der Konfirmatorischen Faktorenanalyse aus Griffith et al. (2015) konnte eine einfaktorielle Struktur bestätigt werden, sodass die englischsprachige, originale Version der SDES aus nur einer Skala bestand. Die deutsche Version der SDES wurde mithilfe der bereits ins Deutsche übersetzten Items der Defeat Skala und Entrapment Skala mit den gleichen Items, die in der englischsprachigen SDES verwendet wurden, zusammengesetzt. Hierbei wurde der genaue Instruktionstext und Wortlaut der Items sowie deren Rating-Skala der jeweiligen Skala auf Deutsch übernommen.

Erstellung des Tests

Die deutsche Version der SDES wurde mit den bereits übersetzten Items der Defeat Skala und der Entrapment Skala gebildet und beinhaltete die gleichen Items, wie die Originalversion. Nach eingehender psychometrischer Prüfung, auf welche näher im Unterkapitel „Psychometrische Kennwerte" eingegangen wird, zeigte sich eine zweifaktorielle Lösung für die deutsche Version der SDES, sodass die deutsche Version der SDES aus einer Skala für Defeat und einer Skala für Entrapment besteht, welche separat ausgewertet werden sollten.

Analysestichproben

Die psychometrischen Kennwerte des englischen Originals finden sich bei Griffiths et al. (2015).
Aufgrund der uneinheitlichen Befunde zur Dimensionalität der beiden Konstrukte Defeat und Entrapment wurde vor Überprüfung der psychometrischen Eigenschaften die Faktorstruktur der deutschsprachigen Version der SDES geprüft.

Alle Analysen wurden in drei verschiedenen Stichproben durchgeführt. Die erste Stichprobe (Online Stichprobe) bestand aus Personen der Allgemeinbevölkerung (N = 480; 74% weibliche Teilnehmende; Alter: M = 28.5, SD = 11.1; Suizidversuch in der Lebensgeschichte: 8.5%), die zweite Stichprobe (amb. Patient:innen Stichprobe) bestand aus Patient:innen, die sich in ambulanter psychotherapeutischer Behandlung befanden (N = 277; 62.8% weibliche Teilnehmende; Alter: M = 37.2, SD = 12.6; Suizidversuch in der Lebensgeschichte: 11.2%), die dritte Stichprobe (Hochrisiko Stichprobe) bestand aus stationär aufgenommenen hoch suizidalen Patient:innen (N = 308; 53.4% weibliche Teilnehmende; Alter: M = 36.9, SD = 14.3; Suizidversuch in der Lebensgeschichte: 69.81%). Weitere Details zu den Stichproben finden sich bei Höller et al. (2020).

Psychometrische Kennwerte

Skalenstruktur

Aufgrund der Debatte über die Ein- oder Zweidimensionalität der beiden Konstrukte (Forkmann et al., 2018; Griffiths et al., 2015; Taylor et al., 2009), wurde für alle Stichproben sowohl ein zweifaktorielles als auch ein einfaktorielles konfirmatorisches Modell berechnet. Bei der Online Stichprobe und der Hochrisiko Stichprobe zeigte die zweifaktorielle Lösung den besseren Modellfit hinsichtlich der erforderlichen Werte der Root Mean Square Error of Approximation (RMSEA), des Tucker-Lewis-Index (TLI) und des Comparative Fit Index (CFI)[1] (s. Tabelle 1). Auch über die drei Stichproben hinweg zeigte das zweifaktorielle Modell, den besseren fit (χ^2 (1) = 64.00, p < .001)

Tabelle 1: Ergebnisse der konfirmatorischen Faktorenanalysen.

	Zwei-Faktor CFA				Ein-Faktor CFA			
Item	Online Stichprobe	amb. Patient:innen Stichprobe	Hochrisiko Stichprobe	Gesamt-stichprobe	Online Stichprobe	amb. Patient:innen Stichprobe	Hochrisiko Stichprobe	Gesamt-stichprobe
1	.84	.82	.71	.85	.82	.82	.70	.84
2	.76	.84	.84	.86	.76	.84	.84	.85
3	.80	.79	.75	.85	.79	.79	.74	.85
4	.80	.78	.73	.86	.78	.78	.72	.85
5	.83	.69	.49	.81	.79	.69	.45	.79
6	.57	.47	.42	.59	.54	.48	.37	.58
7	.77	.65	.76	.83	.76	.67	.64	.81
8	.78	.69	.68	.82	.75	.71	.58	.80
CFI	.98	.95	.98	.99	.96	.95	.94	.98
TLI	.96	.93	.97	.99	.94	.93	.91	.97
RMSEA	.07	.10	.05	.05	.10	.10	.09	.07

Anmerkung. CFA = Konfirmatorische Faktorenanalyse, CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation, alle Faktorladungen p < .001.

[1] Detaillierte Informationen zu den hier genannten Indizes für die Modellfits konfirmatorischer Faktorenanalysen finden sich bei Höller et al. (2020). Die entsprechenden Analysen wurden mit dem Programm R 3.5.2 durchgeführt.

Itemkennwerte

Die Itemcharakteristiken beider Skalen der SDES für alle Stichproben können Tabellen I und II im Anhang entnommen werden.

Gütekriterien

Die internen Konsistenzen können ebenfalls Tabellen I und II im Anhang entnommen werden. Cronbach's Alpha lag in den verschiedenen Stichproben zwischen .88 und .65. Korrelationen zwischen Defeat, Entrapment und anderen verwandten Konstrukten sprachen für die Konstruktvalidität des Instruments (s. Tabelle III im Anhang). Außerdem konnte die SDES zwischen Proband:innen unterschiedlichster Stadien der Suizidalität unterscheiden (s. Abbildung 1).

Abbildung 1: Ergebnisse der Gruppenvergleiche.
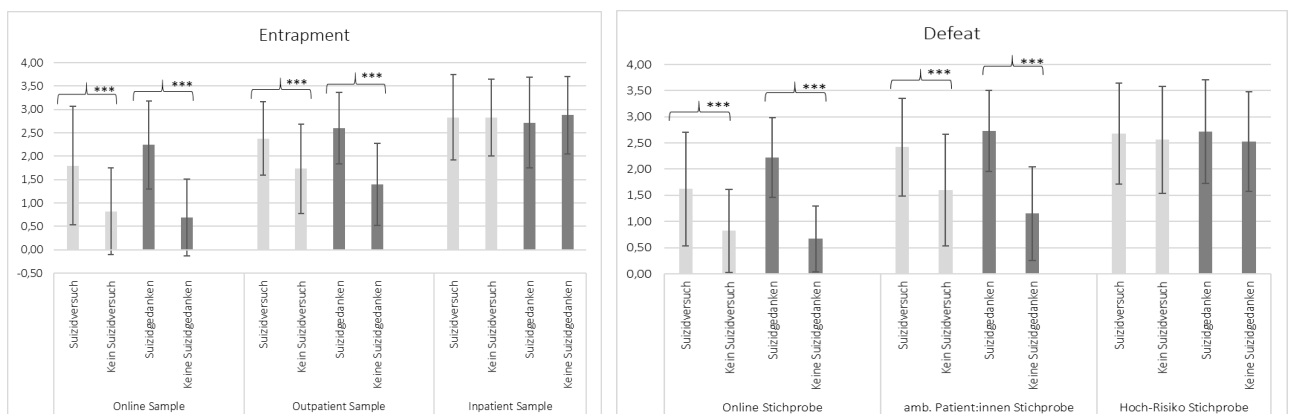
Anmerkung. Darstellung der erreichten Werte für die Subskalen Defeat und Entrapment der SDES von Proband:innen mit versus ohne Suizidversuch und mit vs. ohne Suizidgedanken.

Anwendung

Testdurchführung

Das Ausfüllen des Fragebogens beansprucht grundsätzlich nur wenige Minuten Bearbeitungszeit und kann von der teilnehmenden Person selbstständig vorgenommen werden.

Testinstruktion

Die Testinstruktion kann von der teilnehmenden Person dem Fragebogen entnommen werden.

Testauswertung

Die Ratings der einzelnen Items werden getrennt für Defeat und Entrapment addiert. Sowohl für die Defeat Skala als auch für die Entrapment Skala wird dann getrennt ein

Gesamtmittelwert berechnet, indem die Summe durch die Anzahl der Items geteilt wird. Es wird kein Gesamtmittelwert für die SDES über beide Skalen hinweg berechnet.

Testinterpretation

Höhere Werte auf der Defeat Skala sprechen für eine höhere subjektive Ausprägung von Defeat in der letzten Woche. Höhere Werte auf der Entrapment Skala sprechen für eine höhere subjektive Ausprägung von Entrapment in der letzten Woche. Ein Gesamtmittelwert von 4 entspricht sowohl bei der Defeat als auch bei der Entrapment Skala für die höchst mögliche Ausprägung hinsichtlich der subjektiven Empfindung des jeweiligen Konstrukts.

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Anhang

Tabelle I. Itemcharakteristika der Defeat Skala der deutschen Version der Short Defeat and Entrapment Scale (SDES)

Nr.	Item	*M*	*SD*	Varianz	Corrected item-total correlation	*α,* if item deleted	Cronbach's *α*	$M_{\text{inter-Item Correlation}}$
Defeat Skala								
Online Stichprobe							.88	.64
1	Ich fühle mich vom Leben besiegt.	.81	.97	.95	.79	.82		
2	Ich fühle mich machtlos.	1.33	1.01	1.02	.69	.86		
3	Ich habe das Gefühl, dass ich keinen Kampfgeist mehr habe.	.83	1.02	1.03	.73	.84		
4	Ich habe das Gefühl, zu den Verlierern im Leben zu gehören.	.59	.96	.91	.73	.84		
amb. Patient:innen Stichprobe							.88	.65
1	Ich fühle mich vom Leben besiegt.	1.38	1.26	1.58	.76	.84		
2	Ich fühle mich machtlos.	1.81	1.17	1.36	.76	.84		
3	Ich habe das Gefühl, dass ich keinen Kampfgeist mehr habe.	1.94	1.27	1.62	.72	.85		
4	Ich habe das Gefühl, zu den Verlierern im Leben zu gehören.	1.63	1.36	1.86	.72	.86		
Hochrisiko Stichprobe							.85	.58
1	Ich fühle mich vom Leben besiegt.	2.41	1.18	1.38	.66	.82		
2	Ich fühle mich machtlos.	2.91	1.09	1.18	.72	.79		
3	Ich habe das Gefühl, dass ich keinen Kampfgeist mehr habe.	2.64	1.16	1.36	.69	.80		
4	Ich habe das Gefühl, zu den Verlierern im Leben zu gehören.	2.64	1.31	1.70	.68	.81		

Tabelle II. Itemcharakteristika der Entrapment Skala der deutschen Version der Short Defeat and Entrapment Scale (SDES)

Nr.	Item	M	SD	Va-rianz	Corrected item-total correlation	α, if item deleted	Cronbach's α	M_{inter-Item Correlation}
	Entrapment Skala Während der letzten Woche...							
	Online Stichprobe						.83	.55
3	... konnte ich keinen Weg aus meiner momentanen Situation sehen.	.94	1.20	1.43	.72	.77		
2	... hätte ich mich gerne von gewissen Leuten ferngehalten, die stärker sind als ich.	.57	1.01	1.03	.53	.83		
4	... wäre ich gerne vor meinen Gedanken geflüchtet.	1.23	1.40	1.97	.69	.77		
1	... wäre ich gerne nicht mehr ich selbst gewesen und hätte nochmals von vorne begonnen.	.88	1.28	1.63	.74	.74		
	amb. Patient:innen Stichprobe						.72	.39
3	... konnte ich keinen Weg aus meiner momentanen Situation sehen.	1.81	1.23	1.50	.45	.69		
2	... hätte ich mich gerne von gewissen Leuten ferngehalten, die stärker sind als ich.	1.26	1.31	1.71	.41	.72		
4	... wäre ich gerne vor meinen Gedanken geflüchtet.	2.32	1.24	1.54	.61	.60		
1	... wäre ich gerne nicht mehr ich selbst gewesen und hätte nochmals von vorne begonnen.	1.81	1.40	1.96	.59	.61		
	Hochrisiko Stichprobe						.65	.34
3	... konnte ich keinen Weg aus meiner momentanen Situation sehen.	3.04	1.19	1.41	.55	.50		
2	... hätte ich mich gerne von gewissen Leuten ferngehalten, die stärker sind als ich.	1.85	1.54	2.38	.35	.66		
4	... wäre ich gerne vor meinen Gedanken geflüchtet.	3.37	1.02	1.03	.48	.56		
1	... wäre ich gerne nicht mehr ich selbst gewesen und hätte nochmals von vorne begonnen.	3.02	1.30	1.67	.40	.60		

Tabelle III. Korrelationen der Mittelwerte der deutschen Version der Short Defeat and Entrapment Scale (SDES) mit anderen verwandten Konstrukten.

	Online Stich-probe	amb. Patient:innen Stichprobe	Hochrisiko Stichprobe	Online Stich-probe	amb. Patient:innen Stich-probe	Hochrisiko Stichprobe	Online Stich-probe	amb. Patient:innen Stichprobe	Hochrisiko Stichprobe	Online Stich-probe	amb. Patient:innen Stichprobe	Hochrisiko Stichprobe
	2			3			4			5		
1. SDES_D	.78**	.82**	.59**	.85**	.72**	.71**	.67**	.61**	.58**	.62**	.57**	.53**
2. SDES_E				.83**	.62**	.53**	.66**	.53**	.39**	.59**	.57**	.34**
3. DESC/ DASS-D[1]							.78**	.58**	.57**	.70**	.55**	.50**
4. INQ_PB										.62**	.49**	.46**
5. INQ_TB												

Anmerkung. SDES = Short Defeat and Entrapment Scale; DESC = Rasch-based Depression Screening; DASS-D = Depression-Anxiety-Stress Scales 42, *Depression Subscale*; INQ_PB = Interpersonal Needs Questionnaire, *Perceived Burdensomeness Subscale;* INQ_TB = Interpersonal Needs Questionnaire, *Thwarted Belongingness Subscale*
[1] DESC wurde genutzt für die Online und die Hochrisiko Stichprobe, DASS-D wurde genutzt für die amb. Patient:innen Stichprobe. ** Alle Korrelationen waren auf einem Level von *p* ≤ .01 signifikant.

Construct	Items in German	Items in English
Morning reminder	Guten Morgen! Wir würden Sie nun bitten, die Trainingsphase mit der Fitnessuhr zu starten, damit die Aufzeichnung Ihrer Herzrate beginnen kann. Vielen Dank!	Good morning! We would now like to ask you to start the training phase with your fitness watch so the recording of your heart rate can begin. Thank you very much!
Depression	Im Moment fühle ich mich traurig.	At this moment I feel sad.
	Im Moment fühle ich mich niedergeschlagen.	At this moment I feel downhearted
Positive affect	Im Moment fühle ich mich fröhlich.	At this moment I feel cheerful.
	Im Moment fühle ich mich glücklich.	At this moment I feel happy.
Defeat	Im Moment habe ich das Gefühl, dass ich aufgegeben habe.	At this moment I feel that there is no fight left in me.
	Im Moment habe ich das Gefühl, ganz unten angekommen zu sein.	At this moment I feel that I have sunk to the bottom of the ladder.
Entrapment	Im Moment fühle ich mich wie in einem tiefen Loch, aus dem ich nicht hinauskann.	At this moment I feel like I am in a deep hole I cannot get out of.
	Im Moment kann ich keinen Weg aus meiner momentanen Situation sehen.	At this moment I can see no way out of my current situation.
Active suicidal ideation	Im Moment möchte ich sterben.	At this moment I want to die.
	Im Moment denke ich darüber nach, mir das Leben zu nehmen.	At this moment I think about taking my life,

Construct	Items in German	Items in English
Passive suicidal ideation	Im Moment habe ich das Gefühl, dass das Leben nicht lebenswert ist.	At this moment life is not worth living for me.
	Im Moment gibt es für mich mehr Gründe zu sterben, als zu leben.	At this moment there are more reasons to die than to live for me.
Acquired Capability: Pain tolerance	Im Moment könnte ich sehr viel (körperlichen) Schmerz aushalten.	At this moment I could take a lot of (physical) pain.
Acquired Capability: Fearlessness of death	Im Moment habe ich überhaupt keine Angst vor dem Tod.	At this moment I have no fear of death at all.
Acquired Capability: Explicit	Im Moment könnte ich mich umbringen, wenn ich wollte.	At this moment I could kill myself if I wanted to.
HPT (25, 35 or 45 seconds)	In der folgenden Aufgabe werden Sie einen kurzen Piepton hören. Nach einer Weile folgt ein zweiter Piepton. Ihre Aufgabe ist es, in dem Zeitraum zwischen den beiden Tönen Ihren Herzschlag möglichst genau mitzuzählen. Nachdem der zweite Ton erfolgt ist, klicken Sie bitte auf den Haken oben rechts, um danach die Anzahl ihrer gezählten Herzschläge eingeben zu können.	In the following task you will hear a short beep. After a while a second beep will follow. Your task is to count your heartbeat as accurately as possible in the time between the two beeps. After the second beep, click on the check mark in the upper right corner to enter the number of heartbeats you have counted.
Interoceptive accuracy	Bitte geben Sie die genaue Anzahl Ihrer gezählten Herzschläge an.	Please enter the exact number of your counted heartbeats.
Interoceptive awareness	Wie sicher sind Sie sich, dass die Anzahl Ihrer gezählten Herzschläge mit Ihren tatsächlichen Herzschlägen übereinstimmt? (in Prozent)	How sure are you that the number of your counted heartbeats matches your actual heartbeats? (in percent)

Construct	Items in German	Items in English
Interoceptive sensibility: Noticing	Im Moment merke ich, wo in meinem Körper in mich wohlfühle.	At this moment I notice where in my body I am comfortable.
Interoceptive sensibility: Not distracting	Im Moment lenke ich mich von unangenehmen Empfindungen ab.	At this moment I distract myself from sensations of discomfort.
Interoceptive sensibility: Not worrying	Im Moment fühle ich mich unwohl und mache mir Sorgen, dass irgendetwas nicht stimmt.	At this moment I feel discomfort and start to worry that something is wrong.
Interoceptive sensibility: Attention regulation	Im Moment ist um mich eine Menge los aber ich kann dennoch meiner inneren Körperempfindungen gewahr bleiben.	At this moment there is a lot going on around me but I can maintain awareness of my inner bodily sensations.
Interoceptive sensibility: Emotional awareness	Im Moment bin ich glücklich oder fröhlich und merke wie sich mein Körper anfühlt.	At this moment I notice how my body changes when I feel happy or joyful.
Interoceptive sensibility: Self-regulation	Im Moment kann ich meinen Atem dazu nutzen, innere Spannungen abzubauen.	At this moment I can use my breath to reduce tension.
Interoceptive sensibility: Listen to the body	Im Moment höre ich auf meinen Körper, um zu erkennen was zu tun ist.	At this moment I listen to my body to inform me about what to do.
Interoceptive sensibility: Body trust	Im Moment empfinde ich meinen Körper als einen sicheren Ort.	At this moment I feel my body is a safe place.
Context: Environment	Wo befanden Sie sich gerade als das Signal kam?	Where were you just when the signal for this assessment came?

Construct	Items in German	Items in English
Context: Employment	Was haben Sie gerade gemacht als das Signal zur Befragung kam?	What were you doing when the before the assessment started?
Context: Society	Waren Sie zu dem Zeitpunkt als das Signal zur Befragung kam in Gesellschaft?	Were you in company at the time the assessment started?
Context: Effort	Waren Sie zu dem Zeitpunkt als das Signal zur Befragung kam körperlich angestrengt?	Were you physically strained at the time of the assessment?
Context: Special features	Geben Sie bitte hier an, falls seit der letzten Messung irgendetwas Besonderes vorgefallen ist (z. B. Erfahrungen, Aktivitäten, Ereignisse, usw. – diese können sowohl positiv als auch negativ sein). Falls nichts vorgefallen ist, tragen Sie bitte einfach eine Null ein.	Please indicate here if anything special has happened since the last assessment (e.g. experiences, activities, events, etc. - these can be both positive and negative). If nothing has happened, please simply enter a zero.
Evening reminder	Guten Abend! Für heute haben Sie es geschafft. Wir bitten Sie darum, die Trainingsphase auf Ihrer Fitnessuhr nun zu beenden. Bitte prüfen Sie außerdem den Akkustand des Geräts und laden Sie die Uhr über Nacht auf. Vielen Dank!	Good evening! You are done for today. We kindly ask you to stop the training phase on your fitness watch now. Please also check the battery status of the watch and the smartphone and charge the devices overnight. Thank you very much!