

Evaluation of the Evidence for the Trauma and Fantasy Models of Dissociation

Constance J. Dalenberg
California School of Professional Psychology at Alliant
International University, San Diego

Bethany L. Brand
Towson University

David H. Gleaves and Martin J. Dorahy
University of Canterbury

Richard J. Loewenstein
Sheppard Pratt Health System, Baltimore, Maryland, and
University of Maryland School of Medicine, Baltimore

Etzel Cardeña
Lund University

Paul A. Frewen
University of Western Ontario

Eve B. Carlson
National Center for Posttraumatic Stress Disorder, Menlo Park,
and Veterans Administration Palo Alto Health Care System,
Palo Alto, California

David Spiegel
Stanford University School of Medicine

The relationship between a reported history of trauma and dissociative symptoms has been explained in 2 conflicting ways. Pathological dissociation has been conceptualized as a response to antecedent traumatic stress and/or severe psychological adversity. Others have proposed that dissociation makes individuals prone to fantasy, thereby engendering confabulated memories of trauma. We examine data related to a series of 8 contrasting predictions based on the trauma model and the fantasy model of dissociation. In keeping with the trauma model, the relationship between trauma and dissociation was consistent and moderate in strength, and remained significant when objective measures of trauma were used. Dissociation was temporally related to trauma and trauma treatment, and was predictive of trauma history when fantasy proneness was controlled. Dissociation was not reliably associated with suggestibility, nor was there evidence for the fantasy model prediction of greater inaccuracy of recovered memory. Instead, dissociation was positively related to a history of trauma memory recovery and negatively related to the more general measures of narrative cohesion. Research also supports the trauma theory of dissociation as a regulatory response to fear or other extreme emotion with measurable biological correlates. We conclude, on the basis of evidence related to these 8 predictions, that there is strong empirical support for the hypothesis that trauma causes dissociation, and that dissociation remains related to trauma history when fantasy proneness is controlled. We find little support for the hypothesis that the dissociation–trauma relationship is due to fantasy proneness or confabulated memories of trauma.

Keywords: trauma, dissociative disorder, dissociation, suggestibility, fantasy

Scientific interest in the concept of dissociation and the etiology of the dissociative disorders has increased markedly in recent decades. Building on the foundational work of Janet (1889, 1919),

researchers have empirically identified and investigated various types and categories of dissociation: the identity alterations and amnesias prominent in the dissociative disorders (Putnam, 1991),

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Constance J. Dalenberg, Trauma Research Institute, California School of Professional Psychology at Alliant International University, San Diego; Bethany L. Brand, Department of Psychology, Towson University; David H. Gleaves and Martin J. Dorahy, Department of Psychology, University of Canterbury, Christchurch, New Zealand; Richard J. Loewenstein, Sheppard Pratt Health System, Baltimore, Maryland, and Department of Psychiatry and Behavioral Sciences, University of Maryland School of Medicine, Baltimore; Etzel Cardeña, Department of Psychology, Lund University, Lund, Sweden; Paul A. Frewen, Department of Psychology, University of Western Ontario, London, Canada; Eve B. Carlson, National

Center for Posttraumatic Stress Disorder, Menlo Park, and Veterans Administration Palo Alto Health Care System, Palo Alto, California; David Spiegel, Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine.

David H. Gleaves is now at School of Psychology, Social Work and Social Policy, University of South Australia, Adelaide, Australia.

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Correspondence concerning this article should be addressed to David Spiegel, Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, 401 Quarry Road, Office 2325, Stanford, CA 94305-5718. E-mail: dspiegel@stanford.edu

the depersonalization and derealization experiences related to both posttraumatic stress disorder (PTSD) and the dissociative disorders (E. B. Carlson & Dalenberg, 2011; Lanius et al., 2010; Simeon, 2009), and the extreme forms of absorption that appear to be a diathesis for a variety of pathologies (Allen, Coyne, & Console, 1996). For the upcoming fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*, the American Psychiatric Association (2010) is proposing a definition of dissociation that includes reference to the disruptive nature of the symptoms, which involve “a subjective loss of integration of information or control over mental processes that, under normal circumstances, are available to conscious awareness or control, including memory, identity, emotion, perception, body representation, motor control, and behavior” (para. 1). Cardeña and Carlson (2011, pp. 251–252) have further specified that dissociative symptoms

are characterized by (a) a loss of continuity in subjective experience with accompanying involuntary and unwanted intrusions into awareness and behavior (so-called positive dissociation); and/or (b) an inability to access information or control mental functions, manifested as symptoms such as gaps in awareness, memory, or self-identification, that are normally amenable to such access/control (so-called negative dissociation); and/or (c) a sense of experiential disconnectedness that may include perceptual distortions about the self or the environment.

These definitions include the forms of dissociation labeled by Holmes et al. (2005) as psychological compartmentalization (lack of continuity and integration between psychological processes) and forms of dissociation labeled as detachment (altered self-experience characterized by estrangement from self and/or others). All these phenomena are included in the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986), a measure of dissociation that has been used in most studies of dissociative phenomena in clinical and nonclinical samples. The Cardeña and Carlson (2011) definition is used in this review.

As described below, all these forms of dissociation have been studied in a variety of populations, particularly those groups exposed to negative events. Each has also been theoretically and empirically linked to antecedent experiences of traumatic stress and/or severe psychological adversity. In general, the trauma model of dissociation (hereafter the TM) holds that dissociation is a phylogenetically important aspect of the psychobiological response to threat and danger that allows for automatization of behavior, analgesia, depersonalization, and isolation of catastrophic experiences to enhance survival during and in the aftermath of these events (Bremner & Marmar, 1998; Putnam, 1991; Spiegel, 1984).

In the early 1990s, the clinical syndrome of dissociative amnesia became temporarily conflated with the more general concept of recovered memory, creating heated rhetoric about the ubiquity of trauma as the cause of psychopathology on one the hand and accusations about false memories of trauma on the other (Dalenberg et al., 2007). As the polemics subsided, empirical interest in dissociation itself increased. The PILOTS database, a centralized source for research on trauma and PTSD, contains 78 peer-reviewed citations including the word *dissociation* or *dissociative* from 1986 to 1990. By 2006–2010, this number had increased by nearly a factor of 5.80 (441 citations). Consensus statements crossing theoretical divides (e.g., Lindsay & Briere, 1997) suc-

cessfully spurred dissociation theorists and their critics to tighten their methodology and to test contrasting hypotheses. Inclusion of dissociation in a wide range of research led to repeated findings that dissociation was related to more severe forms of trauma-related syndromes (Alexander & Schaeffer, 1994; Allen, Huntoon, & Evans, 1999), and that dissociative symptoms were present in a variety of syndromes not generally thought to be trauma-related, such as schizophrenia (Yu et al., 2010), attention-deficit disorder (Endo, Sugiyama, & Someya, 2006), obsessive-compulsive disorder (Watson, Wu, & Cutshall, 2004), and bipolar disorder (Oedegaard et al., 2008), likely due, at least in part, to inclusion of individuals with undiagnosed dissociative disorders (Yu et al., 2010). Dissociation was also implicated in treatment nonresponse or relapse among the following groups: heroin users (Somer, 2003), agoraphobia patients (Michelson, June, Vives, Testa, & Marchione, 1998), and those suffering from affective, anxiety, and somatoform disorders (Spitzer, Barnow, Freyberger, & Grabe, 2007). Furthermore, dissociation was positively associated with attrition from treatment for drug use among those with dissociative disorders (Tamar-Gurol, Şar, Karadag, Evren, & Karagoz, 2008) and among children with higher levels of parent-reported dissociation (Hébert & Tourigny, 2010). Among individuals who were treated with exposure therapy for PTSD, 69% of the individuals exhibiting high dissociation still met criteria for PTSD at follow-up compared with only 10% of individuals who did not present with significant dissociative symptoms (Hagenaars, Van Minnen, & Hoogduin, 2010). This pattern of poor response to, and lower engagement in, treatment highlights the importance of clinical assessment of dissociation.

In recent years, a number of authors (e.g., Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2008; McNally, 2003; Merckelbach, Horselenberg, & Schmidt, 2002; Merckelbach & Muris, 2001) have proposed and attempted to test an alternative to the TM. Proponents of the alternative model (hereafter the fantasy model [FM]) argue that dissociation is a psychological process causally unrelated to antecedent traumatic or stressful events. The FM posits that the trauma histories reported by individuals with dissociative experiences and/or dissociative disorders are largely confabulations or exaggerations resulting from fantasy proneness, suggestion, and cognitive distortions. As such, FM theorists acknowledge the relationship between reported trauma and dissociation, but stand the TM on its head by suggesting that dissociation overlaps with or gives rise to fantasy proneness, suggestibility, and cognitive distortion, which in turn heighten trauma reporting. Figure 1 illustrates this basic difference between how the trauma-dissociation relationship is conceptualized by the TM and the FM. In essence, for the TM, trauma leads to dissociation via various biopsychosocial mediator and moderator variables, whereas for the FM, dissociation leads to reports of trauma via various biopsychosocial mediator and moderator variables. Figure 1 does not sketch out the full causal explanation of all endogenous variables, but does list the typical constructs used by each group of theorists.

Although FM theorists at times present the two views as “contrasting” models (e.g., Giesbrecht et al., 2008, p. 622), virtually all theorists studying one or both models, including Giesbrecht et al. (2008), would agree that the propositions are not mutually exclusive: that (a) trauma may lead to dissociation and (b) fantasy proneness—among other factors—may lead to inaccurate trauma reports. Both also accept a nonrandom relationship between re-

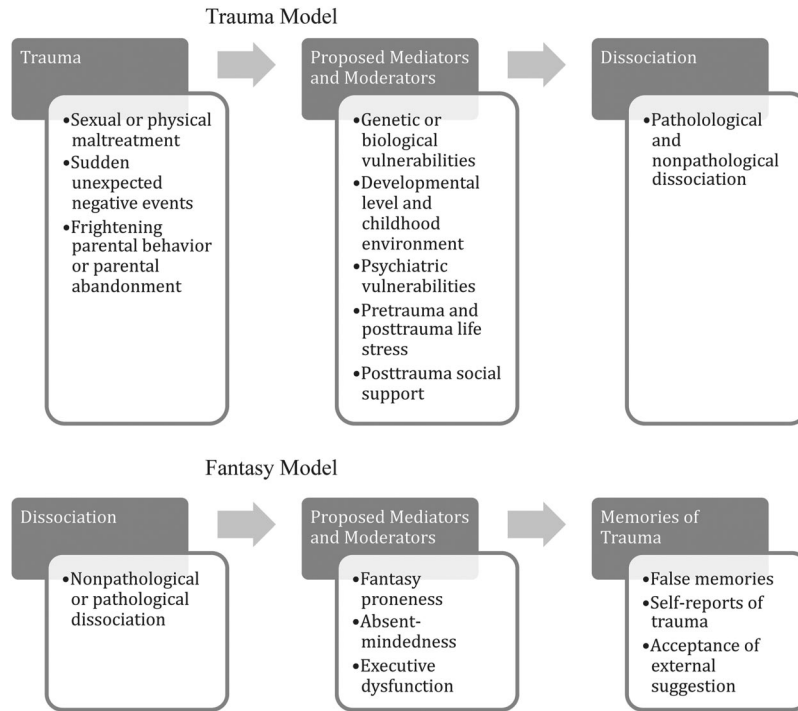


Figure 1. The trauma model and fantasy model of the trauma–dissociation relationship.

ported trauma and dissociation, but ascribe different reasons for the relationship. It is therefore important to clarify the true points of distinction in the two models. These appear to fall into eight categories, each of which we explore in detail below.

Differential Predictions of the Trauma and Fantasy Models of Dissociation

Predictions Regarding the Role of Trauma

Most broadly, proponents of the TM posit that the relationship between trauma and dissociation appears within multiple clinical and nonclinical groups, and varies in strength depending on a variety of trauma-specific features (Allen, Fultz, Huntoon, & Brethour, 2002; E. B. Carlson et al., 2001). Proponents of the FM, on the other hand, propose that the relationship between trauma and dissociation is weak and inconsistent and/or may be restricted to cases of profound dissociative psychopathology (Giesbrecht et al., 2008; Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2010). In fact, several FM theorists make the more extreme statement that “dissociation is related to self-reported but not objective trauma” (Giesbrecht, Lynn, et al., 2010, p. 10), positing instead that the apparent relationship is an artifact of positive reporting bias (Merckelbach, Muris, Horselenberg, & Stougie, 2000) and/or the covariation of both dissociation and trauma report with suggestibility and fantasy proneness (Merckelbach et al., 2002).

Because the TM includes a causative role for trauma in the etiology of dissociation, dissociation is generally predicted to be higher in recently traumatized populations (Cardena & Spiegel, 1993) and chronically or severely traumatized groups (Putnam, 1997). Dissociative symptoms would be predicted to decrease over

time for most individuals, and would be predicted to decrease with trauma-related treatment (E. B. Carlson & Dalenberg, 2011). In contrast, given that the FM regards dissociation as a sign of mild neurological impairment (Giesbrecht, Merckelbach, Kater, & Sluis, 2007) or fantasy proneness (Giesbrecht et al., 2008), the FM makes no strong predictions regarding a decline in dissociative symptoms over time. In fact, a number of FM theorists argue that trauma treatment is likely to enhance or increase dissociative symptoms through suggestion (Loftus & Ketcham, 1994).

Predictions Regarding the Role of Suggestibility and False Memory

Inherent to the FM is the hypothesis that the dissociative individual is prone to the construction of fantasies of abuse that are mistaken for memories (Loftus & Ketcham, 1994; McNally, 2003). The TM differs here by predicting that dissociation is in fact related to objective trauma and that self-reports of trauma are generally accurate. In fact, although TM theorists warn against the use of suggestive language with traumatized clients, particularly in the context of a potential history of exploitation by authority (Courtois, 1999; Dalenberg, 2000), there is no strong prediction made by the TM that dissociative individuals will be prone to false memories.

Given that fantasy proneness might be an alternative psychological escape from a traumatic childhood (Barrett, 1992), and given the shared relationship of both concepts with absorption (Platt, Lacey, Iobst, & Finkelman, 1998), the models do agree that the two concepts of fantasy proneness and dissociation would correlate. Importantly, however, the FM predicts that dissociation relates to trauma report through the mediators of fantasy proneness

and suggestibility, and therefore predicts little to no relationship between dissociation and trauma if fantasy proneness and suggestibility are controlled. Alternatively, the TM clearly predicts an increment for trauma over fantasy proneness or suggestibility in the prediction of dissociation, and an increment for dissociation over fantasy proneness and suggestibility in the prediction of trauma history.

Predictions Regarding Omission and Fragmentation of Memory

The TM posits that the dissociative individual is largely attempting to avoid recall of trauma by conscious and unconscious disavowal of the importance, implications, and/or accuracy or reality of the memory. According to the TM, the dissociative individual attempts to avoid thinking about the memory, disconnects from the emotional content of the memory, and ultimately may fail to recall some or all of the memory (e.g., DePrince & Freyd, 2004; Dorahy, 2006). The avoidance associated with dissociation may be both conscious and unconscious, or may be an initially conscious process that becomes unconscious over time (see Erdelyi, 1990). Automatic withdrawal of attention upon exposure to trauma or reminders of trauma, potentially resulting from dissociative episodes during encoding, may inhibit associative processing (Lyttle, Dorahy, Hanna, & Huntjens, 2010), and may result in a lack of the rich associative network typical of important emotional memories (cf. Spiegel & Cardeña, 1991; Stern, 1997). The result is a set of nonintegrated and fragmented memories (data driven/perceptual rather than autobiographical/conceptual; Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000; Holmes, Brewin, & Hennessey, 2004). This type of processing might account for omissions and poor agreement in detail across narrative recountings. Over the course of time, fragmented memories lacking associative networks may be more easily forgotten. This reasoning supports TM hypotheses regarding relationships between dissociation and fragmentation of memory and between dissociation and lost or recovered memory.

FM theorists make no claim for the relationship of fragmentation and dissociation. Omission, however, is thought by FM theorists to be negatively related to dissociation (cf. Giesbrecht et al., 2008). The FM argument here is that any elevation in trauma report by dissociative individuals is due to exaggeration and fantasy. Therefore, omission of data and loss of detail in severe trauma is less likely for dissociative individuals than is addition of detail and enhancement of the trauma description.

Predictions Regarding the Biology and Neurobiology of Trauma

Both the TM and the FM are consistent with a biological or sociobiological foundation for dissociation. The TM predicts that the experience of trauma and high levels of stress are related to cognitive deficits (Vasterling et al., 2002). The effects will appear in individuals with clinical dissociative disorders, as well as in traumatized nondissociative individuals, and will include the errors of omission, commission, and narrative fragmentation mentioned earlier (Harvey & Bryant, 1999; Kleim, Wallott, & Ehlers, 2008). Further, TM theorists expect differences between dissociative and nondissociative individuals in neurobiological studies, such as in

psychophysiological and functional neuroimaging of trauma survivors (Lanius et al., 2010), and expect these differences to reflect or broadly relate to known biologically based responses seen in animals.

In contrast, the causal path for the FM does not posit a role (or at least a significant role) for trauma in the neuropsychological or cognitive deficits seen in dissociative individuals. In Merckelbach et al.'s (2002) model, for instance, the relationship between dissociation and trauma self-report was hypothesized to be fully mediated by absent-mindedness and fantasy proneness, with no role for actual trauma. Cognitive deficiencies inherent to dissociation were thought to be a primary source of the trauma report. Mild executive functioning disorder in dissociative individuals is thought to be present in the presence and absence of trauma stimuli. An additional point of departure between the models relates to genetic factors; whereas the TM clearly posits a role for trauma exposure in the development of dissociation, such that trauma exposure should increment over genotypes in the prediction of dissociation, the FM makes no such prediction.

Summary of Predictions

1. The TM predicts a consistent positive relationship across studies between trauma and dissociation, whereas the FM does not.
2. The TM predicts that the relationship between trauma and dissociation will appear in populations with proven or well-supported assessment procedures for trauma, whereas the FM theorists argue that the dissociation–trauma relationship is largely spurious, and therefore will greatly diminish or disappear if objective (rather than self-report) measurements of trauma are used (Merckelbach et al., 2002).
3. The TM posits that the relationship between traumatic experience and dissociation is, at least in part, causal. Accordingly, the TM predicts that dissociation will increase after known trauma. For most affected individuals, the dissociative symptoms will also wane spontaneously over time. A negative-slope dissociative symptom frequency and strength should also be seen in pre- and posttrauma treatment designs. The FM predicts that dissociation is largely a mental state characterized by high fantasy proneness and weak executive functioning, and makes no prediction of relationship to time or trauma-based treatment (McNally, 2003; Merckelbach et al., 2002), other than proposing that treatment might increase dissociative symptoms (Loftus & Ketcham, 1994).
4. The TM predicts that although fantasy proneness and dissociation are likely to correlate, trauma will have an increment over fantasy proneness in the prediction of dissociation. The FM makes the opposite prediction. Fantasy proneness should predict trauma report with both variables in the model, whereas dissociation should not.
5. The FM makes a strong prediction that dissociative individuals, relative to nondissociative individuals, are at higher risk for false memories of personal trauma. The TM would predict that fantasy proneness characterizes only a portion of dissociative individuals, and that it is fantasy proneness, rather than dissociation, that will control the relationship of the variables to false memory. The relationship between dissociation and false memory therefore should be weak and inconsistent.
6. The TM makes a prediction that dissociation is related to the character of trauma memory, including decreased narrative cohe-

sion and increased fragmentation. The FM, which presents dissociation as related to exaggeration and false generation of trauma, predicts no relationship or a negative relationship between dissociation and fragmentation or omission.

7. The TM predicts that, over time, dissociative individuals will be more likely to “forget” or have difficulty accessing important facets of the memory. The FM states that those who claim recovery of a memory are unlikely to be recalling an actual trauma.

8. Both models predict some relationship between dissociation and neuropsychological measures such as working memory (similar to those seen in work with PTSD; Vasterling & Brewin, 2005). The TM holds that the biology of dissociation will ultimately fit with a theory of a brain-based regulatory response to fear or other extreme emotion (Lanius et al., 2010). Thus, the psychophysiology of the dissociative individual should be differentiable from the nondissociative individual in fear-relevant situations. The FM makes no prediction in this area.

Measurement of Dissociation and Fantasy Proneness

Prior to the analysis of the evidence for the TM and FM of dissociation, attention should be given to the measurement of this construct. The DES (Bernstein & Putnam, 1986) has been used in over 2,000 studies of dissociation to date, as both the focus for reviews of positive findings and the central instrument cited by critics of dissociation and its measurement. The DES also has an adolescent variant (the Adolescent Dissociative Experiences Scale [ADES]; Armstrong, Putnam, Carlson, Libero, & Smith, 1997) and a checklist form for use by parents or other adults assessing young children (Child Dissociative Checklist [CDC]; Putnam, Helmers, & Trickett, 1993).

In addition to the DES and its variants, a number of alternative instruments have appeared, such as the Questionnaire of Experiences of Dissociation (Riley, 1988) and the Dissociation Questionnaire (Vanderlinden, Van Dyck, Vandereycken, Vertommen, & Verkes, 1993), but these alternatives have not received substantial research attention. Briere’s (2002) Multiscale Dissociation Inventory (MDI) is a promising new addition to the library of dissociation measures, particularly given the availability of clinical norms, but again little is yet available to establish the ability of the measure to tap important dissociation-related phenomena.

Wright and Loftus (1999) have developed a creative alternative to the DES. Using the same items as the DES, Wright and Loftus’s DES-C asks participants not to rate their dissociative symptoms, but instead to rate whether they are dissociating less or more than others whom they know. The contention that this capacity is within the skill set of the dissociative patient (or even the normal control) has yet to be demonstrated. Further, the DES-C correlates only .25 with the DES (Wright & Loftus, 1999), clearly raising questions about the similarity of the two measures. We could find no published evidence showing that the DES-C is in fact a measure of dissociation. In the review below, research focuses on the original DES and its child and adolescent variants.

In addition, several diagnostic inventories and interviews have been developed for the diagnosis of clinical dissociative disorders. They are not discussed in detail here. However, they include two diagnostic interviews, the Structured Clinical Interview for *DSM-IV-TR* Dissociative Disorders (SCID-D; Steinberg, 1994) and the Dissociative Disorders Interview Schedule (Ross et al., 1989), as

well as a self-report measure, the Multidimensional Inventory of Dissociation (Dell, 2006; see Cardeña, 2008, for a review of the main measures).

The Dissociative Experiences Scale

The DES is a 28-item self-report measure. In the original Bernstein and Putnam (1986) measure, the frequency of each item was rated along an 11-point visual analog scale. In a revision by E. B. Carlson and Putnam (1993), the scale was changed to a Likert model with choices ranging from 0% (*never*) to 100% (*always*) at 10 percentage point increments. A sample item is “Some people have the experience of finding themselves in a place and having no idea how they got there” (Item 3). The DES has also been shown to measure both a taxon, often described as “pathological” dissociation, typically measured by the eight-item dissociative taxon, or DES-T (Waller, Putnam, & Carlson, 1996), and a continuum, measured by the total scale or by the “nonpathological” absorption subscale (Waller et al., 1996). The DES-T consists of lower base rate items targeting measurement of depersonalization and derealization, identity fragmentation, and amnesia. The absorption subscale is a subset of higher base rate DES items assessing normal experiences of deep focal attention as well as lapses in attention.

Critics of the current measurement of dissociation and, in particular, of the DES tend to focus on three issues: the inclusion of absorption in the domain of dissociation, the reliability and meaning of the taxon, and the more general issue of giving a unitary label (dissociation) to a wide range of topics, often symbolized by the argument of whether the DES is unifactorial or multifactorial (Bernstein, Ellason, Ross, & Vanderlinden, 2001; Giesbrecht et al., 2008; Watson, 2003). The argument against the inclusion of absorption in the measurement of dissociation can be made in two ways: (a) that high absorption is not a symptom of dissociative disorders, because it is more common in the general population than DES taxon items, and (b) that absorption is normal and nonpathological at all levels. The first assumption is not supported by the empirical evidence. For example, approximately 75% of patients with diagnosed dissociative disorders in Leavitt’s (2001) sample had high scores on absorption scales. Dalenberg and Paulson (2009), using a version of the DES corrected for skewness, found that over 95% of taxon-positive individuals were also above the cutoff for high absorption. Further, the correlation between the taxon and absorption factors is very high (e.g., $r = .80$ in Levin & Spei, 2004; $r = .36-.72$ in six psychiatric groups in Leavitt, 1999). These findings call into question the contention that “cleaner” measures of dissociation should exclude absorption. Instead, the data support the inclusion of items that measure capacities that may be facilitators, precursors, or lower level symptoms of dissociation.

With reference to the second assumption, high absorption has been shown repeatedly to be a marker for severe psychopathology. Indeed, Allen, Coyne, and Console (1997) reported surprise that the nonpathological absorption facets of dissociation were more related to psychosis than were the taxonic items. Absorption correlated more highly with severe psychopathology on the Minnesota Multiphasic Personality Inventory and the Millon Multi-axial Inventory than did the amnesia and depersonalization factors (Allen et al., 2002).

TM theorists and FM theorists both share the concern that the DES-T yields unacceptably high false-positive rates if used as a sole diagnostic instrument (cf. Cardeña, 2008), and that it has modest reliability in nonclinical samples when dissociative disorder should be rare or nonexistent ($r = .62$ over 2 months; Watson, 2003). However, the DES was designed as a screening, not a diagnostic, instrument (Bernstein & Putnam, 1986). Given the higher likelihood of false positives in screening for low base rate diagnoses, we agree that the DES-T should signal the likely presence of dissociative symptoms and the need for further evaluation for dissociative disorder, rather than the definitive presence of such a disorder. We also agree that dissociative symptoms do not always (or even typically) lead to dissociative disorder. We focus on the research using the DES, and the adolescent and child versions (the ADES and CDC), as they are the dissociative measures most frequently chosen in trauma studies, most inclusive of the full range of dissociative symptoms, and most psychometrically acceptable (given lower base rates for DES-T and lower reliability relative to the DES in nonclinical samples).

The proper use of the full scale and subscales of the DES has generated considerable discussion within and across the TM and FM literature (cf. Giesbrecht et al., 2008; Waller & Ross, 1997; Watson, 2003). Although we focus on the full DES in keeping with our overall definition of dissociation, we do not view the issue of the potentially multidimensional nature of the DES as an inherent problem. Most screening scales meant to measure complex, dimensional, diagnostically relevant concepts are multifactorial. For example, Shafer (2006) conducted a meta-analysis of four commonly used depression scales (the Beck Depression Inventory, Center for Epidemiologic Studies Depression Scale, Hamilton Rating Scale for Depression, and Zung Self-Rating Depression Scale), finding all four to be reliably multidimensional.

On a more technical note, the multidimensionality of the DES may be an artifact of “difficulty factors” (Carroll, 1945), that is, sets of items with differing base rates of agreement. Bernstein et al. (2001), who examined the skewness and difficulty of each DES item across clinical and nonclinical samples, concluded that the absorption items might also have been called “commonly endorsed dissociative symptoms,” the amnesia factor might have been labeled “infrequently endorsed dissociative symptoms,” and the depersonalization–derealization factor could have been called “dissociative symptoms endorsed at an intermediate level” (p. 107). Further, although many researchers find that the DES is multifactorial using the Kaiser criterion, the first factor of the analysis often has a much greater eigenvalue than the second (e.g., 11.61 vs. 1.79 for Amdur & Liberzon, 1996; 11.14 vs. 1.82 for Dunn, Ryan, & Paolo, 1994; 12.65 vs. 1.83 for Ruiz, Poythress, Lilienfeld, & Douglas, 2008). With the scree criterion, these analyses would be redefined as unifactorial. Finally, researchers who use the factors rather than the total scale have repeatedly noted high correlations between the factors (Allen et al., 2002; Giesbrecht, Merckelbach, et al., 2007; Pekala et al., 1999–2000).

Peritraumatic and State Dissociation

Although inclusion of a range of types of dissociation seems appropriate as long as adequate intercorrelations can be shown, the equation of trait dissociation with peritraumatic dissociation is problematic. Peritraumatic dissociation (i.e., dissociation at or

around the time of trauma) is often measured by the Peritraumatic Dissociative Experiences Questionnaire (PDEQ; Marmar, Weiss, & Metzler, 1997) or the Stanford Acute Stress Reaction Questionnaire (SASRQ; Cardeña, Koopman, Classen, Waelde, & Spiegel, 2000). The PDEQ contains 10 self-report items (also available in clinician administration form) measured along a 5-point scale ranging from 1 (*not at all true*) to 5 (*extremely true*). Dissociative experiences assessed during or immediately after a traumatic event include “I felt disoriented; that is, there were moments when I felt uncertain about where I was or what time it was” (Item 10). The SASRQ is a 30-item self-report measure of acute reactions to stress, including a subscale for dissociative reaction, with separate items for severity of disturbance and duration of worst symptoms. The 30 experiential items are assessed along a rating scale of 0 (*not experienced*) to 5 (*very often experienced*). A sample item is “I felt a sense of timelessness” (Item 4).

Dissociative symptoms may appear during trauma consequent to hyperventilation, panic, or arousal (Bryant et al., 2011; Nixon & Bryant, 2006). Such symptoms are not necessarily signs of a general tendency to dissociate or risk for a trauma disorder (Briere, Scott, & Weathers, 2005; Tichenor, Marmar, Weiss, Metzler, & Ronfeldt, 1996). In Tichenor et al.’s (1996) veteran sample, the correlation of the DES with the PDEQ was .26. An additional problem with measurement of peritraumatic dissociation is that reports are likely to be accurate only if they are collected soon after an event. Reports of peritraumatic dissociation associated with events that occurred months or years earlier will likely be influenced by emotional states at the time of recall.

A commonly used state dissociation measure is Bremner et al.’s (1998) Clinician-Administered Dissociative States Scale, containing 27 items rated along a scale from 0 (*not at all*) to 4 (*extremely*), with 19 items self-reported and eight observer reported. Equating measures of trait dissociation such as the DES with measures of state dissociation is somewhat more defensible (r with DES = .48 in the initial study) than the equating of the DES with peritraumatic dissociation, but should also be considered in the context of the trigger event. Although dissociation at the time of the trauma is arguably a state, the term *state dissociation* (in contrast to peritraumatic dissociation) refers to dissociative symptoms at a particular point in time subsequent to the trauma. Additionally, it should be noted that a marked increase in state dissociation during experimental procedures designed to induce it, such as ketamine infusion (an anesthesia with dissociative side effects; Rowland et al., 2005) or a dot-staring task (used to induce hyperfocus and absorption; Leonard, Telch, & Harrington, 1999), may have a different meaning than state dissociation elevation reported during admission to a psychiatric center or after trauma memory exposure (Bremner et al., 1998). Thus, trauma-related state dissociation may have more in common with trait dissociation than does pharmacologically induced state dissociation.

Measurement of Fantasy Proneness

The concept of fantasy proneness, introduced by S. C. Wilson and Barber (1983), is most commonly measured by their Inventory of Childhood Memories and Imaginings (ICMI) or by Merckelbach, Horselenberg, and Muris’s (2001) Creative Experiences Questionnaire (CEQ). Merckelbach et al.’s factor analysis of the CEQ found nine factors with eigenvalues greater than 1.0. Klinger,

Henning, and Janssen (2009) found 18 factors in the ICMI, with only a two-component promax-rotated solution proving stable across two approximate halves of their college sample ($n = 232$). The components of fantasy proneness proposed by S. C. Wilson and Barber based on in-depth interviews, and since supported by further empirical work (cf. Merckelbach et al., 2001), include large amounts of time spent fantasizing, vivid childhood memories, the experience of bodily component of fantasies, and intense religious and paranormal experiences.

The factors of the ICMI and the CEQ appear to measure very different constructs and correlate differently with dissociation. For example, Klinger et al.'s (2009) factor analysis of the ICMI found that Component 1 of the ICMI correlated .66 with an estimate of the DES taxon (using the Curious Experiences Survey; Goldberg, 1999) and Component 2 correlated .22 with this estimate. Component 1 was also related to depression, anxiety, and somatization, whereas Component 2 was unrelated to these variables. It remains unclear whether the two components actually measure proneness to fantasy in equal measure, or whether they instead reflect different goals to which fantasy may be harnessed (e.g., fearful avoidance, which correlates more with Component 1, and positive constructive daydreaming, which correlates with both factors). In either event, Klinger et al. concluded that the full-scale score "cannot yield general statements regarding dispositions to fantasize, and *fantasy-proneness* is accordingly a misleading summary label for what the full-scale ICMI measures" (p. 510). Similarly, after finding the CEQ to be multidimensional, Sánchez-Bernardos and Avia (2004) concluded that vividness–intensity of fantasies, make-believe or suggestibility, and fantasy to escape may be separate components of fantasy proneness with differential relationships to psychological risk. Recent evidence further suggests that Component 1 is prevalent among high hypnotizables who are also strong dissociators, but not among those who do not have such propensity (Terhune, Cardeña, & Lindgren, 2011). In summary, deeper analyses of the concept and construct of fantasy proneness, and separate analysis of the factors of fantasy proneness scales, are necessary to further the understanding of the fantasy proneness–dissociation relationship. Nonetheless, in keeping with the models used by FM theorists, herein the CEQ and the ICMI are used as the best available proxies for the trait of fantasy proneness.

Research Inclusion Criteria

The proposition that good data are lacking to support the link between trauma and dissociation is a cornerstone of the FM (Kihlstrom, 2005; Lilienfeld et al., 1999; Merckelbach et al., 2002; Merckelbach & Muris, 2001) and is one of the primary tenets distinguishing this theory from the more widely accepted TM. For example, McNally (2003) wrote that trauma theorists (DePrince & Freyd, 2001, in this case) "appear to believe that a high DES [dissociation] score is related to trauma," noting simply that this is "incorrect" (p. 176). We would argue that such a statement is questionable, but the point that TM theorists should not assume a causal relationship between trauma and dissociation is well taken. On the other hand, gathering the full literature on dissociation to test these conflicting assumptions is a daunting task. Entering the words *dissociation* and *dissociative* into PsycINFO yielded 16,237 references in February 2011, given that the word *dissociative* is used in a number of nonpsychological contexts (for instance, as an

opposite of *associative*). To gather the research for this review, we therefore took the following steps:

1. To overinclude those articles that might support the FM prediction, we crossed the words *dissociative* and *dissociation* with the terms *commission**, *false mem**, and *fantasy*. Only peer-reviewed articles available in English were included. This yielded 273 references.

2. The first 250 randomly selected empirical articles on psychological dissociation located among the original 16,237 using the term *dissociation* or *dissociative* showed that 96% of the articles with a dissociation measure chose the DES, the ADES, or the CDC as the measure of dissociation. Therefore, the citation index for PsycINFO was used to collect all articles that cited the DES, ADES, or CDC. The articles used as foundational citations were Bernstein and Putnam (1986), E. B. Carlson and Putnam (1993), Armstrong et al. (1997), and Putnam et al. (1993). All articles listed in PsycINFO as citing one or more of the foundational articles were included.

3. To maximize the quality of the studies, we also crossed the search term *dissociative or dissociation* with *prospective or longitudinal*. The results were reviewed, and articles that referred to psychological dissociation were added to the database.

The total reference base consisted of 1,492 articles meeting one or more of these criteria. This number was further supplemented by inclusion of a search of the ProQuest database for dissertations and theses to partially capture the gray (unpublished) literature. This last task is recommended in order to avoid the bias created by lack of publication of statistically nonsignificant findings. This yielded 40 dissertations for the fantasy search and 73 dissertations (from 2000 to 2010) for the DES search.

Findings

Evidence for Prediction 1: Is There Consistent Evidence for the Trauma–Dissociation Connection?

Relationship between trauma and dissociation. The relationship between trauma and dissociation has been found in a large array of specific populations, including patients with schizophrenia (Holowka, King, Saheb, Pukall, & Brunet, 2003), obsessive-compulsive disorder (Lochner et al., 2004), trichotillomania (Lochner et al., 2004), and psychosomatic disorders (Besiroglu et al., 2009), as well as those with alcohol dependency (Evren, Şar, & Dalbudak, 2008). The number of such studies is too large to be reviewed in detail here. With such a variety of studies to discuss, there is a danger of overemphasis on one of the few studies that found no correlation between trauma and dissociation in a small and nongeneralizable sample (e.g., Cima, Merckelbach, Klein, Shellbach-Matties, & Kremer's, 2001, study of 30 male forensic psychiatric patients; $r = -.07$, $p > .05$) or those that find unusually high correlations in such samples (e.g., Lochner et al.'s, 2004, study of 31 trichotillomania patients; $r = .61$, $p < .01$). Focusing on evidence from the most methodologically rigorous studies, Table 1 presents all studies from the database that met the following criteria: (a) effect size of the trauma–dissociation relationship was reported or data could be transformed into an effect size (e.g., from means and standard deviations), with statistically nonsignificant studies with no effect size data set to 0; (b) participants

Table 1
Relationship of Trauma and Dissociation

Study	Participants	Trauma type	Trauma measure	Dissociation measure ^a	r		
Akyüz et al., 2005	251 adult women See above	PA	Nonclinical samples CANQ	DES (Turkey)	.06		
					SA	DES	.18**
					TOT	DES	.22***
					BT	DES	.34**
Chu & DePrince, 2006 Collin-Vézina & Hebert, 2005	72 adult mothers 67 children evaluated for abuse and matched controls	SA	UCLA-PTSD Index Hospital evaluation and interview	CDC	.38***		
					SA	CDC	.38***
DePrince et al., 2008	97 children	TOT	Guardian report on UCLA-PTSD Index	ADES	.21*		
					TOT	CDC	.25*
Dorahy et al., 2007 Dutra et al., 2009	66 adults	DV	TEC	DES	.40***		
					SA	DES	.38**
Geraerts et al., 2005 Kistel & Lyons, 2001	56 young adults 56 young adults	DMC	Behavioral codes on AMBIAC	DES	.16		
					TOT	DES	.31***
Macfie et al., 2001a Macfie et al., 2001b	98 adults ^b 114 wards of DCFS	SA	Self-report	DES (Netherlands)	.20*		
					PA	ADES	.24**
McNally et al., 2000 McNally et al., 2006	114 wards of DCFS 114 wards of DCFS	SA	Reported by DCFS caretaker	ADES	.32***		
					PA	CDC	.30**
Narang & Contreras, 2005 Näring & Nijenhuis, 2005	114 wards of DCFS 198 children	SA	Reported by DCFS caretaker	CDC	.11		
					SA	CDC	.39***
Nilsson & Svedin, 2006 Noll et al., 2003	166 children 168 young adults	PA	CPS records	CDC	.42***		
					TR	CDC	.32**
Ogawa et al., 1997 Sayar et al., 2005	88 children 50 adults	SA	Coded from CPS records	DES	.42***		
					TOT	DES	.42***
Smith et al., 2010 Somer, 2002	68 adults ^b 166 adults	SA	Self-report	DES	.37***		
					SA	DES	.27***
Trickett et al., 2001 Twaite & Rodriguez-Srednicki, 2004	76 mothers 147 adults	PA	CHQ	DES (Netherlands)	.37***		
					TOT	DES	.28***
Zoroglu et al., 2003	391 adolescents 166 children	TOT	DIS-Q	ADES (Sweden)	.28***		
					SA	CDC	.36***
Sayar et al., 2005 Smith et al., 2010	173 adolescents 50 adults	PA	Home observation, CPS records, parent interview	DES	.26***		
					TOT	DES	.31***
Somer, 2002 Trickett et al., 2001	90 adults 166 children	TOT	THS	ADES (Turkey)	.44***		
					TOT	DES	.44***
Twaite & Rodriguez-Srednicki, 2004 Zoroglu et al., 2003	158 young adults 284 adults	SA	Verified through DCFS	DES (Israel)	.39***		
					SA	CDC at 6 months (Time 1)	.34***
Zoroglu et al., 2003	284 adults 839 adolescents	PA	Verified through DCFS	ADES at 7 years after Time 1	.16*		
					SA	DES	.24***
Brunner et al., 2000 E. B. Carlson et al., 2001	198 adolescent inpatients See above	TR	CANQ	ADES (Turkey)	.18**		
					TOT	DES	.33***
Dell, 2006	178 adult inpatients See above	SA	Clinical samples Therapist reports based on guardian report, DCFS records, and self-report	ADES (Germany)	.36***		
					PA	ADES	.22***
Dell, 2006	178 adult inpatients See above	Violent SA Other SA	Structured interview	DES	.52***		
					Violent PA Other PA	DES	.49***
Dell, 2006	204 clinical and nonclinical See above	PA	TEQ	DES	.35***		
					SA	TEQ	.28***
Dell, 2006	See above	TOT	TEQ	DES	.34***		
					TOT	DES	.44***

(table continues)

Table 1 (continued)

Study	Participants	Trauma type	Trauma measure	Dissociation measure ^a	<i>r</i>
El-Hage et al., 2002	140 adult outpatients	TR	CAPS	DES (France)	.49***
Francia-Martínez et al., 2003	100 adult inpatients	SA	BSAE	DES (Puerto Rico)	.14
Freyd et al., 2005	99 adults with chronic illness or pain	BT	BPTS	DES	.43***
Gast et al., 2001	102 adult inpatients	PA	CTQ	DES (Germany)	.47***
	See above	SA	CTQ	DES	.32***
	See above	TOT	CTQ	DES	.46***
Peleikis et al., 2005	112 women	SA	Confirmation by therapists	DES (Norway)	.21*
Reyes-Pérez et al., 2005	64 children	SA	Confirmation by therapists	CDC (Puerto Rico)	.63***
Salmón et al., 2003	123 gastroenterology patients	SA	MHQ	DES	.27***
	See above	PA	MHQ	DES	.23**
	See above	ASA	MHQ	DES	.27***
Skarabø et al., 2004	100 outpatients	TOT	KLEHS	DES (Norway)	.30**
Somer et al., 2001	70 outpatients	TOT	TEQ	DES (Israel)	.62***
Spitzer, Vogel, et al., 2007	122 inpatients with severe mental illness	TOT	PDS	DES (Germany)	.27**
Sullivan, 2003	192 inpatients	PA	Self-report	DES	.25**
	See above	SA	Self-report	DES	.40**

Note. Values in italics derived from studies using objective documentation of trauma. Trauma type: PA = physical abuse; SA = sexual abuse; TOT = total on trauma scale; TR = any trauma; BT = betrayal trauma; DV = domestic violence; DMC = dysfunctional maternal communication; ASA = adult sexual assault. Trauma measure; CANQ = Child Abuse and Neglect Questionnaire; UCLA-PTSD = University of California, Los Angeles-Posttraumatic Stress Disorder; TEC = Traumatic Experiences Checklist; AMBIAC = Atypical Maternal Behavior Instrument for Assessment and Classification; CTES-R = Childhood Traumatic Experiences Scales-Revised; self-report = investigator determined questions; DCFS = Department of Child and Family Services; CHQ = Childhood History Questionnaire; DIS-Q = Dissociation Questionnaire; CPS = Child Protective Services; THS = Traumatic History Screen; TEQ = Traumatic Experiences Questionnaire; CAPS = Clinician Administered PTSD Scale for DSM-IV; BSAE = Brief Scale of Abusive Experiences; BPTS = Brief Betrayal Trauma Survey; CTQ = Childhood Trauma Questionnaire; MHQ = Medical History Questionnaire; KLEHS = Kerkhof Life Events and History Scale; PDS = Posttraumatic Diagnostic Scale. Dissociation measure: DES = Dissociative Experiences Scale; CDC = Child Dissociation Checklist; ADES = Adolescent Dissociative Experiences Scale.

^a If a translated version of measure was used, the country or territory in which the study was conducted is listed. ^b Recovered and continuous memory survivors combined and compared with control. ^c Traumatic events in first 2 years of life.

* $p < .05$. ** $p < .01$. *** $p < .001$.

with no trauma of the type studied were included; (c) sample size was 50 or greater; and (d) the study used a community sample or a clinical sample including a range of psychiatric diagnoses. Thus, samples consisting entirely of dissociative disordered patients or those with PTSD, which may have restricted values on trauma likelihood or dissociation, were not included, but consecutive psychiatric admissions samples or groups of children in therapy are represented. College samples, which are likely to be biased in favor of low impairment, were not included. Lev-Wiesel, Daphna-Tekoah, and Hallak's (2009) large sample of pregnant women was not included given the complex literature on the relationship of pain, stress, and dissociation (cf. Ludäscher et al., 2007). Studies using only certain subscales of the DES also were not included. Studies that appeared to test the same sample in different publications and studies that limited trauma effects to emotional abuse were excluded. The effect size *r* was chosen, since the majority of studies reported this figure.

Table 1 presents the results of 38 studies that met our criteria. The average weighted effect size was .31 for the 19 sexual abuse samples, .27 for the 12 physical abuse studies, and .34 for the 16 total trauma score studies (for the E. B. Carlson et al., 2001, study, the two relevant values were averaged). The overall weighted *r* estimate was .32. Fixed-point estimates were made via Comprehensive Meta-Analysis software. All values are moderate effect sizes. *Q* values were between 24.59 (for sexual abuse) and 63.71 (for all studies), indicating heterogeneity of effect sizes.

The table also illustrates that large population studies and well-controlled comparison studies do exist that test the relationship of

trauma and dissociation. Collin-Vézina and Hébert's (2005) study of 134 children (abused children, evaluated in a hospital, and their matched controls) found a statistically significant relationship between sexual abuse and dissociation with a large effect size. Zoroğlu et al. (2003), who examined the relationship between trauma and dissociation in 839 Turkish high school students, found that trauma and dissociation were strongly related, with stepwise increments in dissociation based on the number of types of trauma experienced (i.e., one trauma vs. no trauma Hedges's *g* = 0.56, two traumas vs. no trauma Hedges's *g* = 0.84, and three traumas vs. no trauma Hedges's *g* = 1.12). E. B. Carlson et al. (2001) found large magnitude correlations for both sexual abuse and physical abuse in their inpatient sample, with violent sexual abuse showing an increment over family environment variables in predicting dissociation and PTSD. Thus, in summary, the TM Prediction 1 is supported; the relationship between trauma and dissociation is not "weak or nonexistent," as suggested in the FM, but instead is consistent and moderate in size, as suggested by the TM.

Relationship between trauma and dissociative disorder diagnosis. Critics of the TM also question the relationship of trauma to the dissociative disorder diagnoses. To specifically examine this question, we collected the 481 citations on dissociative disorders and abuse or trauma history (*child abuse or sexual abuse or physical abuse or trauma hist**) to locate empirical evaluations of the prevalence of trauma in the background of the most severe dissociative cases. Table 2 shows the results of the four studies with *n* > 50 that examined this question. Many more studies exist (e.g., Gast, Rodewald, Nickel, & Emrich, 2001; Middleton & Butler, 1998; Ross, Duffy, & Ellason, 2002; Ross et al., 1991); however, most such studies did not include a comparison group

Table 2
Abuse and Trauma Rates in Dissociative Disorder Samples Versus Comparison Groups

Study	Comparison	Abuse type	Trauma rate (%)	Effect size (ϕ)
Duffy, 2000	82 DD	PA	57.3	.36
	119 Inpatients		21.8	
	82 DD	SA	51.2	.24
	119 Inpatients		27.7	
	82 DD	TR	75.6	.36
Foote et al., 2006	119 Inpatients		39.5	
	24 DD	PA	70.8	.38
	58 Outpatients		29.3	
	24 DD	SA	75.0	.44
	58 Outpatients		27.5	
Ross & Ness, 2010	266 female DID	PA	83.8	.74
	318 controls		9.7	
	37 male DID	PA	83.8	.78
	184 controls		4.3	
	266 female DID	SA	90.2	.78
	318 controls		11.6	
	37 male DID	SA	73.7	.75
Şar et al., 2007	184 controls		2.7	
	115 DD	PA	18.3	.13
	513 non-DD		8.4	
	115 DD	SA	9.6	.20
	513 non-DD		1.2	
	115 DD	MT	60.9	.22
	513 non-DD		32.7	

Note. All comparison groups were from the general population unless otherwise noted. DD = dissociative disorder; DID = dissociative identity disorder; PA = physical abuse; SA = sexual abuse; TR = any trauma; MT = any maltreatment (includes neglect).

that would allow an effect size computation, presenting instead large samples of dissociative disorder or dissociative identity disorder (DID) patients. Trauma history was found in 50%–100% of such individuals in all studies (with the exception of the Turkish study by Şar, Akyüz, & Doğan, 2007). These results also support the TM, but differ from the data in Table 1. For Table 1, all clinical samples showed a general relationship between trauma and level of dissociativity on the DES. However, the base rate of DID in most clinical samples is low (1.3% in Ross's, 1991, nonclinical sample); thus, the correlation coefficient can be misleading. For instance, in a large sample ($N = 618$), Briere's (2006) correlation of .11 between trauma and clinical elevation on the MDI accounts for less than 2% of the variance. If the same results are translated into the language of binomial probability to make base rates more visible, as Briere made possible through cross-tabulation charts, the probability of clinical elevation in the MDI is 4 times greater in the trauma-exposed compared with a nonexposed sample (8% vs. 2%). Further, the probability of a trauma history given an elevated MDI in this sample was 90%. Similarly, in the study with the weakest effect size in Table 2 (Şar et al., 2007), the probability of abuse within the dissociative disorder samples were still 2–4 times higher than the rates within psychiatric controls. The heterogeneity of effect sizes are reflected in the very high Q values of 263.63 ($p < .001$) for physical abuse and 270.40 ($p < .001$) for sexual abuse. The mean-weighted r was .54 for the five sexual abuse samples and .52 for the five physical abuse samples. Again, with diagnosis rather than dissociation as a continuum, the hypothesis of the consistent relationship between trauma and dissociation in Prediction 1 is supported.

Evidence for Prediction 2: Does the Trauma–Dissociation Relationship Disappear in Studies With “Objective” Measures of Trauma?

In Table 1, 10 studies included external criteria for determination of maltreatment status. Ten graduate student raters—blind to the hypotheses of this review and blind to the results of each study—made this judgment with 100% agreement. The “objective” data included confirmation by therapists (with access to guardians and Child Protective Services [CPS] reports), protective agency report determined by researchers, or, in the case of Dutra, Bureau, Holmes, Lyubchik, and Lyons-Ruth (2009), observer behavioral codes of mothers' treatment of their infants. In Dutra et al., disrupted maternal communication included ratings of sexualized behavior, hostile and intrusive behavior, contradictory cues, withdrawal, and fearful-disoriented behavior on the part of the mother in the Ainsworth Strange Situation task. Nine of these 10 studies tested the correlation between dissociation and sexual abuse, whereas three also tested the correlation between dissociation and physical abuse. The FM prediction that objectively determined trauma would show lower correlations with dissociation than self-reported trauma thus could be tested by comparing the effect size of the objective studies with the studies using a standardized self-report measure or a single-item self-label of sexual abuse. Using a weighted mean effect size, the objective studies on sexual abuse had a weighted average r of .30, whereas the self-report, standardized measure, or structured interview studies had a weighted average effect size of .32. The three objective measure studies on physical abuse had a weighted average r of .30, com-

pared with the average weighted r for the remaining physical abuse studies of .26. The objective physical abuse analysis yielded a nonsignificant Q value of 3.67 ($p > .05$), with the remaining analyses showing Q values at or greater than 23.32 ($p < .01$). These results contradict the FM prediction, and go to the heart of the FM argument. If the trauma–dissociation relationship were largely due to fantasy proneness and subsequent exaggeration of trauma, clearly the relationship should be weaker when trauma is measured with greater objectivity. This argument has been made explicitly in Giesbrecht et al.'s (2008) recent review. They were able to locate two studies with objective criteria, both with small and nongeneralizable samples, noting that neither reached statistical significance. The 10 studies with larger and more generalizable samples, all of which did support the TM hypothesis, were not discussed by those authors. In this full review comparing studies with self-report to those using objective measures, studies with self-report measures of trauma did not show a greater relationship to dissociation than those with objective measures. Again, these findings support the TM position, not the FM view.

There have been no large-scale studies of the objective evidence for trauma reported by dissociative disordered patients including control groups. Longitudinal studies are less realistic here, given the base rate of dissociative disorders. However, the smaller studies that have followed up on the evidence for child trauma history in DID patients have confirmed the existence of such trauma. Coons (1994) found documented corroboration (e.g., CPS and police records) for 20 of his 21 child and adolescent DID and dissociative-disorder-not-otherwise-specified patients. Similarly, Coons and Milstein (1986) found documentation through medical records or family testimony in 17 of 20 adult DID patients (see also Lewis, Yeager, Swica, Pincus, & Lewis, 1997). Further, Hornstein and Putnam (1992) described two samples of children and adolescents with dissociative disorders totaling 74 participants, all of whom had reported histories of a wide variety of types of maltreatment, including physical abuse, sexual abuse, witnessing parental death, and/or neglect. Social service investigation substantiated 95% of these histories.

In support of the call for further research with more sophisticated models, it should be emphasized here that prospective longitudinal studies have found that objective trauma leads to heightened dissociation in children who have disorganized attachment (e.g., Lyons-Ruth, Dutra, Schuder, & Bianchi, 2006; Ogawa et al., 1997), been victims of corroborated sexual abuse (Noll, Trickett, & Putnam, 2003; Trickett, Noll, Reiffman, & Putnam, 2001), or experienced verified painful medical procedures (Diseth, 2006). For example, in an ongoing, case-controlled longitudinal study of girls with a substantiated history of child sexual abuse (CSA; Trickett et al., 2001), participants were assessed with a variety of biological, psychometric, and educational measures, as well as measures of social functioning. They were assessed within 6 months of the initial report of CSA to protective services and again 7 years later. The abused girls had higher levels of caregiver-rated dissociation at intake than nonabused controls. Furthermore, the abused girls who had experienced more severe forms of abuse (i.e., earlier onset, father figure abuse) had higher levels of self-reported dissociation at a 7-year follow-up. Similarly, in the longitudinal studies of E. A. Carlson (1998) and Ogawa et al. (1997), disorganized attachment in infancy predicted observed dissociative behavior reported by elementary and high school teachers, and cor-

related with self-reported dissociation at age 19. Within the disorganized group, higher dissociation scores were found for the group that had experienced documented traumas in childhood and adolescence. Ogawa et al. also reported a statistically significant correlation between trauma (with both objective and parent self-report documentation) and dissociation at Time 1 (infancy), Time 4 (age 16–17), and Time 5 (age 19) with a sample of 168. In Diseth's (2006) smaller study of children who had experienced repeated and painful medical procedures ($N = 42$), an objective trauma, dissociation in both adolescence and young adulthood correlated with number of hospitalizations ($r = .59$ with the ADES and $r = .79$ with the DES, 10 years later).

Many prospective studies follow at-risk samples in order to have realistic probability of finding traumatized individuals with varying symptom levels. Barring the random (and unethical) assignment of individuals to traumatizing conditions, the optimal determination about whether dissociation is causally related to trauma would be to prospectively study dissociative symptoms and PTSD symptoms in a sample that is representative of the general population that has been exposed to verified trauma. It would further clarify the relationship between dissociation and trauma if symptoms were assessed in real time rather than retrospectively and if the symptoms were assessed longitudinally at multiple time points. A study following those criteria has recently been conducted (E. B. Carlson et al., 2011). Dissociation and PTSD symptoms were assessed in real time (at 4-hr intervals over 7 days) in 62 adults who were exposed to traumatic stress (either severe injury or severe injury to a loved one). Participants experienced an initial elevation in dissociative symptoms that dissipated over time. In addition, the relationship between PTSD and dissociation symptoms assessed in real time was extremely high at $r = .83$ and homoscedastic, indicating that dissociation symptoms were strongly related to the expected responses to trauma exposure. In summary, across methodologies, dissociation is related to objective trauma.

Evidence for Prediction 3: Does Level of Dissociation Change With Time and After Trauma Treatment?

The effect of treatment on dissociative symptoms. Table 3 shows the results of seven studies showing a pre- and postchange in dissociation after short-term trauma treatment. Given that power for repeated measures is greater than power for between-group designs, studies with samples greater than 25 are presented. To be

consistent and conservative, we calculated effect sizes (d values) using the standard deviation of baseline scores as the denominator. Thus, we did not use the standard deviation of change scores, even if the original researchers did, because doing so can lead to an overestimate of effect sizes (Dunlap, Cortina, Vaslow, & Burke, 1996). All studies reported reductions in dissociation after treatment for at least one treatment approach. Controls did not show a statistically significant decrease. In the case of Bohus et al. (2004); Chard (2005); Rothbaum, Astin, and Marsteller (2005); and Van Emmerik, Kamphuis, and Emmelkamp (2008), nontreatment controls did not show a statistically significant decrease in dissociation in the comparable period. The same pattern appeared in the only pharmacology study that met our criteria. Chronic PTSD patients who were treated with paroxetine (in a randomized double-blind study) reliably dropped in dissociation symptoms, with no statistically significant change in the placebo condition, but this study had a large dropout rate and should be replicated (Marshall et al., 2007). Because the studies varied in treatment type and treatment length, we do not present one overall estimate of effect size. Rather, we note that most or all studies of the effect of trauma-relevant treatment on dissociative symptoms found results supporting the TM. We were unable to locate any FM explanations of decrease in dissociation after trauma treatment.

Change in dissociative symptoms across time. Researchers asking questions about short-term changes in dissociation after stressors have typically used state dissociation measures. A number of pre- and postdesign studies have been conducted. Lanius et al. (2005) observed an increase in state dissociation subsequent to exposure of combat veterans to their own scripted trauma memories. Morgan et al. (2001) also reported increases in dissociation in a resilient group of Special Forces soldiers after highly stressful survival training. Although most soldiers had prior trauma, 42% of the sample reported dissociative symptoms pretraining, whereas 96% reported symptoms after training. In perhaps the most theoretically interesting of the state dissociation studies, Zoellner, Sacks, and Foa (2007) used the Velten mood induction procedures. In this procedure, phrases associated with state dissociation, such as "I feel detached and distant today," are read to the participant to induce a dissociative experience. Dissociation induction was most easily accomplished by those with PTSD as compared with nontrauma-exposed participants, suggesting that trauma-exposed individuals have been sensitized to experience dissociation.

Table 3
Pre- and Posttrauma Effect Sizes of Decreases in Dissociation Measures With Treatment

Study	Type of treatment and description of sample	N	Effect size (d)
Abramowitz & Lichtenberg, 2010	Hypnotic treatment for combat-related PTSD	36 men	.68
Bohus et al., 2004	DBT for BPD patients	31 women	.53
Chard, 2005	CPT for sexual abuse	28 women	.92
Ross & Haley, 2004	Stabilization and trauma treatment in hospital program	46 adults	.30
Rothbaum et al., 2005	PE or EMDR for recent rape victims	40 women	.83 and .97
Sachs et al., 2006	Dynamic trauma-focused treatment for BPD and CPTSD	75 women	.28
Van Emmerik et al., 2008	CBT or writing task groups for ASD/PTSD patients	41 and 44 adults	.18 and .39

Note. PTSD = posttraumatic stress disorder; DBT = dialectical behavior therapy; BPD = borderline personality disorder; CPT = cognitive processing therapy; PE = prolonged exposure; EMDR = eye movement desensitization and reprocessing; CPTSD = complex posttraumatic stress disorder; CBT = cognitive behavioral therapy; ASD = acute stress disorder.

Over longer time spans, the TM prediction would be that traumatized individuals would be temporarily elevated in dissociative symptoms as a group, and that these symptoms would diminish for most individuals over time as the trauma becomes more integrated into cognitive systems and trauma-related emotions (e.g., fear and anxiety) dissipate. In studies in which participants were followed after trauma—as in Cardeña and Spiegel (1993); E. B. Carlson et al. (2011); Feeny, Zoellner, Fitzgibbons, and Foa (2000); and Feeny, Zoellner, and Foa (2000)—large and statistically significant drops in dissociative symptom severity occur over time without intervention in most individuals. Two to 10 days after trauma exposure in E. B. Carlson et al., 40% of the sample showed elevated levels of dissociation when compared with a normative sample of adults with no prior trauma exposure. One week later, 39% still reported dissociation at elevated levels. At 2 months postevent, only 27% of participants reported dissociative symptom elevation. This pattern also fits the TM and not the FM prediction.

In summary, the increase in state dissociation after exposure to high stressors or traumatic events and trauma reminders is consistent with TM Prediction 3. Similarly, findings support the TM prediction of the short-term decrease in dissociation (relative to comparison groups) with trauma-relevant psychological or pharmacological treatment and the long-term decrease in dissociation over time. If dissociation were a stable outgrowth of fantasy proneness and mild neurocognitive disturbance (cf. Giesbrecht et al., 2008), such patterns would be much harder to explain. These findings clearly support TM Prediction 3, that dissociation is temporally related to trauma and trauma treatment.

Evidence for Prediction 4: Does Dissociation Show an Increment Over Fantasy Proneness in the Prediction of Trauma?

Both the TM and the FM predict a relationship between the measures typically used for the dissociation and fantasy proneness concepts, because both types of scales were developed from a theoretical base that included an etiological role for psychological absorption and trauma. Fantasy proneness is acknowledged to be a “close cousin” of absorption by Geraerts, Merckelbach, Jelicic, Smeets, and Van Heerden (2006, p. 1143). The authors of both of the most commonly used fantasy proneness scales report that they developed their measures from a theoretical framework that includes absorption (Merckelbach et al., 2001; S. C. Wilson & Barber, 1983). Similarly, absorption items were purposely included in the DES, the most commonly used dissociation scale (Bernstein & Putnam, 1986). It is easy for theoreticians from all perspectives to lose track of this history, reifying the scale totals, and reporting as an independent and surprising finding that absorption correlates strongly with each measure.

Merckelbach et al.’s (2001) CEQ and S. C. Wilson and Barber’s (1983) ICMI do correlate with dissociation (Merckelbach et al., 2002; Pekala et al., 1999–2000; Rauschenberger & Lynn, 1995; Waldo & Merritt, 2000), but the reason for the correlation is unclear. Highly fantasy-prone individuals have been reported to be diagnosed with dissociative disorders more often than low- or medium-level fantasy-prone individuals (Rauschenberger & Lynn, 2002–2003). The inclusion of absorption within each scale type is the most obvious explanation. Merckelbach et al., the developers

of the CEQ, also noted that there is overlap between the item content of the CEQ and the DES. They suggested:

Two CEQ items (i.e., “I often confuse fantasies with real memories” and “I sometimes feel that I have an out of body experience”) clearly overlap with some DES items (e.g., “not sure whether one has done something or only thought about it” and “feeling as though one’s body is not one’s own,” respectively). (p. 989)

Such similar items would contribute to correlations between measures of fantasy proneness and dissociation.

Further, it is consistent with prior theory and research on fantasy proneness scales that trauma is one cause, although not the sole cause, of fantasy proneness. In early articles on the CEQ, Merckelbach et al. (2001) conceded there are different paths to fantasy proneness, including coping with childhood adversity: “Other fantasy-prone,” they wrote, “reported a heightened frequency of aversive childhood events. In these cases, a profound fantasy life may have become a means to cope with or escape from negative experiences” (p. 988). Rhue and Lynn (1987, p. 121), for instance, noted that fantasy-prone participants reported “greater frequency and severity of physical punishment, greater use of fantasy to block the pain of punishment, more thoughts of revenge toward the person who punished them, greater loneliness, and a preference for punishing their own children less severely” than those lower in fantasy proneness. Lynn and Rhue (1986) and S. C. Wilson and Barber (1983) also reported that fantasizers acknowledged more severe and more frequent childhood punishment. In keeping with the TM hypothesis of use of fantasy as escape, fantasy proneness is related to the five scales of the Childhood Trauma Questionnaire (Pekala et al., 1999–2000).

Therefore, dissociation and fantasy proneness may correlate spuriously in part through their common connection to trauma history. Again, from the TM perspective, those who voluntarily and (over time) involuntarily shift attention from stimuli that trigger unwanted memories (dissociate) will also use other techniques to escape from unwanted environments (such as voluntary shifts of attention to internally generated images in the form of fantasizing or daydreaming). A definitive answer to the question of the etiology of this relationship awaits more sophisticated studies that include all relevant variables. Particularly helpful would be studies that track these relationships over time.

Although the relationship of fantasy proneness and dissociation is not incompatible with either model, the FM does make a prediction of the relative relationship of these variables to trauma self-report. In the FM given by Merckelbach et al. (2002), and replicated in Figure 1, a statistical prediction can be made that fantasy proneness will produce an increment over dissociation in the prediction of trauma self-reports, whereas dissociation will produce no significant increment over fantasy proneness. Because the TM posits a causal role for trauma in producing dissociation, an increment for dissociation is predicted.

We were able to locate four studies with samples greater than 50 (to allow sufficient power) that included the three relevant correlations allowing partial correlation to be computed. Support for the TM contention (statistically significant partial correlation of trauma and dissociation controlling for fantasy proneness) occurred in all four studies: research by Merckelbach et al. (2002); Pekala, Angelini, and Kumar (2001); Pekala et al. (1999–2000); and Thomson, Keehn, and Gumpel (2009). Specifically, in each

case, fantasy proneness did relate to trauma history and dissociation, but trauma history did have an increment over fantasy proneness in the equation predicting the DES. Dissociation does relate to report of trauma history controlling for fantasy proneness.

Furthermore, the few studies on fantasy proneness in dissociative disordered samples do not indicate the strong elevations in fantasy proneness that would be expected if their trauma histories were entirely fantasized. Huntjens et al. (2006) found that DID patients scored higher on fantasy proneness than controls and nonclinical DID simulators. However, the DID mean score on the CEQ (9.92) was very similar to means of male and female college students reported in Merckelbach et al.'s (2001) psychometric article on the CEQ ($M = 9.2$, $SD = 4.4$, and $M = 8.7$, $SD = 4.0$, respectively). Using the ICMI, Levin, Sirof, Simeon, and Guralnick (2004) also found elevated levels of fantasy proneness in patients with depersonalization disorder (DPD) compared with nonsymptomatic controls. However, as Levin et al. wrote, the total scores for the DPD group were well below typically used thresholds for high fantasy proneness. The DPD mean was 14.7 ($SD = 7.3$), which falls at the low end of the range for medium fantasy proneness on this instrument (14–36 in Levin et al., 2004). These findings in general support the TM prediction (Prediction 4) regarding the independent contribution of dissociation over fantasy proneness in the prediction of trauma history.

Evidence for Prediction 5: Are Dissociative Research Participants at High Risk for Suggestibility and False Memory?

Research on suggestibility is also central to the FM contentions about the dissociation–trauma connection. The controversial contentions of the FM are not only that the dissociation and trauma report connection is mediated by fantasy proneness, which appears unfounded as discussed earlier, but also that dissociation produces enhanced probability of confabulation of trauma memory itself. Giesbrecht et al. (2008) repeatedly cited their concern that dissociative individuals will overreport trauma on standardized questionnaires unless provided with a context that “discourages reporting of traumatic experiences” (p. 622). It seems ill-advised and potentially harmful to discourage patients from reporting trauma exposure due to fears of high rates of false report without strong support for this hypothesis.

Suggestibility paradigms. In the standard FM argument of dissociation as a risk factor for suggestibility, many nonequivalent forms of suggestibility are mentioned and tested (Giesbrecht et al., 2008; Merckelbach & Muris, 2001). To extend the range of studies reported, all research with samples greater than 25 are presented in Table 4. The best known are clustered under event suggestibility studies, and represent forms of suggestion that include acceptance of the false suggestion that one has seen or experienced an event. In the nonautobiographical studies of this type, participants are typically shown slides or read paragraphs, and pressed at a later point to agree to a false statement about a slide seen or fact heard. The Gudjonsson (1997) suggestibility paradigm is a standardized form of this type of suggestibility. In this paradigm, participants are read paragraphs and then (through social pressure or misleading questions) pushed toward acceptance of false statements about the information heard. An overall suggestibility score, a yield score (degree of acquiescence to leading questions), and a shift

score (the number of times the individual changed an answer in response to interpersonal pressure) are then calculated.

The methodology in autobiographical event suggestibility studies is more varied. In studies typically referred to as “false memory” studies (e.g., Hyman & Billings, 1998), participants are told that a knowledgeable person (typically the individual’s mother) recalls an event in the person’s life. The dependent variable is the degree to which the research participant appears to accept the truth of this false memory. In misinformation studies, the dependent variable is the same, but the procedures typically involve less powerful suggestion (misleading questions, varying in terms of source, number, and strength).

In source monitoring or source confusion studies, the task of the participant is typically to discriminate between competing sources for an alleged memory (e.g., whether information came from a picture seen, a paragraph read, or a new story heard). Alternatively, in the Deese–Roediger–McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995), the participants read a series of words that relate to an overarching nonpresented word (e.g., read the words *nap*, *doze*, and *dream*—all words related to the concept “sleep”). The dependent variable is whether the individual recalls or falsely assents to seeing the nonpresented concept word.

Finally, in the imagination inflation studies, participants imagine a series of incidents and are asked about their feeling of remembering the event, as opposed to merely knowing or believing that the event might have happened. The events are typically plausible or known events from childhood.

The degree to which each of these paradigms is linked to a general “suggestibility” trait is unknown, but sets of studies are reviewed in turn as examples of suggestibility as defined within the FM. Historically, false memory has been fairly loosely defined in such paradigms (cf. DePrince, Allard, Oh, & Freyd, 2004). Research testing general memory skills of dissociative individuals, or errors on event memory tasks in the absence of suggestion, are not considered as examples of suggestibility paradigms.

Nonautobiographical event suggestibility. Table 4 contains data from eight studies with 10 samples investigating suggestibility for nonautobiographical events, all using the Gudjonsson methodology, and the examination of suggestibility relationship with dissociative experiences. The clinical samples—a small group of anxious patients reported by Wolfradt and Meyer (1998) and the larger mixed sample by Little (1996)—and the only abuse sample (Schultz, Passmore, & Yoder, 2003) produced nonsignificant results. The weighted estimate for the correlation between dissociation and suggestibility in this category is .12. Further, the pattern of correlations on the Gudjonsson subscales varied across the few studies reporting statistically significant results. Wolfradt and Meyer in their nonclinical sample found DES correlations with both Shift and Yield scales; Merckelbach, Muris, Rassin, and Horselenberg (2000) reported DES correlations with the Shift (but not Yield) score; and Merckelbach, Muris, Wessel, and Van Koppen (1998) found correlations with the Yield (but not Shift) score. Horselenberg et al. (2000) came to the conclusion that “the relation between dissociative tendencies and memory distortions is not as impressive as some authors have suggested” (p. 136), noting that the few previous studies that had found positive associations had significant methodological limitations. Gudjonsson (2003) himself specifically noted with surprise the lack of consistent relationship

Table 4
Relationship of Dissociation and Suggestibility

Study	Sample	Dissociation measure	Suggestibility task	<i>r</i>
Nonautobiographical event suggestibility				
Haraldsson, 2003	30 children, half with reincarnation beliefs	CDC	E; GSS	.11
Hekkanen & McEvoy, 2002	111 UG	DES	E; acceptance of false suggestions regarding slides	.00
Horselenberg et al., 2004	38 UG	DES	E; GSS	.08
Merckelbach, Murrin, Rassin, & Horselenberg, 2000	56 female UG	DES	S; GSS	.37**
Merckelbach et al., 1998	40 UG in Study 1	DES	S; GSS	.32*
Schultz et al., 2003	51 CM and 31 RM sexual abuse survivors	DES	E; GSS	-.06 and .06
Torrens, 2005	146 UG	DES	E; GSS	.06
Wolfardt & Meyer, 1998	45 controls and 37 anxious patients	DES	E; GSS	.34* and -.04
Autobiographical events				
Drivdahl & Zaragoza, 2001	149 UG	DES	E; errors after suggestion regarding staged event	.07
Eisen & Carlson, 1998	130 UG	DES	E; agreement with misleading information after staged event	.21**
Eisen, Morgan, & Mickes, 2002	111 UG	DES	E; agreement with misleading information after staged event	.13
Eisen, Qin, et al., 2002	49 children	CDC	E; agreement with misleading information after abuse assessment	.01
Horselenberg et al., 2004	38 UG	DES	E; false recognition of foils regarding autobiographical events	.19
Horselenberg et al., 2003	34 UG	DES	E; internalization of false suggestion of performed action	-.30
Hyland, 2000	100 UG and community	DES	E; acceptance of false autobiographical event	.16
Hyman & Billings, 1998	48 UG	DES	E; acceptance of false autobiographical event	.48***
Ost et al., 1997	35 UG	DES	E; confidence in suggested false or distorted, autobiographical events	.45** and .00
Porter et al., 2000	47 UG	DES	E; agreement to suggested false autobiographical memory	.45
Porter et al., 2008	60 UG	DES	E; agreement to suggested false autobiographical memory	.27*
Qin et al., 2008	119 UG and community adults	DES	E; acceptance of false media event	.16*
Spanos et al., 1999	117 UG	DES	E; acceptance of false memories of infancy	.06
Source monitoring				
Clancy et al., 2000	30 abused, 15 no memory, 15 RM, and 15 controls	DES	E; false recognition in written DRM	.31**
Geraerts et al., 2005	94 abuse survivors, 20 controls ^a	DES	E; false trauma word recall and recognition in written DRM	.10 and .16 ^b
Jeinek et al., 2009	76 mixed clinical and control	DES	E; false recall and recognition in visual DRM	.00 and .00
Little, 1996	160 mixed control and psychiatric	DES	E; false recognition of texts and slides seen	.08 and .00
McNally et al., 2005	138 abused and 26 controls ^a	DES	E; nondiscrimination between words seen versus imagined	.02 first test and -.13 second test
Platt et al., 1998	73 UG	DES	E; false recall and recognition in written DRM	-.03 and .08 ^b
Qin et al., 2008	86 UG and community adults	DES	E; false recall in written DRM	.00
Torrens, 2005	146 UG	DES	E; false recall and false recognition in written DRM	.06 and -.04 ^b
Wilkinson & Hyman, 1998	92 UG	DES	E; false recall and false recognition in written DRM	-.09 and .04 ^b
K. Wilson & French, 2006	100 UG	DES	E; acceptance of suggestion of seeing video of known event	.26**
Winograd et al., 1998	42 UG	DES	E; false recognition of recalled and nonrecalled lists in written DRM	.18 and .32*
Zermatten et al., 2006	75 UG	DES	E; nondiscrimination of acts performed and imagined	.25*
Imagination inflation				
Paddock et al., 1998	98 UG in Study 1	DES	E; increased sense of remembering after guided imagination	.32**
Paddock et al., 2000	143 UG	DES	E; increased sense of remembering after guided imagination	.04
Wilkinson & Hyman, 1998	94 UG in Study 1, 92 UG in Study 2	DES	E; increased sense of remembering after guided imagination	.26* in Study 1 and .11 in Study 2

Note. Study 1 and Study 2 are treated as separate in effect size calculation. Recognition used in recognition-recall paradigms. Values averaged if two figures are given. Sample: UG = undergraduate; CM = continuous memory; RM = recovered memory. Dissociation measure: CDC = Child Dissociative Checklist; DES = Dissociative Experiences Scale. Suggestibility task: E = experiment or group comparison design; GSS = Gudjonsson Suggestibility Scale; S = survey and correlational design; DRM = Deese-Roediger-McDermott paradigm.

^a Includes "repressed memory" group ($n = 38$). ^b This figure was used in average effect size calculations.

* $p < .05$. ** $p < .01$. *** $p < .001$.

between dissociation and his measure of suggestibility. Thus, our best estimate is that dissociation accounts for an unimpressive 1% of the variance in nonautobiographical event suggestibility. Q , the statistic used to determine heterogeneity of effect size, was non-significant at 9.89. Thus, the average weighted effect size was a good estimate of the full range of studies.

In the only published study examining interrogatory suggestibility using the Gudjonsson procedure in a group of clinical subjects with reported delayed recall of trauma memories (dissociative amnesia), Leavitt (1997) found that "recovered memory" patients scored lower on interrogatory suggestibility than the psychiatric comparison group. Thus, the research to date indicates that patients with delayed recall of trauma are actually less suggestible in this paradigm than other psychiatric patients. The question of suggestibility and its relationship to overreporting or underreporting of trauma memories requires far more research with ecologically sound studies before broad conclusions can be made.

Autobiographical event suggestibility. Eleven studies fell in the category of autobiographical event suggestibility. The misleading questions in the study varied in power, from the strong insistence that the false event was true in Hyman and Billings (1998) to the misleading questions or foils used in the majority of studies. The overall weighted r in this case was .16, or 2% of the variance, with a Q of 25.86 ($p < .05$), representing heterogeneity of effect size.

The elevated correlation found by Hyman and Billings (1998) and Ost, Fellows, and Bull (1997) might be explained by some of the unusual features of the studies. In many senses, Hyman and Billings's work was an advance over other false memory studies in that the false memory "event" chosen was unique and unlikely to have occurred to any participant. Participants were told that they had spilled a bowl of punch on a bride during a wedding reception they attended when very young. Most importantly, the measurement of false memory in this case was a continuous one, with participants receiving credit (in the sense of a higher false memory score) if they indicated that they were trying to remember the event but failed to do so. Further credit was given if the participants recalled remembering attending a wedding (which could well have been true) but not the event of spilling the punch. Thus, the distinction between dissociation as a predictor of recovery of accurate memory and dissociation as a predictor of false memory cannot be made with certainty. Similarly, Ost et al. reported only that the dissociative individuals were more confident in false events presented as true than nondissociative individuals, but did not report the level of confidence achieved.

Several false memory studies used the DES-C (Ost, Foster, Costall, & Bull, 2005; Ost, Granhag, Udell, & Roos af Hjelmsäter, 2008), the revision of the DES by Wright and Loftus (1999). These studies are not cited in Table 4, given the lack of evidence for the DES-C as a valid measure of dissociation. Although the DES-C literature was not fully reviewed, it does contain both nonsignificant correlations between dissociation and suggestibility (Horselenberg et al., 2006) and positive correlations in a similar range to those in Table 4 (e.g., Ost et al., 2005).

Source monitoring studies. The source monitoring section contains 12 studies, most of which use the DRM paradigm. The overall weighted correlation here is .08, accounting for less than 1% of the variance. The Q value of 18.64 is nonsignificant, showing homogeneity of effect size. Only three of the 12 studies

reached statistical significance. The statistically significant studies do not show any particular shared similarities, and accounted for 6%–10% of the variance in their samples. It seems quite plausible here to conclude that source monitoring is a complex and multi-determined concept, and not strongly or uniquely related to dissociation. Note that the methodology here, unlike the event suggestibility paradigms, requires the individual to internally generate the false idea or memory. Thus, arguably this methodology is applicable to the situation of internally manufactured memories of abuse.

Further research might include more trauma-relevant variables, such as degree of trauma exposure or level of PTSD symptomatology. Zoellner, Foa, Brigidi, and Przeworski (2000), using the DRM paradigm, found that traumatized participants with and without PTSD generated more false recalls of critical nonpresented words than nontraumatized participants. False recall was related to PTSD severity. More recently, Brennen, Dybdahl, and Kapidžić (2007) found that war-traumatized participants with PTSD were even more susceptible to false intrusions of war-related material than traumatized individuals who did not have PTSD. Again, it should be emphasized that (a) these effects occurred with war veterans, acknowledged to be genuinely traumatized, and (b) increases were found in the recognition of trauma-related words, not in the fabrication of battles that did not occur. One could not logically argue that such data cause one to doubt the soldiers' report that they had been exposed to grave danger or that they had been traumatized, as the FM interpretation of the data would suggest. Rather, the data are more compatible with the hypothesis that the intrusions represent an aspect of overinclusive responding and fear stimulus generalization, other potential costs of trauma exposure.

Imagination inflation studies. The four imagination inflation results have the best base rate of significant correlations with dissociation (two of four samples). The weighted r is low (.17), accounting for 2.89% of the variance (with a nonsignificant Q value, 6.03), but methodological differences in the samples point to possible further directions for research. Paddock et al. (1998), for instance, found a statistically significant correlation between dissociation and the robust imagination inflation effect in their young adult college sample. However, in their factory worker sample, arguably more likely than college samples to include individuals whose cognitive capacities are more impaired by trauma, the imagination inflation effect itself disappeared. Paddock et al. therefore did not attempt further correlational analyses.

Overall findings from suggestibility studies. Given the strong statements made within the FM regarding suggestibility and dissociation, including the more extreme statements making the claim that all trauma-related dissociative disorders may be artifacts of suggestibility (Piper & Merskey, 2004), or warnings that asking a routine screening question might produce false memory (Giesbrecht et al., 2008), it is surprising to see average weighted effect sizes between dissociation and suggestibility that are so small (1%–3% of variance accounted for) across categories. Looking through the whole of Table 4 at the most statistically significant studies, with the caveat that much more work needs to be done, one would see that the dissociative individual may be at risk for false memory in situations that directly or indirectly encourage imagination and rumination over a believed-in but nonremembered event. This is the methodology of the imagination inflation studies,

but also may occur under event suggestibility paradigms that convince the participant of the truth of a nonremembered event and encourage general attempts to remember (Hyman & Billings, 1998; Ost et al., 1997).

A challenge for suggestibility theorists is the differentiation of acquiescence and false memory. If the task is to remember an allegedly true event when asked by an authority figure, the achievement-oriented undergraduate might claim memory to show intelligence, just as the traumatized dissociating individual might claim memory out of fear-based deference, or resist due to fear or anger-based distrust of authority. One study provides some indication that those with higher levels of dissociative symptoms may be motivated by fear or distrust of authority to acquiesce when prompted. A study of psychiatric inpatients found that dissociative symptoms were moderately related to measures of dependent personality and antisocial personality, among others (Modestin, Ebner, Junghan, & Erni, 1996).

Dissociation thus may interact with other variables to form groups at high or low risk for suggestibility, false memory formation, or acquiescence to false statements. Eisen, Goodman, Qin, Davis, and Crayton (2007), for instance, showed differing predictors of memory errors for their high- and low-dissociating groups within a child maltreatment sample. For low-dissociating children, increase in stress, posttraumatic symptoms, and cortisol level predicted better memory scores in general. For high-dissociating children, greater increase in cortisol from baseline to after the anogenital exam and higher trauma symptom report predicted memory error commissions ($r = .28, p < .05$), and greater increase in cortisol and lower trauma symptom report predicted omissions ($r = .25, p < .05$). Malek (2010), in a recently completed study, found that dissociation related to the report of a significant false memory experience (defined as a personally significant memory later proven to be inaccurate) only in the context of elevations in executive dysfunction scores. Future research might attempt to differentiate dissociative from fantasy-prone groups.

The failure of TM theorists, for the most part, to include suggestibility among their panoply of routinely studied variables, and the parallel failure of FM theorists, again for the most part, to consider trauma-relevant covariates and to study traumatized groups, leaves much territory for collaborative endeavors. Given the low effect size averages found by considering dissociation as a main effect across multiple domains in predicting suggestibility, interaction studies (together with longitudinal studies) appear to be the appropriate next step. In the meantime, the current evidence supports the TM prediction regarding suggestibility. The literature on dissociation and suggestibility supports the existence of a weak and inconsistent relationship between the two concepts.

Evidence for Prediction 6: Is Dissociation Related to Fragmentation, Omission, and Narrative Cohesion?

The TM and FM differ in their position on the relationship of fragmentation of memory and memory loss as it relates to dissociation. Writing from the FM perspective, Giesbrecht et al. (2008) argued that there are no studies linking dissociation to objective fragmentation, but two student sample studies (Kindt & Van den Hout, 2003; Kindt, Van den Hout, & Buck, 2005) link dissociation to subjective fragmentation (the belief that one's memory is fragmented). The TM posits a relationship between fragmentation of

memory and the experience of trauma, a relationship that would be stronger for dissociative than for nondissociative individuals. First, fragmentation does appear to relate to traumatic symptoms in general, as shown by Foa, Molnar, and Cashman (1995) in work with rape survivors and replicated by Van Minnen, Wessel, Dijkstra, and Roelofs (2002) with a group varying in trauma type. Both showed covariation in improvement in trauma symptoms and reduction in fragmentation over time ($r = .73$ for Foa et al., $N = 14$; effect size for Van Minnen et al., $N = 20$, not reported). Both used an objective measure of narrative fragmentation. In a larger, well-controlled study by Silva (2006), the free narratives of 98 children were examined as they discussed their general likes and dislikes during a rapport phase of a child abuse interview and as they answered questions about their alleged abuse in the abuse phase. For the children alleging severe abuse, narrative fragmentation rose significantly (effect size for rapport vs. abuse phase: $r = .37, p < .01$), with no such relationship occurring in children alleging single exposure abuse by a nonattachment figure ($r = .14, p > .05$).

Kindt et al. (2005) used peritraumatic rather than state or trait dissociation measures in their research finding of statistically significant relationships between subjective fragmentation and dissociation. The trait measure used (the DES) reportedly did not correlate with either subjective or objective measures of fragmentation, although effect sizes were not given. Using a DPD group rather than a nonclinical college population, Giesbrecht, Merckelbach, Van Oorsouw, and Simeon (2010) found differences in both objective ($r = .39, p < .05$) and subjective ($r = .51, p < .01$) fragmentation measures, despite using an emotional film clip as the provocation.

A more direct test was provided by Halligan, Michael, Clark, and Ehlers (2003), who assessed self-reported disorganization, experimenter-rated disorganization, and an objective measure of narrative disorganization in both retrospective ($n = 81$) and prospective samples ($n = 73$) of assault victims. All three measures related to dissociation in both samples ($r = .24-.48$, all $ps < .05$). Thus, the only study of dissociative disordered clients, the only retrospective study of trauma victims, and the only prospective study of trauma victims that were located all support Prediction 6, the TM hypothesis of the correlation of dissociation and objective fragmentation of memory (see Huntjens, Dorahy, & Van Wees, in press).

Evidence for Prediction 7: Is the Recovered Memory Phenomena a Product of Dissociation or Fantasy?

Report of recovered memory or traumatic amnesia as fantasy. The hypothesis of confabulation as a primary source of recovered memory of trauma after dissociative amnesia (see Loftus & Ketcham, 1994) must rely on evidence that recovered memory victims are less likely (relative to those with continuous memories) to be authentic abuse victims. Methodological challenges to such research are plentiful, but it appears that the current evidence supports the TM rather than the FM view. Equivalent accuracy of recovered and continuous memories of child trauma was reported by Williams (1995), using hospital records (e.g., of genital or anal injury) as the criterion, and by Dalenberg (1996), using records combined with perpetrator confessions, both objective measures of accuracy. In a volunteer sample, Geraerts et al.

(2007) found spontaneously recovered memories to be similarly likely to have corroboration (37%) when compared with continuous memories (corroborated in 45%). However, memories recovered in therapy, which represent a small proportion of the total recovered memory reports (Elliott, 1997; Wilsnack, Wonderlich, Kristjanson, Vogeltanz-Holm, & Wilsnack, 2002), were never corroborated in Geraerts small sample ($N = 16$).

Longitudinal studies also support the TM. Mechanic, Resick, and Griffin's (1998) study of amnesia posttrauma found that 37% of assaulted women reported some degree of amnesia at the 2-week point. At the 3-month marker, this number had dropped to 16%. This is the pattern to be expected for a traumatic reaction that is resolving for a portion of the participants. The opposite pattern would occur if involved therapists were creating the illusion of amnesia over time.

Experimental studies have achieved similar results, although they have also been criticized on the basis of ecological validity (Freyd & Gleaves, 1996). If recovered memory were reliably equal to confabulated memory, and particularly if dissociative amnesia were a myth (Loftus & Ketcham, 1994), then one would expect that the negative-event memories recovered in experimental paradigms would be more often false than true. This is not the case. In Hyman and Billings's (1998) study, for instance, participants were asked to attempt to recall actual childhood events (contributed by their parents) or false events constructed by the researcher (such as spilling a punch bowl on the wedding party at a reception). Participants initially denied 26% (of 218) true memories and 97% (of 66) false memories. Given that it is unlikely that the participants confabulated a complex memory on the spot, the small number of initial agreements in such studies are likely to be responses to social demand rather than memories. Thus, the typical dependent variable in false memory research is the number of false "recoveries" after the research participants are sent home to attempt retrieval of their lost memories. In Hyman and Billings, the participants subsequently recalled 25% of the false events and 44% of the true events. The comparable percentages in Hyman and Pentland (1996) are 65% of the initially denied true memories and 26% of the initially denied false memories. Thus, in experimental false memory studies, recovered memories are predominantly accurate, but should be questioned (just as perceived continuous memory should be questioned) in situations of strong suggestion (Geraerts et al., 2007). Across all samples—abused or nonabused, clinical, nonclinical, and experimental—it has been found that (a) recovered memories and continuous memories were equally accurate and (b) both recovered and continuous memories of trauma are more likely to be true than false (cf. Dalenberg, 2006).

Such results should not be taken to contradict the theory that susceptible individuals could be pushed into acceptance of a false statement of trauma (or even create a false memory of trauma) after repeated exposure to suggestion. The "retractor" group—individuals who now state that they were led by suggestion to a false memory—is understudied, but there is no current evidence that this group is more likely to be dissociative, or that the individuals' retractions are more likely true or less subject to suggestive influence. As one FM review conceded, current fantasy proneness studies should not lead to an implication that patients high on these constructs would create "wildly inaccurate" responses to self-report measures of trauma (Merckelbach et al., 2002, p. 703).

The corroboration issue could also be applied to the verification of dissociative phenomenology itself. Is there evidence that dissociative symptoms are actually occurring, rather than being a manifestation of malingering or misunderstanding of more common cognitive states? Gleaves, Hernandez, and Warner (1999) found in a survey of clinicians that therapists for 446 DID patients reported evidence for corroboration of dissociative symptoms from family or psychiatric records in 67% of patients prior to diagnosis. Because this type of evidence is likely to be discounted by FM theorists as due to the credulity of therapists, it should be noted that observers using other documentation have reached similar conclusions. Somer and Weiner (1996) used just such a methodology, comparing the adolescent diaries of two DID patients and four controls. The diaries were rated for overt mention of dissociative symptoms (e.g., derealization, depersonalization, amnesia). The DID patient diaries contained over 6 times the frequency of dissociative contents compared with the control diaries. In a similar study with a large sample ($N = 126$), Bagley, Rodberg, Wellings, Moosa-Mitha, and Young (1995) identified dissociative traits that could be behaviorally rated as present by reviewers of child welfare department records. The number of traits rated as present correlated .67 with the ADES in the 55 adolescents who had been given this measure.

Dissociation and traumatic amnesia. Dissociation has been correlated with the presence of traumatic amnesia in a number of settings and methodologies. The DES correlates with the presence of DID, a disorder that requires amnesia for *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition, text revised) diagnosis, in mixed psychiatric samples with high effect sizes ($r = .69-.86$; Dale, Berg, Eldin, Odegard, & Holte, 2009; Dorahy, Irwin, & Middleton, 2002; Gleaves, Eberenz, Warner, & Fine, 1995; Martínez-Taboas, 1995; Scropo, Drob, Weinberger, & Eagle, 1998). In research samples of abused adults who have not been diagnosed with psychiatric disorders, dissociation still typically differentiates between those with continuous and those with recovered memories (Geraerts, Smeets, Jelicic, Van Heerden, & Merckelbach, 2005; McNally, Clancy, Schachter, & Pitman, 2000; Melchert, 1999; Paresh, 2001). McNally, Clancy, Barrett, and Parker (2005) presented the only null finding that we could locate.

A few laboratory paradigms exist to support these cross-sectional findings. Geraerts, McNally, Jelicic, Merckelbach, and Raymaekers (2008) found that those who had spontaneously reported recovered memories of abuse were more successful in a thought suppression paradigm. Recovered memory survivors were better able to suppress thoughts than continuous memory survivors, and experienced less rebound of the targeted thoughts when the suppression period was over. Directed forgetting paradigms, which use single words as the target to be recalled or forgotten, produce more variable results (DePrince & Freyd, 2001, 2004; Devilly et al., 2007). The distinction between these paradigms most likely rests on the issues raised by Geraerts and McNally (2008), discussing the directed forgetting results. First, a complex thought, or a complex experience such as abuse, should not be equated with the ability to remember or forget a word such as *incest*. Thus, the ecological validity and generalizability of this paradigm to actual traumatic memories is unclear. Second, forgetting abuse memories may occur over a period, sometimes following an initial conscious strategy of thought suppression (Koutstaal

& Schacter, 1997), rather than immediately following the presentation of trauma-related words in the directed forgetting paradigm.

Interidentity amnesia studies. Interidentity amnesia in DID is a separate issue from that of dissociative amnesia in general. Authors from both TM and FM positions, including several of the authors of this review, have contributed to the general finding that implicit memories often cross dissociative identity barriers.

Interidentity amnesia has been studied as a paradigm for memory in DID since the late 19th and early 20th centuries (Prince & Peterson, 1908; see Dorahy, 2001). With renewed interest in multiple personality disorder and DID, this phenomenon has been examined to attempt to understand the nature of memory and amnesia in DID, often with contradictory findings (Eich, Macaulay, Loewenstein, & Dihle, 1997). In a series of studies designed to overcome these contradictions, Huntjens and others (Huntjens, 2003; Huntjens, Peters, Woertman, Van der Hart, & Postma, 2007) compared DID patients reporting mutually amnesic identities with simulator and normal controls. Studies included tests of neutral episodic information, perceptual and conceptual priming, procedural memory, transfer of trauma-related words, and stimulus valence as shown by affective priming. These researchers reported no objective evidence of interidentity amnesia in any of these studies. Huntjens (2003) concluded that dissociative amnesia in DID may have more to do with subjective appraisal and “metamemory” than actual lack of accessibility of memory between alternate identities.

Despite the amount of effort put into these studies, they have limitations. First, the notion of relatively stable, fixed “two-way” amnesic identities is based in the classical notion of DID as a small set of relatively unchanging, structured “personalities” with separate memory subsystems. This review is not the place to detail the TM-based view of the phenomenology of DID. Suffice it to say that the TM views DID as a posttraumatic developmental disorder with a relatively dynamic self-state system derived from a variety of developing intrapsychic, interpersonal, and psychosocial needs over time, and a phenomenology usually based in, overlap, interference, intrusion, and shifting (not simply switching) among personality states (Dell, 2006; Putnam, 1997). Further, this phenomenological model contrasts with the classical notion of well-defined identities with characteristics that can be reliably reproduced across clinical interviews and research trials (Dell, 2006; Putnam, 1997; Putnam, Zahn, & Post, 1990). Proponents of the TM—and, for that matter, proponents of the FM—do not take at face value DID identities’ prevalent beliefs that they actually are “real people” with varying demographic and psychological characteristics, including differing ages, genders, etc. Nor would proponents of either model take at face value other common beliefs that alternate identities are animals, mythical beings, internalized “outside” people, demons, or omniscient beings. Therefore, it is unclear why claims of two-way amnesia between identities should also be accepted at face value preferentially by either set of model theorists.

Thus, Forrest (1999, 2001), in a study of explicit memory in identities claiming coconsciousness, or shared memory, found evidence of interidentity amnesia, compared with normal and simulating controls, despite the identities’ beliefs in their coconsciousness. In additional support of the notion that alternate identities may not accurately assess their own subjective psychological characteristics, Loewenstein, Hamilton, Alagna, Reid, and deVries

(1987) found, in a case study of DID using experiential sampling techniques, that alternate identity self-reports of personality characteristics were discrepant with objective data provided by rating scales filled out in real time.

Elzinga, Phaf, Ardon, and Van Dyck (2003), in a directed forgetting paradigm between subjectively amnesic DID identities, found evidence supporting explicit memory disruption in a state-dependent fashion between alternate identities, indicating not only a possible encoding problem but also a retrieval inhibition between identities. In addition, this disruption was partial, not complete. The latter finding was thought to indicate that amnesia between states is not rigidly compartmentalized, whatever their subjective experience, consistent with the TM-based understanding of the phenomenology of DID, where access to memory between identities may vary in complex ways, depending on a variety of factors.

Finally, the interidentity amnesia studies did not test autobiographical memory in DID, presumably the type of memory most importantly affected in these patients. Notwithstanding methodological limitations (e.g., low power, lack of controls, confirmation biases), individual case studies using autobiographical memory paradigms have found marked alterations in autobiographical memory in DID, for both global memory of life history and memory between identities (Bryant, 1995; Schacter, Kihlstrom, Kihlstrom, & Berren, 1989). In addition, it is no longer controversial that material can influence memory and behavior without conscious processing or conscious awareness, and that conscious and unconscious awareness have measurably different neural correlates (e.g., Morris, Öhman, & Dolan, 1998).

Neurobiological studies are beginning to elucidate aspects of autobiographical memory functioning in DID. For example, Reinders et al. (2003, 2006), using a positron emission tomography (PET) scan regional cerebral blood flow (rCBF) paradigm, as well as measurement of autonomic functioning, assessed the reactions of different DID alternate identities to personal trauma scripts. Alternate identity pairs were said to experience trauma memory as either part of personal (i.e., autobiographical) memory (traumatic identity state) or not part of personal memory (neutral identity state; Van der Hart, Nijenhuis, & Steele, 2006). In brief, analysis of rCBF regional activation patterns and autonomic function showed that the identity having self-referential understanding of the trauma experienced the trauma script as an emotionally unpleasant autobiographical memory. This included activation of areas such as the amygdala and insula with associated autonomic increases. The neutral identity state appeared not to subjectively experience the trauma scripts as personal autobiographical memory. These identity states showed a different rCBF and autonomic activation pattern similar to DPD and dissociative PTSD patients with medial prefrontal cortex inhibition of emotional and brain association areas, and little or no autonomic activation (Lanius et al., 2010).

We do not disagree that DID is in part a disorder of self-understanding. Clearly those with DID have the inaccurate idea that they are more than one person. However, this inaccurate belief or perception is not evidence for the inherent invalidity of the patients’ psychopathology, just as delusions of those with psychotic disorders are not indicators that they do not have a psychiatric disorder. The psychotic mind may develop delusional beliefs more easily, require less evidence for belief generation or maintenance. Similarly, some fundamental mechanism of dissociative

disorders may cause and maintain dissociative self-schemata (e.g., the idea that one is not a coherent self). High dissociativity on standardized measures is a characteristic of DID patients that is found across virtually all studies of these patients. Inconsistent access to autobiographical information is another. Neither of these features is identical to interidentity amnesia.

In summary, the findings from studies of traumatic amnesia, dissociative amnesia, and recovered memory are not consistent with the FM. However, amnesic phenomena are related to dissociation across a variety of clinical manifestations (e.g., DID, dissociative amnesia, and recovered memory), supporting Prediction 7.

Evidence for Prediction 8: Can Biological Studies Inform the Debate?

Both FM and TM theorists agree that biological research might be informative for the understanding of dissociation. However, biological studies published to date have not been designed explicitly with the goal of differentiating predictions emanating from the FM and TM. Accordingly, the relevance of biological studies to these models can only be determined post hoc. This stated, most biological studies, particularly those examining dissociative symptoms in individuals with PTSD, have assumed that trauma plays an etiological role and have used fear-relevant paradigms and pathways as a foundation. In contrast, we are not aware of research examining biological underpinnings for fantasy proneness in reportedly traumatized persons. Table 5 includes a summary of relevant psychobiological studies of dissociation.

Genetic Studies

With the exception of Waller and Ross (1997), who did not identify a genetic contribution to dissociative symptoms, twin studies suggest that heritability estimates for dissociative symptoms approximate 50%–60% (Becker-Blease et al., 2004; Jang, Paris, Zweig-Frank, & Livesley, 1998; Pieper, Out, Bakermans-Kranenburg, & Van IJzendoorn, 2011). By contrast, research suggests that shared environmental factors explain a negligible amount of variance in dissociative symptoms as compared with nonshared environmental factors that do contribute to a dissociative diathesis (Becker-Blease et al., 2004). Accepting that dissociative symptoms have a sizable genetic loading, Geraerts et al. (2006) argued that it is difficult to conceptualize dissociation as a defensive reaction to traumatic experience. Thus, they stated, the high absorption scores of CSA survivors provide evidence for the presence of pseudomemories, given that absorption also carries some genetic loading (roughly 50%; Tellegen et al., 1988). Nevertheless, the TM does not posit negligible effects for genetic factors, but instead hypothesizes a significant role for trauma exposure.

Genetic factors may act as vulnerabilities for pathological dissociation specifically in the context of trauma exposure. Pieper et al. (2011) found that individuals homozygous for the short (SS) 5-HTTLPR allele evidenced greater pathological dissociative symptoms particularly when reporting a trauma history in the presence of depressive symptoms; trauma exposure did not interact with genotypic variants of 5-HTTLPR in the prediction of non-pathological dissociation. One interpretation of such findings is

that SS carriers of the 5-HTTLPR gene are at increased risk of developing a combined depressive–dissociative syndrome only in the context of trauma exposure. In comparison, exposure to traumatic events in SS carriers is unlikely to be associated with pathological dissociation if depression is not present as well. In a related finding, Lochner et al. (2007) concluded that childhood trauma histories were predictive of increased pathological dissociation in individuals with obsessive-compulsive disorder only in SS carriers of the 5-HTTLPR gene. Furthermore, dissociative symptoms were predicted by the interaction of genes related to dopaminergic function and childhood trauma history; dissociation was highest in individuals with the Val/Val genotype of the COMT gene (functional catechol-O-methyltransferase Val158Met polymorphism) who were also exposed to childhood trauma (Savitz et al., 2008). Although this research is only in its infancy, preliminary evidence thus far suggests that genetic factors alone are insufficient to account for variability in dissociative symptoms. Instead, gene by environment (i.e., trauma exposure) interactions may better explain dissociative phenotypes.

Psychophysiology and Neuroendocrine Response to Stress

Studies have examined the psychophysiological and neuroendocrinological correlates of dissociation. However, most studies fail to differentiate between peritraumatic dissociation, state dissociation, and trait dissociation, or differentiate state dissociation from measures of general distress or negative affect (cf. Morgan et al., 2002). Higher (e.g., Hetzel-Riggin, 2010; Hetzel-Riggin & Wilber, 2010; Ladwig et al., 2002; Nixon, Bryant, Moulds, Felmingham, & Mastrodomenico, 2005), lower (e.g., Griffin, Resick, & Mechanic, 2007; Pole et al., 2005), and null (e.g., Kaufman et al., 2002) associations with cardiovascular (heart rate) and autonomic (e.g., galvanic skin conductance response [SCR]) response to trauma reminders have been observed in individuals differing in peritraumatic dissociative experiences. In comparison, the majority of studies of state (Lanius et al., 2005, 2002) and trait (Bonnano, Noll, Putnam, O'Neill, & Trickett, 2003; Koopman et al., 2004; Sierra et al., 2002; Sierra, Senior, Phillips, & David, 2006; Simeon, Yehuda, Knutelska, & Schmeidler, 2008) dissociation have shown decreased heart rate and SCR reactivity during stress, emotional processing, and/or symptom challenge, although increased physiological reactivity has also been observed (Giesbrecht, Geraerts, & Merckelbach, 2007).

Few studies of trait dissociation have examined the degree of state dissociation experienced by participants during psychophysiological measurements. However, Hauschildt, Peters, Moritz, and Jelinek (2011) found that both trait and state dissociation were associated with reduced heart rate variability when participants viewed trauma-relevant videos. Surprisingly few clinical studies have examined dissociative disorders other than DPD.

However, an elegant study by Reinders et al. (2003, 2006) showed that in ego states defined by a personal autobiographical experience of traumatic memories, in contrast to ego states that fail to label such memories as autobiographical, trauma script-driven imagery was associated with greater heart rate, higher systolic blood pressure, and lower heart rate variability in individuals with DID. Future studies of psychophysiological response to symptom provocation in dissociative disorders should examine degree of

Table 5
Review of Psychobiological Studies of Dissociation

Study	Sample description	Measures and method	Measures of dissociation and diagnosis	Results of interest in brief
Becker-Blease et al., 2004	75 unrelated adoptive siblings, 91 related siblings, 218 MZ twins, and 173 DZ twins	Heritability and genetics Twin study of h^2 of trait dissociation; parent and teacher rated trait dissociation	6 trait dissociative items from CBCL	h^2 of dissociation = .60, c^2 = .00
Jang et al., 1998	General population sample of 177 MZ twins and 152 DZ twins	Twin study of h^2 of trait dissociation	DES-T, DES	h^2 of DES-T and DES = .48 and .55, respectively; c^2 = .00 for both DES-T and DES
Lochner et al., 2007	83 OCD participants	Genetic study of 5-HTTLPR, childhood trauma history and trait dissociation	DES-T, DES, CTQ	Childhood trauma and 5-HTT genotype predicted 22% of the variance in DES-T scores. Moderate correlations between CTQ and DES-T scores with SS genotype; association nonsignificant with LL genotype.
Pieper et al., 2011	184 twin pairs	Twin study of h^2 of trait dissociation, 5-HTTLPR, trauma history and trait dissociation	DES-T, DES	h^2 of DES-T and DES = .43 and .44, respectively; c^2 = .00 for both DES-T and DES. Participants with the SS genotype who also had high depressive symptoms and trauma had highest DES-T scores.
Savitz et al., 2008	178 individuals from 35 families bipolar proband and one additional first-degree relative with bipolar disorder	Study of genes related to COMT, polymorphism, trauma and trait dissociation	DES	DES scores predicted by the interaction of COMT genotype with childhood trauma; DES scores highest in individuals with the Val/Val genotype with childhood trauma
Tellegen et al., 1988	217 MZ and 114 DZ adult twins reared together and 44 MZ and 27 DZ adult twins reared apart	Twin study of h^2 of trait absorption	MPQ	h^2 of absorption = .50, c^2 = .03
Waller & Ross, 1997	280 MZ and 148 DZ twins	Twin study of h^2 of trait dissociation	DES-T	h^2 of DES-T scores = .00; c^2 = .45
Bonanno et al., 2003	103 women, 48 with documented CSA	Psychophysiology (trait dissociation) HR while participants spoke of the "most distressing event" was contrasted with baseline HR	ADES-T	ADES-T scores correlated negatively with increases in HR (r = -.24) and facial expressions (r = -.21) during discussion of distressing events (relative to baseline).
Giesbrecht et al., 2007	62 undergraduates	Viewed a provocative video while SCR was measured	DES	DES correlated with SCRs to the video (r = .34); fantasy proneness showed null effects (r = .18, <i>ns</i>).
Hauschildt et al., 2011	26 trauma exposed with PTSD, 26 trauma exposed without PTSD, 18 nontrauma controls	HRV recorded during videos of varying emotional valence	DES, DSS, PDEQ	Within trauma groups, higher DES (r = -.24) and DSS (r = -.20) related with lower HRV, whereas PDEQ was not correlated with either.
Koopman et al., 2004	41 delinquent adolescents	Randomly assigned to either talk about their most stressful life experience or talk freely while HR was measured	SCID-D	Lower HR was associated with higher derealization (r = -.29) and higher identity alteration (r = -.33).
Sierra et al., 2002	15 DD patients, 15 HC, 11 anxiety controls	SCRs to pleasant versus unpleasant versus neutral pictures	CDS	DD patients showed reduced and prolonged SCR to unpleasant pictures.
Sierra et al., 2006	16 patients with DD, 15 HC, 15 anxiety disorder controls	SCRs to viewing facial expressions of happiness and disgust	PSE, CDS	DD group had attenuated SCR to disgust stimuli in comparison with HC (d = .98). CDS scores in the DD group correlated with SCR to disgust (r = -.40) and happy faces (r = .20).

Table 5 (continued)

Study	Sample description	Measures and method	Measures of dissociation and diagnosis	Results of interest in brief
Neuroendocrinology				
State dissociation Morgan et al., 2001	44 healthy male soldiers	NE, EPI, NPY, and plasma/salivary cortisol assessed before, during, and after exposure to physical and mental stress	CADSS	Increased CADSS associated with decreased cortisol during stress ($r = -.49$) and increased cortisol 24 hr subsequently ($r = -.46$)
Trait dissociation Koopman et al., 2003	49 women with PTSD related to CSA	Five salivary cortisol samples collected at the beginning, end, and 1, 24, and 48 hr after an interview about stress and childhood trauma	SASRQ	High dissociators had elevated salivary cortisol 24 hr after the interview.
Schechter et al., 2004	41 mothers of young children, the mothers of whom had PTSD from interpersonal trauma	Maternal perception of children and maternal behavior assessed during separation–reunion sequences. Salivary cortisol collected from mothers before and 30 min after reunions	HADSI	Baseline salivary cortisol negatively correlated with severity of trait dissociation ($r = -.31$), but cortisol reactivity to separation–reunion was nonsignificant correlated with severity of dissociation ($r = .15, ns$)
Simeon et al., 2007	46 DD without PTSD, 35 PTSD, 58 HC	24-hr urine and serial blood samples collected before and after DST and TSST	DES	DD had higher basal cortisol in urine (but not plasma) compared with HC. DD group had greater resistance to and faster escape from DST. No differences in cortisol reactivity. DES correlated negatively with peak cortisol reactivity to the TSST ($r = -.43$).
Simeon et al., 2008	21 high exposure and 10 nontrauma HC without major exposure to the World Trade Center attack	24-hr urine cortisol after DST. During TSST, plasma cortisol changes, HR, and BP assessed during rest and at peak response	DES	DES negatively correlated with plasma cortisol levels at 08.00 h post-DST ($r = -.56$), but not with baseline urinary cortisol ($r = -.29, ns$), DST suppression ($r = .12$), or cortisol reactivity to the TSST ($r = -.18$). DES negatively correlated with resting systolic BP ($r = -.54$) and peak HR during the TSST ($r = -.48$) but unrelated to other BP and HR measures during rest and TSST.
Neuroimaging				
Structural imaging Irlle et al., 2009	10 PTSD with either DA or DID, 25 HC	MRI of total brain volume, bilateral amygdala, and bilateral hippocampus	SCID-D diagnosed DID and DA	Volumes of left 31% and right 29% amygdala and left 17% and right 11.0% hippocampal volumes were reduced when compared with HCs, but correlated with PTSD symptom severity rather than DA/DID symptoms.
Vermetten et al., 2006	15 DID, 23 HC	MRI determined hippocampal and amygdala volume	SCID-D diagnosed DID	Hippocampal volume 19% less in DID but confounded by age differences. Amygdala volume 32% less in DID, but only the effect of right amygdala volume still significant after covarying age.
Weniger et al., 2008	13 DID or DA, 25 HC, 10 PTSD	MRI scan of amygdala and hippocampal size	SCID-D diagnosed DID and DA	Neither amygdala nor hippocampal volumes differed between the DID/DA group and HC.
Functional imaging Brand et al., 2009	14 DA, 19 HC	PET scan acquired during eyes-closed resting state	DA diagnosis made according to <i>DSM-IV</i>	DA participants showed less metabolism in the right inferolateral PFC.
Elzinga et al., 2007	16 DID or DDNOS, 16 HC	fMRI scanning during verbal <i>n</i> -back test of working memory	DES	Working memory nonsignificant. DID/DDNOS greater response as a function of increasing task difficulty, relative to HC, within left anterior PFC, DLPFC, and parietal lobe (BA 40).

(table continues)

Table 5 (continued)

Study	Sample description	Measures and method	Measures of dissociation and diagnosis	Results of interest in brief
Felmington et al., 2008	12 PTSD displaying dissociative reactions, 11 PTSD who did not dissociate	fMRI during fearful and neutral faces presented consciously or nonconsciously	CADSS	Conscious presentations: Dissociatives had less response in right superior (BA 8), left middle, right inferior (BA 45), and medial (BA 6) frontal cortex, but more response in left ventral ACC (BA 25). Nonconscious presentations: Dissociatives had greater response in left pallidum, bilateral amygdala, bilateral insula, and left thalamus. Increasing state dissociation associated with increasing MPFC response and right superior temporal cortex response, and decreasing right anterior insula, right inferior frontal, and left superior temporal cortex response
Hopper et al., 2007	27 PTSD	fMRI while hearing trauma scripts	CADSS, PDEQ	PTSD exhibited greater response in ACC, right MPFC, right inferior frontal gyrus, right precuneus, and right middle and superior temporal gyrus. PTSD exhibited less response in left superior temporal gyrus, left parahippocampal gyrus, and right middle frontal gyrus. Greater correlation in HC with left superior frontal cortex, right parahippocampal gyrus, and right superior occipital cortex. Greater correlation in PTSD within right middle frontal cortex, right insula, right cuneus, right superior temporal cortex, and left superior parietal cortex.
Lanius et al., 2002	7 PTSD, 10 HC	fMRI while hearing trauma scripts. All participants with PTSD experienced state dissociation during scanning	DES and CADSS	Dissociation was higher and pain sensitivity was lower after dissociation-inducing script. High DSS scores characterized by frontolimbic activation pattern with increased BOLD signal in the left inferior frontal gyrus (BA 9) during script in contrast to activation of right middle frontal gyrus (BA 46) during neutral script.
Lanius et al., 2005	10 PTSD, 10 HC	fMRI while hearing trauma scripts. All PTSD experienced state dissociation during scanning	CADSS	No differences observed in recognition accuracy or reading. During recognition tests, DD patients exhibited less response in medial frontal cortex (BA 9,8), orbitofrontal cortex (BA 11), precuneus (BA 7), and cerebellum.
Ludäscher et al., 2010	15 women with BPD (of whom 10 comorbid PTSD)	Listened to scripts of either a personalized dissociation-inducing situation or a neutral situation during fMRI. Postscan, dissociation and pain sensitivity assessed	DSS-4	HC rated aversive pictures as more aversive than neutral pictures; DD did not. DD exhibited less response in left insula, bilateral ACC (BA 24/32), occipital cortex (BA 18), lingual gyrus (BA 10), superior temporal gyrus (BA 22/42), and left inferior parietal cortex (BA 40) during aversive relative to neutral scenes.
Medford et al., 2006	10 DD, 12 controls	fMRI scanning done while participants read, then presented with a recognition test of aversive and neutral sentences	DD diagnosis according to DSM-IV	No differences between NIS and TIS during neutral memory. During traumatic memory, TIS showed greater activation in sub-cortical areas including bilateral amygdala, caudate, and left insula. NIS showed greater activation in cortical areas, including bilateral parietal cortex, precuneus, MPFC, and ACC
Phillips et al., 2001	6 DD, 5 HC	Viewed aversive and neutral scenes during fMRI; later judged the aversiveness of scenes	PSE, DES	No differences between NIS and TIS during neutral memory processing. During traumatic memory, TIS had greater activation in left insula and parietal operculum. NIS showed greater activation in bilateral parietal cortex, middle frontal cortex, and right MPFC.
Reinders et al., 2006	11 DID	Listened to neutral and trauma-related scripts in an NIS and TIS while HR, BP, HRV, and rCBF assessed while undergoing PET	SCID-D diagnosed DID	
Reinders et al., 2003	11 DID	Listened to neutral and trauma scripts in an NIS and TIS while HR, BP, HRV, and rCBF assessed while undergoing PET	SCID-D diagnosed DID	

Table 5 (continued)

Study	Sample description	Measures and method	Measures of dissociation and diagnosis	Results of interest in brief
Simeon et al., 2000	8 DD, 24 HC	Read and recalled word lists	SCID-D diagnosed DD	DD exhibited less response in right superior (BA 22) and middle temporal gyrus (BA 21), and more response in parietal cortex (BA 7B and 39) bilaterally. DES correlated with response in BA 7B. Greater response in occipital cortex (left BA 19) in DD patients. DD had increased response in sensory association cortex.
Veltman et al., 2005	11 high dissociatives, 10 nondissociatives	Verbal working memory tasks (<i>n</i> -back and Sternberg tasks) while undergoing fMRI	DIS-Q	High dissociatives had greater response in left DLPFC during both tasks with increasing task difficulty.

Note. Results of a literature review of psychobiological studies of dissociation. Journal articles published in the English language since 1995 were identified by keyword and abstract searches of the PsycINFO and PubMed databases with the following terms: *dissociation/dissociative, biological/psychobiological/psychophysiological/neuroimaging/heart rate/cortisol/skin conductance*. Reference sections of identified articles were also reviewed. To be summarized in the table above, studies had to examine state or trait dissociation as an independent variable in a between-group or within-group (correlational) design; studies of peritraumatic dissociation were not included. Effect sizes are reported when they were retrievable directly from the references cited. MZ = monozygotic; DZ = dizygotic; CBCL = Child Behavior Checklist; h^2 = heritability; ζ^2 = shared environmental influence; DES-T = Dissociative Experiences Scale taxon score; DES = Dissociative Experiences Scale; OCD = obsessive compulsive disorder; 5-HTTLPR = serotonin transporter polymorphism; CTQ = Childhood Trauma Questionnaire; COMT = functional catechol-O-methyltransferase Val158Met polymorphism; MPQ = Multidimensional Personality Questionnaire; CSA = child sexual abuse; HR = heart rate; ADES-T = Adolescent Dissociative Experiences Scale taxon score; SCR = skin conductance response; PTSD = posttraumatic stress disorder; HRV = heart rate variability; DSS = Dissociation Tension Scale-Acute; PDEQ = Peritraumatic Dissociative Experiences Questionnaire; SCID-D = Structured Clinical Interview for DSM-IV Dissociative Disorders; DD = depersonalization disorder; HC = healthy controls; CDS = Cambridge Depersonalization Scale; PSE = Present State Examination; NE = neuroepinephrine; EPI = epinephrine; NPY = neuropeptide Y; CADSS = Clinician-Administered Dissociative States Scale; SASRQ = Stanford Acute Stress Reaction Questionnaire; HADS-I = Hopkins Augmented Dissociative Symptom Inventory; DST = dexamethasone suppression test; TSST = Trier Social Stress Test; BP = blood pressure; MRI = magnetic resonance imaging; DA = dissociative amnesia; DID = dissociative identity disorder; PET = positron emission tomography; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition); PFC = prefrontal cortex; DDNOS = dissociative disorder not otherwise specified; fMRI = functional magnetic resonance imaging; DLPFC = dorsolateral prefrontal cortex; ACC = anterior cingulate cortex; MPFC = medial prefrontal cortex; BPD = borderline personality disorder; DSS-4 = Dissociation Tension Scale; BOLLD = blood oxygen level dependent; NIS = neutral identity state; TIS = traumatic identity state; rCBF = regional cerebral blood flow; DIS-Q = Dissociation Questionnaire.

trauma exposure and response to both idiographic and standardized stimuli (e.g., McTeague et al., 2010).

A growing number of studies have examined cortisol response as a measure of stress reactivity and functioning of the hypothalamic–pituitary–adrenal axis in individuals as a function of dissociative symptoms. However, most studies to date have examined peritraumatic dissociation only (e.g., Ladwig et al., 2002; Neylan et al., 2005; Nixon et al., 2005). Higher (Simeon et al., 2007), lower (Schechter et al., 2004), and null effects have been observed for basal cortisol in comparisons of individuals high versus low in dissociative symptoms. Cortisol reactivity to psychological stressors was decreased in response to combat training as a function of state dissociation (Morgan et al., 2001), but Simeon et al. (2007, 2008) did not find decreased (or increased) cortisol reactivity in response to the Trier Social Stress Test. Finally, Koopman et al. (2003) observed increased salivary cortisol in individuals reporting greater trait dissociative symptoms only 1 day (but not immediately or 2 days) after being interviewed about traumatic life events. Discrepant findings across studies may suggest that patterns of arousal differentiating high and low dissociators within PTSD groups may change over time. In addition, future studies of cortisol reactivity to psychological stressors as a function of trait dissociation should examine the extent that individuals experience state dissociation in response to the stressor.

The significance of documented psychophysiological and neuroendocrine correlates of self-reported dissociative symptoms can be interpreted from either the FM or the TM perspective. FM theorists can maintain that objective psychophysiological responses to stimuli reminiscent of trauma may represent solely individuals' belief that they have experienced trauma, a belief that may be unfounded in reality. For example, McNally et al. (2004) found that heart rate, SCR, and left frontal electromyography increased more significantly in individuals believing themselves to be alien abductees than in comparison volunteers when exposed to auditory recounting of alien abduction experiences. However, McNally et al. did not distinguish between high and low dissociation groups in their analysis.

In comparison, TM theorists may note that behavioral and psychophysiological responses observed in reportedly traumatized dissociative subjects closely match those often observed in animals within the context of inescapable predatory threat, a behavioral pattern referred to in the animal literature as *tonic immobility* (Bracha & Maser, 2008; Bracha, Ralston, Matsukawa, Williams, & Bracha, 2004; Marx, Forsyth, Gallup, Fusé, & Lexington, 2008; Moskowitz, 2004). Within the state of tonic immobility, an animal takes upon itself an outwardly passive defensive response involving inhibition of movement, muscular rigidity or limpness, and evidently unfixed concentration (e.g., unfocused gaze, eye closure), a behavioral and psychophysiological state that has been associated with increased analgesia.

These characteristics bear a resemblance to certain dissociative states as discussed above (Frewen & Lanius, 2006; Nijenhuis, Vanderlinden, & Spinhoven, 1998). Tonic immobility to date has been examined primarily in its relevance to trauma and PTSD as opposed to dissociative symptoms specifically, although researchers have discussed its particular relevance to dissociative symptoms in PTSD (Bovin, Jager-Hyman, Gold, Marx, & Sloan, 2008; Fiszman et al., 2008; Heidt, Marx, & Forsyth, 2005; Humphreys, Sauder, Martin, & Marx, 2010; Rocha-Rego et al., 2009). Further-

more, psychometrically measured tonic immobility correlates with dissociative symptoms (Abrams, Carleton, Taylor, & Asmundson, 2009). In short, the animal literature on tonic immobility affords a translational model informing the psychophysiological study of dissociative symptoms. These studies support the basic principle of the TM that traumatic stress plays a causal role in dissociative symptoms.

Neuroimaging

Neuroimaging studies have examined emotional processing in subjects with DPD, and trauma memory and/or pain processing in individuals with PTSD or borderline personality disorder (BPD) with prominent dissociative symptoms, with a common finding being either increased or decreased response in medial prefrontal cortex and limbic regions accompanying dissociative symptoms (see Table 5). Phillips et al. (2001) observed less difference in emotional processing regions of the brain, most notably the insula, and a greater frontal response, in people with DPD when viewing valenced photographs.

Among PTSD patients, individuals exhibiting state depersonalization in response to trauma reminders also showed an increased response within midline anterior regions including the dorsal and rostral anterior cingulate cortex and the medial prefrontal cortex (Hopper, Frewen, Sack, Lanius, & Van der Kolk, 2007; Lanius et al., 2010, 2005, 2002). In comparison, null effects were observed for the contrast of encoding emotional relative to neutral sentences in 10 participants with DPD, although during a subsequent recognition test for emotional words, healthy controls activated the medial prefrontal cortex more so than individuals with DPD (Medford et al., 2006). Less response within medial prefrontal cortex was also observed in PTSD patients reporting dissociative symptoms in response to threatening facial expressions (Felmingham et al., 2008). Increased midcingulate and insula response in patients with BPD and comorbid PTSD was observed in conjunction with reduced pain sensitivity during script-induced dissociative states (Ludäscher et al., 2010).

Thus, functional neuroimaging studies increasingly implicate a frontocingulate and limbic basis for positive symptoms of dissociative disorders and dissociative symptomatology, most notably those of depersonalization and analgesia. Recently, neuroimaging studies have also sought to investigate the basis of negative symptoms of dissociation, including dissociative amnesia and interidentity amnesia. Findings in 14 individuals with dissociative amnesia tested with fluorodeoxyglucose PET in a resting state showed decreased metabolism within the right inferolateral prefrontal cortex (Brand et al., 2009). These findings complement a neuropsychological case series showing reduced response in the frontotemporal cortex typically within the right hemisphere, in individuals whose amnesia was documented to have been provoked by traumatic and/or stressful events (review by Staniloiu & Markowitsch, 2010; see also Staniloiu, Markowitsch, & Brand, 2010). Vermetten, Schmahl, Lindner, Loewenstein, and Bremner (2006) observed reduced volume of the hippocampus and amygdala in individuals with DID. This result was not replicated in a subsequent study, where brain morphological changes were reported to be associated with a PTSD diagnosis, not with a dissociative disorder diagnosis without PTSD (Irlé, Lange, Sachsse, & Weniger, 2009; Weniger, Lange, Sachsse, & Irlé, 2008). However, in

these latter studies, only four of 13 trauma-exposed individuals met SCID-D diagnostic criteria for DID. Most met diagnostic criteria for dissociative amnesia, and no data are reported on which dissociative patients met diagnostic criteria for PTSD. Accordingly, further studies will be needed to more completely elucidate whether the Vermetten et al. findings can be better explained by comorbid PTSD, by DID, or by both disorders.

The reviewed neuroimaging studies were not designed to address the present question regarding the degree to which dissociative symptoms represent the product of traumatic life events rather than fantasy proneness. Complicating this matter, quantitative reviews of the neuroimaging literature demonstrate that the neural architecture facilitating the human capacity for episodic memory (including the medial and ventrolateral prefrontal cortex, medial and lateral temporal cortex, retrosplenial and posterior cingulate cortices, temporoparietal junction, and cerebellum; Svoboda, McKinnon, & Levine, 2006) overlaps significantly with that mediating our ability to imagine ourselves taking part in fantasized events as assessed in studies of propection and mental time travel (particularly within medial regions; see Spreng, Mar, & Kim, 2009; Spreng, McKinnon, Mar, & Levine, 2009).

Although the preceding studies address the neural basis of our faculties for episodic memory and imagination as most germane to the TM and FM of dissociation, additional research has examined the neural correlates of working memory function in dissociative disorders. In comparison with PTSD samples, which generally show working memory impairment, some studies of dissociative symptoms (e.g., de Ruiter, Phaf, Elzinga, & Van Dyck, 2004) and dissociative disorders (Elzinga et al., 2007) have shown preserved or enhanced working memory ability in comparison with healthy controls (de Ruiter, Elzinga, & Phaf, 2006; de Ruiter et al., 2004; cf. Amrhein, Hengmith, Maragkos, & Hennig-Fast, 2008; Terhune et al., 2011). Increased response within dorsolateral prefrontal cortex in individuals with high trait dissociation (Veltman et al., 2005) and DID (Elzinga et al., 2007) during working memory tasks has also been observed under nonemotional conditions. Neuroimaging studies are needed to evaluate whether working memory ability in individuals with dissociative disorders sustains emotional and/or symptom challenge (e.g., Chiu, Yeh, Huang, Wu, & Chiu, 2009) and relates to the concept of psychological resilience.

Methodological Concerns

Statistical Partialing as a Test of Causal Theories

The studies in Table 1 do vary in effect size, with Q values (reflecting heterogeneity of effect size) statistically significant for each trauma type. The methodologies within the nonoutlier studies (effect sizes .20–.47) include validated questionnaires, interviews, self-reports, reports by others, and chart reviews. The statistical significance of the overall weighted r s (as well as the rarity of nonsignificant studies in general) supports the consistency of the trauma–dissociation connection across samples; heterogeneity of effect size suggests the presence of mediators or moderators affecting the strength, not the presence, of the correlation.

The most common response in FM literature is to suggest a set of potential confounds recommended for covariation to clarify the causal mechanism, such as Giesbrecht et al.'s (2008) list of “family pathology, general psychological distress, and specific variants

of psychopathology associated with dissociation, such as eating disorders, impulsivity, and schizotypal traits” (p. 632). The importance of individual or family variables as potentially important context variables related to the impact of trauma might be cited as a justification for covariation of such variables, as in Nash, Hulse, Sexton, Harralson, and Lambert (1993) and Nash, Neimeyer, Hulse, and Lambert (1998). The conclusion then is offered that some other factor, such as family environment, carries more explanatory power than trauma, or, in the extreme, that the TM simply does not fit the data.

A study by Mulder, Beautrais, Joyce, and Fergusson (1998) is an example of the use of partial correlation to make these causal statements. In this research, a large and representative sample was assessed on dissociation, clinical pathology, and history of physical and sexual abuse (not included in Table 1 because the full DES was not used). At the zero-order level, physical and sexual abuse were related to high endorsement of dissociative symptoms and to clinical pathology. When physical abuse, sexual abuse, and clinical pathology were regressed simultaneously on dissociation, the effect for sexual abuse became statistically nonsignificant (but the effect for physical abuse and clinical pathology remained statistically significant). Mulder et al. concluded that “the influence of sexual abuse was due to its associations with current psychiatric illness and with childhood physical abuse” (p. 806), stating that their findings suggest that “any causal influence of childhood sexual abuse on dissociation is likely to be indirect and mediated by more general linkages between childhood sexual abuse and risks of mental disorder” (p. 809).

The problem with this reasoning is that it assumes foreknowledge of the causal flow within the model. Clinical pathology (such as anxiety or depressive disorder) may provide a vulnerability to dissociation; may be a genetic, cultural, or familial covariate of dissociation proneness; may be an associated feature of dissociation; or may be a secondary reaction to dissociation. Statistical control will not provide distinctions between these hypotheses (see Briere & Elliott, 1993, for a trauma-relevant discussion). As Pedhazur (1982) noted, partial correlation is inappropriate if X and Y are correlated causes of Z (e.g., if anxiety proneness and trauma history are correlated and both provide vulnerability for dissociation), or if X affects Z directly, as well as acting through Y (i.e., if the effects of trauma on dissociation do not flow entirely through the existence of other clinical disorders). Both of these alternatives are entirely plausible models. As summarized by Fisher (1958), choice of a set of variables without a clear causal model, followed by the calculation of zero-order and partial correlation coefficients, “will not advance us a step towards evaluating the importance of the causes at work” (p. 190).

Therefore, a lesson that the TM theorists should take from the overall findings is that alternative model-testing with clearly distinct hypotheses is needed in the field. We have good evidence that short-term stress and trauma predict dissociation (De Wachter, Lange, Vanderlinden, Pouw, & Strubbe, 2006; Nixon et al., 2005). The offering of more complex models, and the pulling apart of multiple pathways to dissociation (whether trauma initiated or not), await further research. Promising candidates for inclusion in these models include genetic markers that appear to facilitate stress–pathology relationships (Lochner et al., 2007; Savitz et al., 2008) and known buffers of trauma-related pathology, such as social support (E. B. Carlson et al., 2001). It should be emphasized

that each of these additions to the TM are proposed as moderators of the dissociation–trauma relationship, not as mediators of the relationship. Future researchers would be better served by designs that include relevant variables as independent grouping factors (e.g., intrafamilial vs. extrafamilial abuse, low vs. high family pathology) so that simple effects and interactions can be examined.

Recent studies have begun to answer this question. Data from the National Comorbidity Study–Replication report that multiple forms of childhood adversity, including childhood maltreatment and family dysfunction, covary strongly together, such that it may not be possible to separate the effects of maltreatment from a pathogenic family environment in which multiple forms of neglect and abuse occur (Green et al., 2010; McLaughlin et al. 2010; Scott, Varghese, & McGrath, 2010). Trickett et al. (2011) came to a similar conclusion in their review of the many pathological outcomes of childhood sexual abuse, including increased dissociation. These adverse outcomes are difficult to completely parcel out from the manifold harms caused by the pathogenic family environment in which childhood sexual abuse, physical abuse, emotional abuse, and neglect occur.

Should We Discount the Nonobjective Trauma Studies?

Regarding the issue of objective and subjective measures of trauma in general, it is certainly true that much research on trauma is conducted with participants whose traumatic background has not been independently verified. This, however, is the norm rather than the exception in most areas of psychology. In comparing nonsmokers with light and heavy smokers on rates of varying diseases, seldom are there external documents verifying the number of cigarettes per week actually consumed. Salivary cotinine levels have been used to document abstinence after intervention, but are used less now because of the high correspondence between these levels and self-report (Yeager & Krosnick, 2010). The number of bingeing or purging episodes for the bulimic are virtually never verified, nor is there an objective verification that the fantasy-prone individual actually spends more time fantasizing. Thus, in a wide range of fields, it is understood that self-report contains measurement error, and independent studies are conducted to show that the criterion-positive group (e.g., alcoholic, sexually abused, bulimic) is reliably more likely to contain criterion-positive individuals than the self-reported criterion-negative group.

Unfortunately, longitudinal studies cannot provide a full answer to the question here, since the individual who first reports sexual abuse as an adult cannot dependably be labeled as a false report (even if the same individual denied it as a child), because alternative hypotheses of shame or fear serving to silence the child from disclosing abuse are viable possibilities. Twenty-year follow-ups of a large sample of abused children and matched controls revealed large omission rates for those asked if they had experienced prior physical abuse (38%–40% in Widom & Shepard, 1996) and prior sexual abuse (37% of women in Widom & Morris, 1997). Similarly, 31% of children denied recent anal touch (and 14% denied vaginal touch) in a follow-up of a doctor's examination that contained these features (Saywitz, Goodman, Nicholas, & Moan, 1991). In the control group, 3% of children made false allegations (answered the question positively when the touch did not occur). These low rates of false allegation are typical of research asking

direct questions regarding sexual touch in studies with objective evidence (cf. Bottoms, Najdowski, & Goodman, 2009). Therefore, although we do not see reason to distrust the relationship between trauma and dissociation that is seen in the many self-report studies, we agree that the method of collapsing across individuals with very different types and severity of trauma, and using single-item or presence–absence measures of trauma or sexual abuse, oversimplifies experiences and undermines a more complex understanding of the impact of such experiences (cf. E. B. Carlson et al., 2001).

Conclusion and Research Directions

This article has reviewed the evidence for eight predictions made by the TM and FM of dissociation. The evidence from all eight areas more strongly and consistently supports the TM than the FM, as we summarize below.

Strength of the Trauma–Dissociation Relationship

Prediction 1 was strongly supported in favor of the TM. The trauma–dissociation relationship is not weak and inconsistently found, as predicted by the FM, but rather appears reliably in both clinical and community samples. The incorrect conclusions reached by FM theorists may be caused by their reliance on undergraduate samples (e.g., Merckelbach et al., 2002) or on very small and underpowered studies (e.g., Cima et al., 2001). At this point, research focus should be directed toward risk factors, moderators, and mediators (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001) of the trauma–dissociation relationship. Promising avenues include psychiatric and genetic vulnerability (Lochner et al., 2007), attachment-related variables (E. A. Carlson, 1998; Ogawa et al., 1997), social support (E. B. Carlson et al., 2001), shame (Talbot, Talbot, & Tu, 2004), working memory (de Ruiter et al., 2004), and executive dysfunction (Malek, 2010), among others. It is quite plausible that dissociation in the context of varying diagnoses will manifest differently—an area that is underresearched.

Strength of the Trauma–Dissociation Relationship in Objective Versus Subjective Reports

Prediction 2 was strongly supported in favor of the TM. The clearest test of the two models is the comparison of studies using objective and self-report trauma definitions. If the trauma–dissociation relationship was caused by fantasized trauma within the dissociative group, clearly the correlation between the two measurements would be higher in studies relying solely on self-report or guardian report than in those supplementing report with CPS findings, therapist ratings, and/or documentation of the trauma. In contrast with that prediction, objective studies had effect sizes equivalent to those found in self-report studies.

Course of Dissociation After Trauma and Trauma Treatment

Prediction 3 was strongly supported in favor of the TM. If dissociation were nothing more than a manifestation of cognitive impairment, executive dysfunction, and/or fantasy proneness, as FM theorists argue, then the pattern of change in dissociation over

time should be slow or nonexistent and unrelated to trauma or trauma treatment. Instead, as the TM suggests, dissociation drops over the course of the 1st year after trauma for most individuals (e.g., Feeny, Zoellner, Fitzgibbons, & Foa, 2000; Feeny, Zoellner, & Foa, 2000), but is stable over the course of short periods in clinical populations unless treatment is offered (e.g., Chard, 2005; Rothbaum et al., 2005). The effect size for treatment is typically moderate. In future research, there is room for methodological advancement of these designs, including use of active rather than wait list controls, larger cell sizes, and use of treatments that target dissociation specifically versus traumatic aftermath generally.

Dissociation Versus Fantasy Proneness as Predictors of Trauma History

Prediction 4 was strongly supported in favor of the TM. Given that fantasy proneness and dissociation do covary, the question arises as to whether there is statistically significant additional unique variance accounted for by dissociation over fantasy proneness in the prediction of trauma, as hypothesized by TM theorists. This was repeatedly shown to be the case. However, there is a paucity of research on a possible fantasy proneness–dissociation interaction, a focus that would inform and enhance the understandings within both models. Important research questions would include investigation of base rates for trauma, dissociative disorders, BPD, and PTSD as they relate to dissociation, fantasy proneness, and the fantasy proneness–dissociation interaction; investigation of differential vulnerability to event suggestibility, imagination inflation, and source confusion; and the study of physiological and genetic markers for dissociation.

Dissociation and Suggestibility

Prediction 5 was strongly supported in favor of the TM. The relationship of dissociation to event suggestibility, source monitoring, and imagination inflation was weak and inconsistent. In the event suggestibility, source monitoring, and imagination inflation categories, 50%–73% of the results were not statistically significant, and the remainder typically had small to moderate effects. This finding does not support the strong statements made that dissociative individuals, and particularly dissociative disordered patients, are at high risk for false memories. In fact, studies that used clinical or abused populations routinely failed to find the relationship at all. Instead, the findings are more in keeping with a model suggesting that the difference is one of degree, and that dissociative individuals as a group are only slightly more likely, if more likely at all, to accept a suggestion under pressure (with average effects sizes supporting the conclusion that dissociation accounts for 1%–3% of the variance in suggestibility).

Methodological improvements in this area would stem from a merging of the strengths of the TM and FM theoretical backgrounds. FM theorists raise the likelihood of fantasized trauma, less commonly discussed in TM literature, but seldom address the distinctions between false memory, slightly inaccurate memory, and acquiescence to pressure (Pezdek & Lam, 2007). The latter three concepts, although each is of great interest, have quite different implications in clinical and forensic settings. Future research on suggestibility might use paradigms similar to that of Hyland (2000) for differentiation of false and slightly inaccurate

memory, or that of Ost et al. (2008) for differentiation of false memory and acquiescence. Further, it is important to extend the findings of suggestibility research from undergraduate samples to clinical and community samples. TM theorists might find valuable information in the inclusion of fantasy proneness in their predictive designs, but as a potential partial explanation for effects and as an alternative outcome of trauma exposure.

Dissociation and Narrative Fragmentation

Prediction 6 was supported in favor of the TM, although more research in the area is necessary for definitive conclusions. As predicted by the TM, dissociation is related to objective fragmentation of narrative in prospective and retrospective studies of assault victims (Halligan et al., 2003, Studies 1 and 2), and is higher in dissociative disordered (in this case, DPD) patients than in controls (Giesbrecht, Merckelbach, et al., 2010). The prediction of the FM—that fragmentation is related solely to subjective fragmentation and not to objective fragmentation—is not supported. A promising direction for future research, following Halligan et al. (2003), would be to extend the longitudinal work to include tests of later memory of trauma. The TM would predict that fragmented memory would be more difficult to maintain over time, particularly in accurate temporal form, than cohesive memory. This prediction fits with experimental literature suggesting that conscious inhibition of memory leads over time to loss of memory (Wright, Loftus, & Hall, 2001).

Dissociative Amnesia Versus Trauma History as Fantasy

Prediction 7 was strongly supported in favor of the TM. In understanding loss of memory for trauma, the FM suggests that recovered memory or dissociative amnesia patients are fantasizers—thus referring to the more extreme writings about the proposed “myth” of dissociative amnesia (e.g., Loftus & Ketcham, 1994). It is important to emphasize that we were unable to locate a single study supporting this point of view. All research attempting to locate corroboration for the accounts of trauma from those recovering from dissociative amnesia have found this corroboration (e.g., Coons, 1994; Geraerts et al., 2007; Williams, 1995), and studies comparing the accuracy of continuous and recovered memory have found, in general, equivalent accuracy (e.g., Dalenberg, 1996; Williams, 1995). In studies from the TM perspective, most research on the correlation between dissociation and the experience of recovery of memory has found this relationship to be statistically significant (e.g., McNally et al., 2000; Melchert, 1999). Research on thought suppression (e.g., Geraerts & McNally, 2008) typically supports the TM, but directed forgetting paradigms, using words as targets for forgetting over short time intervals, have reported more contradictory results (DePrince & Freyd, 2001, 2004; Devilly et al., 2007). New paradigms have hypothesized that neural networks that subserve directed forgetting may also be those that explain psychogenic loss of memory (e.g., Anderson & Green, 2001; Anderson et al., 2004). Studies like these should be extended to dissociative disordered samples, abused samples, and community samples varying in dissociation ability.

Psychobiology of Dissociation as a Regulatory Response to Trauma

Extant research supports the TM of dissociation as a regulatory response to fear or other extreme emotion with measurable biological correlates. The strong caveat here is that, to our knowledge, most research has not been done with FM and TM theories in mind, and thus has not included measures of fantasy proneness or suggestibility. Nonetheless, biological researchers have found trauma-related theories (e.g., tonic immobility) to be useful in synthesizing findings from animal and human samples. Compelling alternative heuristics that are not trauma related have yet to appear.

Summary

Finally, in future research, we recommend the careful analysis of varying alternative causal models; attempts to differentiate mediators, moderators, and risk factors; the avoidance of use of outlier studies to make theoretical arguments; and attention to measurement issues in all conceptual areas (dissociation, fantasy proneness and false memory) to further this complicated and fascinating dialogue. Our review of current research suggests that trauma and dissociation are connected for psychological and neurobiological reasons, and fantasy proneness is not the explanation.

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