



# Mental toughness, reinforcement sensitivity theory, and the five-factor model: Personality and directed forgetting



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## ARTICLE INFO

### Article history:

Received 18 July 2014

Received in revised form 12 March 2015

Accepted 9 April 2015

Available online 23 April 2015

### Keywords:

Mental toughness

Big Five

Directed forgetting

Memory

Reinforcement sensitivity theory

Inhibition

Context-change

## ABSTRACT

A recent study (Dewhurst, Anderson, Cotter, Crust, & Clough, 2012) proposed that mental toughness – a personality construct from sports psychology that predicts many outcomes in sports and elsewhere – reflected ability at inhibitory control. Specifically, they found that mental toughness predicted directed forgetting, which measures peoples' ability to forget things on purpose. We explored the relationships between the short form of the mental toughness scale (the MT-18), other personality traits (the Big Five and BIS/BAS), and directed forgetting. The correlation between mental toughness and directed forgetting replicated. Including a control group with no forget instruction ruled out sustained effort on memory tasks as an explanation; it was specific to directed forgetting. However, mental toughness was shown to correlate with many other personality characteristics, and its effects on directed forgetting were largely due to conscientiousness. We concluded that the basis of mental toughness was probably not inhibitory control as the original authors had proposed.

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## 1. Introduction

A recent paper argued that inhibitory control might be an important determinant of why some people are “mentally tougher” than others (Dewhurst, Anderson, Cotter, Crust, & Clough, 2012): Specifically, they stated that “[t]he findings... suggest that cognitive inhibition is one of the mechanisms that underpin mental toughness.” Their evidence came from a study linking mental toughness to intentional forgetting. Intentional forgetting is usually studied using the *directed forgetting paradigm*, which involves studying two lists. After the first list, people are instructed to forget what they just studied (for reviews, see Bäuml, Pastötter, & Hanslmayr, 2010; MacLeod, 1998; Sahakyan, Delaney, Foster, & Abushanab, 2013). Sahakyan et al. (2013) reviewed accumulated evidence that directed forgetting involves *no* inhibition in the method Dewhurst et al. (2012) employed. The current work was thus aimed to re-examine the link between personality and directed forgetting in light of the alternative non-inhibitory theories of directed forgetting.

The mental toughness scale was developed in sports psychology to predict athletes' performance under stress (e.g., Bull, Shambrook, James, & Brooks, 2005; Gucciardi & Gordon, 2011;

Jones, Hanton, & Connaughton, 2002, 2007), but has been extended to other contexts like business (Marchant et al., 2009). Mental toughness is thought to involve characteristics like resilience, confidence, commitment, self-belief, concentration, and the ability to cope with pressure (Clough, Earle, & Sewell, 2002). There is some disagreement about its exact definition (see Gucciardi & Gordon, 2011, for review), but it is often assessed using the Mental Toughness Questionnaire-48 (MTQ-48; Gucciardi, Hanton, & Mallett, 2012). High scorers on the MTQ-48 tend to view negative experiences as a challenge they can overcome, believe they are in control of their life experiences, are committed to achieving their goals, and are confident with their ability to deal with obstacles and overcome them (Clough et al., 2002). These four traits form the basis of the definition of mental toughness we employed here.

### 1.1. Directed forgetting theories

Dewhurst et al.'s (2012) study used a list-method directed forgetting design. In most modern directed forgetting studies, people study two lists of words. After List 1, half the participants are instructed to forget the list they just studied (the *forget* group), while the others are told to keep remembering it (the *remember* group). Then everyone studies List 2. Finally, a free recall test is administered in which participants write down all the words they can remember from the two lists they studied. There are two typical outcomes of directed forgetting studies: the *costs* reflect the

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forgetting of List 1 items in the forget condition compared to the remember condition. The *benefits* reflect the memory advantage of List 2 items in the forget condition compared to the remember condition.

An early account of directed forgetting was the selective rehearsal theory, which attributed directed forgetting to selectively rehearsing the remember list at the expense of the forget list (Bjork, 1970). Selective rehearsal was largely abandoned in favor of the *inhibitory theory* after discovering that directed forgetting occurs even when people do not expect a test, and hence have no reason to rehearse (Geiselman, Bjork, & Fishman, 1983). Dewhurst et al. (2012) used the inhibitory theory to interpret their results in terms of inhibitory control in the mentally tough.

A more recent theory of the List 1 costs is the *contextual change theory* (Sahakyan & Kelley, 2002), which proposes that in order to comply with forget instructions, people try to think of something else. For example, they might think about their upcoming wedding or about a sad event from their past. A mismatch then occurs between the mental context from the time during List 1 study and the mental context at test, resulting in forgetting. There are many reasons to favor the contextual change theory (for a theoretical review, see Sahakyan et al., 2013); the contextual change account is integrated with modern context-based theories of memory that provide unifying accounts of a wide variety of memory phenomena (Lehman & Malmberg, 2009). Forgetting of comparable magnitude is obtained by instructing people to think of something else, even in the absence of explicit forget instructions (Sahakyan & Kelley, 2002). Finally, a number of specific experimental predictions were subsequently borne out in the literature (for a review, see Sahakyan et al., 2013).

Modern theories attribute the List 2 benefits to a different mechanism involving an improvement in study strategies or reset of encoding after the forget instruction (e.g., Pastötter, Kliegl, & Bäuml, 2012; Sahakyan & Delaney, 2003, 2005; Sahakyan et al., 2013). Sahakyan and Delaney (2003) showed that most people begin studying word lists by rehearsing them, but some people switch to more effective strategies like making up a story using all the words on the lists. Sahakyan and Delaney (2003) suggested that strategy change occurs more often in the forget group because the instructions interrupt ongoing rehearsal processes, which allows people to reflect on what they are doing (and hence a greater chance of changing strategy compared to the remember control group). Consistent with this theory, the benefits are usually absent when people do not expect a test or when they are instructed on which learning strategy to use. Furthermore, people who report not changing strategies between List 1 and List 2 show small or absent benefits, while the relatively few people who switch to a better strategy show large benefits on List 2.

## 1.2. Current paper goals

In Dewhurst et al.'s (2012) study, participants studied two lists of words with a forget instruction following List 1 (there was no remember control group in their experiment). They used the *remember minus forget (R–F)* measure of directed forgetting, which is List 2 memory minus List 1 memory. Larger difference scores indicate more successful directed forgetting. They found greater mental toughness was reliably associated with larger *R–F*, which they interpreted in terms of better inhibition in the mentally tough. Unfortunately, the *R–F* method cannot separate the List 1 costs from the List 2 benefits, as there is no remember control group (for critiques, see Bjork, Bjork, & Anderson, 1998; Sahakyan et al., 2013). Perhaps the mentally tough are better at “sticking with it” through List 2, whereas the less mentally tough give up and spend less effort on List 2. In that case, mental toughness would predict sustained memory even in a remember control

group. Our study addressed these methodological concerns about the original study and provided a replication.

We also examined whether the correlation between mental toughness and directed forgetting could be better understood in terms of other, better-known personality factors. We employed the well-known five-factor model of personality (McCrae & Costa, 1987; for a review, see John, Naumann, & Soto, 2008), because an earlier study found that mental toughness as measured by the MTQ-48 is significantly correlated with each of the “Big Five” personality traits. Specifically, it was negatively correlated with neuroticism and positively correlated with extraversion, openness to experience, agreeableness, and conscientiousness (Horsburgh, Schermer, Veselka, & Vernon, 2009).

Additionally, we tested whether Gray's (1991) reinforcement sensitivity theory could predict directed forgetting. Gray argued for a biologically-determined personality structure. In its most recent revision, it has three systems (Gray & McNaughton, 2000). First, the fight–flight–freeze system drives reactions to both conditioned and unconditioned aversive stimuli, for example, with escape or avoidance behavior (Corr, 2004). This system is related to fear. Second, the behavioral activation system (BAS) drives reactions to both conditioned and unconditioned appetitive stimuli. Third, the role of the behavioral inhibition system (BIS) is to resolve goal conflicts, as when the fight–flight–freeze system motivates an escape behavior and BAS simultaneously motivates an approach behavior. The activity of the BIS generates anxiety. People vary in BIS and BAS sensitivity, and together these dimensions provide a good measure of personality. There are also well-established relationships between the BIS/BAS and the five-factor model (Mitchell et al., 2007); no one has yet explored the relationship between mental toughness and BIS/BAS in the literature.

This paper was an exploratory study examining whether the mental toughness effect in directed forgetting could be replicated and whether other personality variables could influence directed forgetting. Biologically-based personality factors like BIS and BAS could be associated with inhibitory control (e.g., Avila & Parcet, 2001). Stronger inhibition in the mentally tough would produce a negative correlation between mental toughness and List 1 memory in the forget group, but not in the remember group. Alternatively, personality differences could affect participants' motivation or perseverance in studying. If the mentally tough “stick with it” by maintaining effort during memory studies, then mental toughness should be correlated with List 2 memory in both the forget and remember groups. Furthermore, other personality variables such as conscientiousness would likely correlate negatively with List 2 memory.

The two-factor account of directed forgetting (Sahakyan & Delaney, 2005; Sahakyan et al., 2013) provides plausible alternative predictions to the inhibition account. For the List 1 costs, personality could influence peoples' compliance with the forget instruction. For example, conscientiousness could be associated with more forgetting because people would be more likely to make an effort to forget. Likewise, agreeableness might influence people's willingness to go along with an experimenter's instruction to forget. Neuroticism might lead people to be suspicious and therefore less likely to comply. For the benefits, one might predict that conscientiousness would produce a greater desire to excel and therefore a greater likelihood of changing strategies.

## 2. Methods

### 2.1. Participants

The sample size of 120 UNCG undergraduates was set in advance to equate the size of the experimental and control groups

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