

Psychological Interventions Potentially Useful for Increasing Conscientiousness

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Conscientiousness is commonly conceptualized as a personality trait that reflects tendencies to be disciplined, goal oriented, self-controlled, responsible to others, hardworking, orderly, and rule following. Higher levels of conscientiousness reliably predict a host of desirable life outcomes, including longevity and better health throughout the life span. Given the consistently positive relationship of conscientiousness to desirable behaviors and outcomes, there is considerable enthusiasm for researching interventions to improve conscientiousness. The goals of the current review are twofold: (a) to provide an overview of several existing cognitive-behavioral, metacognitive, and cognitive remediation interventions with the potential to influence conscientiousness and (b) to present several suggestions, related to sample selection, intervention components, and sources of support and motivation, for adapting these interventions to promote healthy aging in the general population. As research continues to progress, new psychological interventions may be developed to effectively target conscientiousness and related constructs, ultimately promoting desirable behaviors and outcomes associated with higher levels of this personality trait.

Keywords: conscientiousness, cognitive-behavioral therapy, metacognitive interventions, cognitive remediation therapy

A growing body of literature suggests that personality plays a significant role in the emergence and course of health problems across the life span (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Personality traits can be described as automatic patterns of thoughts, feelings, and behaviors that are relatively consistent across time and context and differentiate people from one another (Roberts, 2009). Although personality reflects the *average* tendency to express certain patterns across situations (Fleeson, 2004), in any given moment or situation, an individual can exhibit varying degrees of a given personality trait. Additionally, average or mean levels of personality traits can change over longer periods of time, both organically (e.g., in response to aging) and in response to interventions (Roberts et al., 2017; Roberts, Walton, & Viechtbauer, 2006). Therefore, personality is not immutable but dynamic and changing (Mroczek, 2014; Sutin, Costa, Wethington, & Eaton, 2010). The potential for personality to change, coupled with its role in influencing health, suggests that personality may serve as a target for individual-level interventions focused on promoting better health across the life span.

One higher level personality trait—conscientiousness—appears to play an especially important role in influencing health (Roberts

et al., 2007). Conscientiousness is one of the five, statistically derived major factors in the widely adopted five-factor model of personality (John, Naumann, & Soto, 2008), along with neuroticism, extraversion, agreeableness, and openness. Conscientiousness is commonly conceptualized as tendencies to be disciplined, goal oriented, self-controlled, responsible to others, hardworking, orderly, and rule following (John et al., 2008; Roberts, Chernyshenko, Stark, & Goldberg, 2005). Conscientiousness is most often measured using trait-based questionnaires, typically completed via self-report in adults; however, alternatives exist, most notably a measure assessing the frequency of objective and behavioral indicators of conscientiousness (Jackson et al., 2010). Although operationalizations of conscientiousness differ somewhat across measures,¹ the resulting scales tend to be highly correlated, and findings regarding conscientiousness and health are relatively consistent. Across a variety of measures, conscientiousness has been shown to predict better occupational outcomes (Roberts et al., 2007), better social and interpersonal outcomes (Roberts et al., 2007), and better health-related outcomes, including a lower risk of mental illness, especially externalizing psychopathology, and greater longevity (Friedman & Kern, 2014; Kotov, Gamez, Schmidt, & Watson, 2010).

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¹ Recent studies of personality and health have often used conscientiousness measures from the following inventories based on the five factor model of personality: the Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (Costa & McCrae, 1992), the Abridged Big Five Dimensional Circumplex (Hofstee, de Raad, & Goldberg, 1992), the Big Five Inventory (John & Srivastava, 1999), or the International Personality Item Pool Inventory (Goldberg et al., 2006).

Beyond the broad trait of conscientiousness, some researchers have focused on identifying its lower order traits (or “facets”). These facets can have predictive power for important outcomes and behaviors that goes above and beyond the broad trait (Paunonen, Haddock, Forsterling, & Keinonen, 2003). Different personality instruments capture different conceptualizations (as well as operationalizations) of these facets (Costa & McCrae, 1998), and there is continued discussion about the number and identity of facets comprising conscientiousness (Roberts, Lejeuez, Krueger, Richards, & Hill, 2014). Further, some authors question whether these facets are sufficiently highly correlated to be considered part of the same overarching factor (Paunonen & Jackson, 1996), a meta-level question that is intertwined with ongoing debates about measurement methodology (Roberts et al., 2014). However, empirical research, including factor analyses of multiple measures tapping conscientiousness, provides converging evidence for at least three facets that are more context specific than the overall domain of conscientiousness (Roberts, Bogg, Walton, Chernyshenko, & Stark, 2004; Roberts et al., 2005, 2014).²

Industriousness is the tendency to both begin tasks and carry them through to completion. *Order* is the propensity to be organized, both in terms of physical objects (e.g., belongings) and nonphysical resources (e.g., communication style, plan, and schedule). Finally, *self-control*, in the context of conscientiousness, describes the tendency to plan ahead and control impulses (i.e., to inhibit prepotent responses). These facets, and the broader trait of conscientiousness, exist within a nomological network of other constructs from clinical, social, cognitive, and developmental psychology, a network that remains to be fully elucidated (Roberts et al., 2014). This is especially true of the self-control facet, which overlaps conceptually and empirically with the concept of delayed gratification from developmental psychology, and with executive function, and in particular inhibitory control, from cognitive psychology (Duckworth, Tsukayama, & Kirby, 2013; Roberts et al., 2004). Compounding this matter is the large number of diverse measures measuring self-control and related constructs (Duckworth & Kern, 2011; Whiteside & Lynam, 2001), which can be weakly correlated. As a result of this measurement confusion

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(Kagan, 1988), research examining the facets of conscientiousness, specifically self-control, has produced discrepant results, depending on the measure used. With that caveat in mind, lower levels of the industriousness facet have been linked to poor academic achievement (Nofle & Robins, 2007), treatment engagement (Edmonds, Bogg, & Roberts, 2009), and health-related behaviors (Edmonds et al., 2009). Lower levels of order have been linked to higher risk of excess weight gain (Sutin, Ferrucci, Zonderman, & Terracciano, 2011). Finally, lower levels of self-control³ have been associated with traffic risk (Edmonds et al., 2009; Roberts et al., 2005), antisocial behavior (Jones, Miller, & Lynam, 2011), and somatic and psychiatric morbidity, including substance use problems (Edmonds et al., 2009; Roberts et al., 2005). Taken together, these facets of conscientiousness are important predictors of a variety of health outcomes.

However, the exact mechanisms linking these facets—and overall conscientiousness—to desirable health outcomes have not been fully elucidated. Preliminary evidence suggests that the relationship between conscientiousness and better health outcomes is due at least in part to three overlapping sets of mediators: greater educational attainment, cognitive ability, and socioeconomic sta-

tus; reduced risk of stressors and/or better handling of stressors; and greater engagement in beneficial behaviors, such as increased consumption of healthy foods, reduced overeating, increased physical activity, reduced smoking and other substance abuse, and greater adherence to medical regimens and doctor’s visits (Bogg & Roberts, 2004; Edmonds et al., 2009; Hampson, Edmonds, Goldberg, Dubanoski, & Hillier, 2015; Hill & Roberts, 2011; Javaras et al., 2012; Lodi-Smith et al., 2010; O’Connor & O’Connor, 2004; Shanahan, Hill, Roberts, Eccles, & Friedman, 2014). However, these putative mechanisms have been identified from observational and, in some cases, cross-sectional data. Because these data are not sufficient to establish causality, additional, rigorous research is needed to determine conscientiousness’ causal status and fully characterize the complex web of mediating mechanisms linking conscientiousness to better outcomes (Conti & Heckman, 2014; Reiss, Eccles, & Nielsen, 2014).

An important next step for research will be to demonstrate whether experimental manipulation of conscientiousness and its facets produces downstream effects on important real-world behaviors and outcomes. Given the consistently positive relationship between conscientiousness and desirable behaviors and outcomes, there have been repeated calls to research interventions for increasing the trait of conscientiousness (Chapman, Hampson, & Clarkin, 2014; Hill, Roberts, Grogger, Guryan, & Sixkiller, 2011; Reiss et al., 2014).⁴ At present, though, there are no evidence-based interventions focused on increasing general conscientiousness.⁵ However, numerous psychological interventions have been developed to treat behavioral and mental health problems associated with low conscientiousness, and some of these may prove useful in increasing conscientiousness more broadly.

In this spirit, we provide an overview of certain behavioral and mental health interventions that may prove useful for increasing conscientiousness and its facets in adults. We focus specifically on *psychological* interventions, i.e., interventions that directly target individual-level environmental factors, behaviors, cognitions, and cognitive processes, as opposed to lower units of analysis (e.g., genetics, cells, physiology). We first provide an overview of the AQ: 3 interventions, accompanied by discussion of their potential for influencing conscientiousness more broadly. We then conclude by offering several suggestions for adapting these interventions to

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² In empirical research into the facets of conscientiousness, industriousness and order have received the most consistent support, followed by self-control (Roberts et al., 2014). “Responsibility” (the tendency to honor promises and adhere to rules that facilitate the functioning of social groups) has also received considerable support (Roberts et al., 2014), but it is as highly correlated with agreeableness as with conscientiousness (Roberts et al., 2005). Finally, several other constructs (e.g., “traditionalism” and “persistence”) have been identified as facets of conscientiousness in some investigations.

³ Assessed via self-report on measures such as the NEO-PI-R Deliberation Scale.

⁴ Given the consistent positive association between conscientiousness and health-related behaviors and outcomes, there is also understandable enthusiasm for incorporating conscientiousness into assessments conducted in medical settings (Chapman et al., 2014; Israel & Moffitt, 2014).

⁵ A literature review was conducted to identify research on evidence-based interventions for conscientiousness. Literature searches using the terms and phrases *conscientiousness AND intervention*, *conscientiousness AND treatment*, *targeting conscientiousness*, *changing conscientiousness*, *altering conscientiousness*, and *treatment of conscientiousness* were performed in Google Scholar and PubMed.

improve conscientiousness in the general population, accompanied by recommendations for future research.

Overview of Interventions

Because it is not possible to exhaustively review all psychological interventions used in behavioral and mental health, we focus on three types of interventions that have been successfully used to address behavioral or mental health problems in diseases or disorders associated with lower levels of conscientiousness. These three types of interventions include behavioral therapy and cognitive–behavioral therapy (CBT), which directly target environmental variables, behavior, and cognitions (i.e., thoughts); “metacognitive” techniques for enhancing goal setting and striving, which directly target cognition about cognitive processes; and cognitive remediation therapies, which directly target cognitive functions. This typology allows us to organize interventions based on their intended targets. Of course, in practice, specific interventions often contain elements of more than one type, and some of the examples described below could arguably have been included under a different type. Regardless of type, however, all of the interventions described later entail repeated practice of certain techniques, skills, or tasks that could be applied to environmental variables and behaviors, cognitions, and cognitive processes relevant to conscientiousness.

For each type of intervention, we provide a brief general overview of the intervention and its background. During this overview, we note several applications of the intervention, providing citations for applications focused on altering behaviors requiring conscientiousness (e.g., diet and physical activity), constructs related to conscientiousness (e.g., executive function), or treating disorders associated with lower levels of conscientiousness. We then focus on one of these applications as an illustrative example, presenting information on efficacy that is, whenever possible, derived from recent systematic reviews and meta-analyses. Finally, we discuss the intervention’s potential for increasing conscientiousness more generally.

Behavioral and Cognitive–Behavioral Therapies

Behavioral and cognitive–behavioral therapies address individual-level environmental factors, behaviors, and thoughts and emotions that maintain or exacerbate psychopathology and behavioral health problems. The development of behavioral and cognitive–behavioral therapies has been described as occurring in three waves. The first wave consists of behavior therapies, which are rooted in the concepts of behaviorism (e.g., classical and operant conditioning) and focus on observable variables. These techniques focus on altering the environment (e.g., cues) and environmentally mediated contingencies to promote desired behaviors and reduce undesirable behaviors. Examples of behavioral techniques include stimulus control (increasing the presence of cues that elicit the desired behavior and decreasing the presence of cues that elicit the undesired behavior), exposure (repeated presentation of cues previously associated with an undesirable event or response), and contingency management (use of reinforcement or, less often, punishment to promote or reduce certain behaviors).

The second wave encompasses cognitive therapies, most notably Beck’s cognitive therapy (A. T. Beck, 1979, 1991) and Ellis’

rational emotive behavior therapy (Ellis, 1957, 1962). These therapies adopt a cognitive conceptualization in which thoughts have an important impact on behavior and emotion, and inaccurate (or maladaptive) thoughts underlie behavioral and emotional problems. For example, cognitive theorists posit that the interpretation of events, rather than events themselves, can precipitate and maintain undesirable behaviors or emotions. Thus, cognitive therapy entails instruction in a variety of techniques targeting distorted or maladaptive thoughts, ranging from automatic thoughts to intermediate and core beliefs (J. S. Beck, 2011). Many of these techniques seek to challenge the maladaptive thoughts and develop more adaptive alternatives, a process referred to as cognitive restructuring. Examples of cognitive restructuring techniques include identification of cognitive errors (e.g., overgeneralization and dichotomous thinking), examination of evidence for and against maladaptive thoughts, and performance of behavioral experiments designed to test the accuracy of the maladaptive thoughts (J. S. Beck, 2011). Since the 1980s and 1990s, cognitive techniques have typically been used in combination with behavioral techniques, in treatments referred to as CBT. In addition to the aforementioned behavioral and cognitive techniques, other techniques commonly used in CBT include goal setting and scheduling, self-monitoring, functional analysis, problem solving, relaxation training, and social support.

Finally, third-wave therapies, such as dialectical behavior therapy (Linehan, 1993) and acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 1999), focus on the context and function of behaviors, thoughts, and emotions, rather than their content (Hayes, Villatte, Levin, & Hildebrandt, 2011). Third-wave therapies incorporate techniques designed to help individuals respond more flexibly to events, thoughts, and emotions. These third-wave techniques include acceptance and mindfulness techniques, cognitive defusion (various techniques used to gain distance from thoughts), and a focus on values. Notably, many of these techniques seek to change how one relates to thoughts and emotions, rather than their content.

Aside from specific techniques, behavioral and cognitive–behavioral therapies tend to share several characteristics (J. S. Beck, 2011). First, these therapies are of a time-limited duration, often on the order of months. Second, these therapies focus on the present and on factors currently maintaining the specific problem, rather than on the problem’s origins. Third, the therapist works collaboratively with clients to help them learn skills and techniques to address the factors related to a specific problem. Typically, this involves a didactic portion during sessions that is focused on providing information about the problem area and instruction in the use of CBT techniques. This also involves homework outside of sessions where clients practice newly learned skills in their natural environment. Homework is assigned and reviewed in sessions and often involves the completion of one or more worksheets.

Numerous variants of behavioral and cognitive–behavioral therapies have been used to successfully treat a vast array of behavioral health problems (e.g., stress, insomnia, and pain) and mental health problems (e.g., anxiety, depression, eating disorders, and personality disorders; Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012; Öst, 2014; Panos, Jackson, Hasan, & Panos, 2014). For example, in behavioral health, CBT techniques (e.g., goal setting, self-monitoring and feedback, stimulus control, contingency man-

agement, and mindfulness) are used to promote changes in diet and physical activity (Michie, Abraham, Whittington, McAtee, & Gupta, 2009; Spahn et al., 2010). These techniques are incorporated into “behavioral weight management” programs for overweight and obesity, which have been consistently, if modestly, associated with lower levels of conscientiousness (Jokela et al., 2013). Successful weight loss and maintenance require substantial changes in diet and physical activity that are difficult to initiate and maintain due to biological, psychological, and environmental factors (Leahy et al., 2016; MacLean, Bergouignan, Cornier, & Jackman, 2011), and incorporating CBT techniques into behavioral weight management programs increases adherence to these behavior changes and improves weight loss outcomes (Butryn, Webb, & Wadden, 2011; Leahy et al., 2016; K. Olson, Bond, & Wing, 2017; K. L. Olson & Emery, 2015). For mental health problems, CBT therapies are commonly used to treat numerous forms of psychopathology. Potentially most relevant to conscientiousness, CBT has been applied to attention-deficit/hyperactivity disorder (ADHD; Jensen, Amdisen, Jørgensen, & Arnfred, 2016), antisocial personality disorder (Brazil, van Dongen, Maes, Mars, & Baskin-Sommers, 2016), and substance use disorders (McHugh, Hearon, & Otto, 2010). CBT has been used as an adjunct to pharmacological treatment of ADHD, which is associated with lower levels of conscientiousness (Nigg, 2006), as might be expected given that attention and impulse control are important for the expression of conscientiousness. Although most CBT interventions for ADHD address more traditional targets (e.g., cognitions that underlie anxiety and depression, interpersonal problems), other interventions also use CBT techniques to improve planning and organization and minimize distraction (Safren et al., 2010). Additionally, CBT has been used to treat individuals with antisocial personality disorder, a disorder characterized by low conscientiousness (Saulsman & Page, 2004). Although evidence is mixed, CBT, particularly contingency management, tends to be most effective compared to other interventions for individuals with antisocial personality disorder and comorbid substance use disorders, improving abstinence (Silverman et al., 1998) and reducing early dropout (Gibbon et al., 2009).

As an illustrative example, substance use disorders have been consistently associated with lower levels of conscientiousness (Kotov et al., 2010), which is not surprising given that intoxication and withdrawal, as well as time devoted to obtaining illegal substances, can impede the expression of conscientiousness. Contingency management is commonly used to promote behavior change (i.e., reduced substance use) in substance use disorders (Dutra et al., 2008; McHugh et al., 2010). Effect sizes for the efficacy of contingency management across studies are in the moderate range, with greater efficacy for some substances (opioids and cocaine) relative to others (tobacco and polydrug use; Prendergast, Podus, Finney, Greenwell, & Roll, 2006). However, as noted previously, contingency management may be particularly effective compared to other interventions for personality disorders with comorbid substance use disorders, providing an intervention strategy for a notoriously difficult-to-treat population. CBT interventions combining multiple techniques (e.g., relaxation training, goal setting, contingency management, cognitive restructuring, and mindfulness) have been efficacious for cocaine, opiates, cannabis, and polysubstance abuse and dependence, resulting in longer term abstinence, treatment retention, and reductions in treatment drop-

out (Dutra et al., 2008). Based on large-scale trials and quantitative reviews, effect sizes for reducing substance use disorder symptoms and enhancing treatment engagement range from small ($d = 0.24$) to moderate ($d = 0.45$; McHugh et al., 2010), depending on the particular substance use disorder examined.

Conceivably, many of the aforementioned techniques from behavioral and cognitive–behavioral therapies could be used to target the environmental cues and contingencies, cognitions, and emotions that maintain nonconscientiousness behavior, and elicit more conscientious behavior across a variety of domains. However, the utility of these therapies may be limited by nonadherence and scalability, two general concerns that are likely to be more prominent in populations with lower levels of conscientiousness. Behavioral and cognitive–behavioral therapies involve not only attendance at sessions but also practice between sessions (i.e., homework). Although accountability to the treatment provider and treatment group members may help enhance attendance and homework compliance, dropout and nonadherence are consistently found across intervention areas. For example, although dropout is modest (e.g., 20%–30%) for behavioral weight management programs (Butryn et al., 2011) and contingency management (Dutra et al., 2008), missed sessions and other forms of nonadherence are common and increase throughout treatment (Acharya et al., 2009). Further, research suggests that adherence may be especially poor among those with lower levels of conscientiousness (Moroshko, Brennan, & O’Brien, 2011). A second concern is that it would not be easy to scale behavioral and cognitive–behavioral therapies—especially the more therapist- and time-intensive versions—to the level of a population health intervention. Although more easily scalable versions of these therapies exist, such as guided self-help CBT (Wilson & Zandberg, 2012), these may lack the features needed to support adherence among individuals with lower levels of conscientiousness.

Metacognitive Techniques for Setting and Achieving Goals

Pursuing and achieving goals is an essential component of conscientiousness. Goal pursuit consists of *goal setting* and *goal striving*, both of which are intertwined with goal attainment and thus potential areas for intervention.⁶ Here, we describe three metacognitive techniques (i.e., approaches to thinking) that can enhance the pursuit and attainment of goals by targeting goal setting or striving: mental contrasting, implementation intentions, and episodic future thinking. In addition to these three specific techniques, we also describe interventions that integrate multiple metacognitive techniques to address executive dysfunction.

Mental contrasting (MC) is primarily relevant to goal setting. In MC, people first envision the desired future and then imagine the obstacles that need to be overcome to reach the desired future from the present reality. This process helps individuals more objectively assess the feasibility of goals, resulting in selection of more ap-

⁶ Several frequent recommendations regarding goal setting focus on the details of the goals. For example, research suggests that the likelihood of goal attainment is increased by setting goals that are desirable, small, specific, feasible, and measurable, and by selecting goals that focus on achieving positives (rather than preventing negatives) and gaining competence (rather than focusing on performance or outcomes; Ajzen, 1991; Maddux & Tangney, 2010; Webb & Sheeran, 2006).

AQ: 4 appropriate goals and thus greater goal commitment (Oettingen & Gollwitzer, 2010). MC can be taught as a cost- and time-effective technique of behavior change. Work by Oettingen and colleagues in the Netherlands reveals that, relative to dwelling on the present or fantasizing about the future, brief training in MC can help young adults interpersonally connect with an attractive stranger and enhance their self-improvement goals, middle-aged health care providers give higher quality of help, university students cope with acute stress, college-aged women reduce cigarette use, young adult females diminish unhealthy snacking habits, individuals increase exercise behavior, and people improve time-management skills (Oettingen & Gollwitzer, 2010). MC appears to be a powerful technique that can lead to behavior change across areas, including behaviors highly relevant to conscientiousness (e.g., time management).

Once appropriate goals have been set, two other metacognitive techniques, implementation intentions (II) and episodic future thinking, can be used to enhance goal striving. Techniques that address goal striving focus on mobilizing the individual to work toward a goal. The II technique involves coming up with concrete “if–then” plans for handling situations that can arise during goal striving. For example, an individual might generate statements connecting experiences to action plans, such as “If I feel stressed, then I will do deep breathing for 10 min.” This process allows individuals to identify opportunities for pursuing their goals ahead of time and to automatically respond effectively when those opportunities are encountered. II have been used to enhance all phases of goal striving, including initiation, persistence in the face of internal and external distractions, and abandonment of futile goals (Maddux & Tangney, 2010). The II technique generally has moderate ($d = .65$) positive effects on goal attainment, even after taking into account the strength of goal commitment (Gollwitzer & Sheeran, 2006). Moreover, the II technique has small ($d = .31$) positive effects on promoting physical activity (Bélanger-Gravel, Godin, & Amireault, 2013). Notably, the II technique seems to be effective for disorders associated with lower conscientiousness. For example, the II technique has shown beneficial effects for promoting prospective memory in individuals with early psychosis (Khoyratty et al., 2015) and exercise in individuals with major depression (Krämer, Helmes, Seelig, Fuchs, & Bengel, 2014).

Another metacognitive technique that can aid in goal persistence is episodic future thinking (Atance & O'Neill, 2001), which seeks to engage episodic memory in prospectively experiencing future events. In episodic future thinking, an individual is asked to vividly imagine realistic future events, complete with specific details (e.g., “What will you be doing?” “Whom will you be with?” “Where will you be?” and “How will you be feeling?”) based in part on past experiences. This technique alters behaviors associated with future-oriented thinking, for example improving delay discounting, a process relevant to delay of gratification that is important in a number of maladaptive behaviors, from substance abuse to antisocial activities (Koffarnus, Jarmolowicz, Mueller, & Bickel, 2013). The use of episodic future thinking appears to be an effective intervention for a variety of behaviors related to conscientiousness. For example, episodic future thinking interventions have been shown to improve delay discounting and promote abstinence in individuals with alcohol dependence (Snider, LaConte, & Bickel, 2016) and nicotine use disorders (Stein et al., 2016), and to improve delay discounting and reduce intake of high fat foods

in individuals at risk of overeating (Daniel, Stanton, & Epstein, 2013). Thus, enhancing episodic future thinking may produce reductions in delay discounting, which could in turn increase long-term-focused behaviors associated with higher conscientiousness.

Finally, several interventions combine multiple metacognitive techniques, or use metacognitive techniques along with CBT techniques, to address deficits related to low conscientiousness (e.g., deficits in planning, task completion, problem solving, organization, and emotion regulation) in disorders associated with lower conscientiousness. For example, the II technique has been used in combination with MC, with the process of envisioning obstacles in MC setting the stage for the development of implementation interventions to address those obstacles in II. Combining MC and II (in that order), referred to as MC-II, has been shown to be more effective than MC or II on their own at reducing undesirable behaviors and increasing desirable behaviors (Adriaanse et al., 2010). Another example of combining techniques is goal management training (GMT). This intervention for executive dysfunction uses a variety of techniques to help individuals sustain attention on goal-related activities by learning to interrupt ongoing (i.e., habitual or distracted) behaviors to monitor and adjust goals. Small trials have yielded initially promising findings in individuals with frontal lobe damage and abstinent polysubstance abusers (Alfonso, Caracuel, Delgado-Pastor, & Verdejo-García, 2011; Levine et al., 2011).

As an illustrative example, we focus on the use of these metacognitive techniques in ADHD. There are several ways in which metacognitive strategies has been implemented in the treatment of ADHD. For example, the use of II in children with ADHD has led to improvement in response inhibition and executive functioning (Gawrilow & Gollwitzer, 2008; Gawrilow, Gollwitzer, & Oettingen, 2011b), as well as delay of gratification (Gawrilow, Gollwitzer, & Oettingen, 2011a). Among many other benefits (Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011), studies of MC-II have demonstrated improved goal pursuit in children with ADHD (Gawrilow, Morgenroth, Schultz, Oettingen, & Gollwitzer, 2013). Finally, the use of metacognitive therapy, which combines multiple metacognitive techniques with CBT techniques, led to significantly greater improvements in dimensional and categorical measures of ADHD severity, compared with supportive therapy, in adults with ADHD (e.g., $d = .7-.9$ for dimensional measures; odds ratio = 5.4 for categorical measure; Solanto et al., 2010).

The aforementioned metacognitive techniques entail thinking about or planning for the future, to increase attainment of future-focused goals despite a lack of immediate reinforcement, an ability that is important for behaving conscientiously. These techniques may provide a useful approach to increasing behaviors associated with conscientiousness. Further, they may even increase conscientiousness itself and its facets, especially industriousness and self-control, given their relationship to goal attainment and delay of gratification. Moreover, combining these metacognitive techniques, as in MC-II or GMT, may yield especially effective interventions that target aspects of conscientiousness and related processes through multiple integrative techniques. Learning these metacognitive techniques does not require attendance at numerous sessions, which reduces problems with nonattendance and dropout. Further, these techniques are easily taught to large numbers of people, making them highly scalable. However, the suitability of

these techniques for increasing conscientiousness will likely be limited by reliance on reflective functioning, and possibly also by reliance on conscientiousness itself. A critical aspect of effectively implementing metacognitive strategies is the ability to imagine one's future self, including one's future emotions and behaviors. This requires some degree of reflective functioning or mentalization, a mental process that underpins the capacity to imagine the mental states of oneself and others. Unfortunately, many forms of mental health problems characterized by low conscientiousness are associated with low levels of reflective functioning (Katznelson, 2014). The difficulty some may have with reflective functioning might preclude effective use of metacognitive techniques. Similarly, the use of these metacognitive techniques may require conscientiousness. For example, there is some evidence that the II technique is only effective for individuals with higher levels of self-control, a facet of conscientiousness, and better emotion-regulation ability (Churchill & Jessop, 2010, 2011), although another study found that the II techniques were most effective among individuals with lower levels of conscientiousness (Webb, Christian, & Armitage, 2007). Therefore, future research is needed to examine whether the II technique, and metacognitive techniques in general, have the potential to be effective in individuals with lower levels of trait conscientiousness. Given their reliance on reflective functioning and potential reliance on conscientiousness, metacognitive techniques may not be feasible for some individuals as a first step in intervention.

Cognitive Remediation Therapies

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Dysfunctional cognitive processing is a persistent and functionally relevant feature of many problematic behaviors. Such impairments span multiple cognitive functions, including attention, executive functioning, memory, and language. Cognitive remediation therapy (CRT) encompasses a diverse array of "interventions that aim to improve (neuro)cognitive functions (attention, memory, executive function, social cognition, or metacognition) with the goal of durability and generalization" (Wykes & Spaulding, 2011, p. S84). In this section, we focus specifically on CRT interventions that involve the repeated practice of cognitive exercises ("cognitive training") using cognitive functions thought to be impaired and relevant to problematic behaviors. Notably, some CRT interventions combine cognitive training with instruction (e.g., such as the aforementioned metacognitive techniques) to improve cognitive functioning (Siegle, Ghinassi, & Thase, 2007). However, we focus here on CRT interventions in which cognitive training is the primary component, although they may also include other techniques.

Often, cognitive training batteries include well-established neuropsychological tasks that are amenable to repeated administration (e.g., go/no-go and dichotic listening). The format and dose of CRT can vary, with CRT being delivered individually or in groups and over hours or months. Regardless, the ultimate goal of CRT is for the training to generalize to untrained tasks that tap the impaired cognitive functions ("near-transfer") and, ideally, to other types of cognitive tasks and everyday functioning ("far-transfer"). Developed for survivors of traumatic brain injury, CRT has also been used extensively with patients recovering from other types of brain injuries (e.g., stroke). CRT is also increasingly used as a component of treatment for a wide variety of psychiatric disorders including schizophrenia and psychosis (Wykes & Spaulding,

2011), ADHD (Tajik-Parvinchi, Wright, & Schachar, 2014), eating disorders (Lindvall Dahlgren & Rø, 2014; Tchanturia, Lloyd, & Lang, 2013), mood disorders (Bowie, Gupta, & Holshausen, 2013), psychopathy (Baskin-Sommers, Curtin, & Newman, 2015), and substance abuse (Bates, Buckman, & Nguyen, 2013; Bickel, Yi, Landes, Hill, & Baxter, 2011; Houben, Wiers, & Jansen, 2011), with training targeting the cognitive impairments common to the particular disorder. In addition, cognitive training has also been used in "healthy" aging populations, targeted at preventing or reversing age-related declines in cognitive functions (Anguera et al., 2013; Ball et al., 2002).

To date, there are no studies that use CRT to target conscientiousness specifically, but several studies noted previously have demonstrated changes in cognitive functions and behaviors relevant to conscientiousness, in particular executive function and delay discounting.⁷ One example is the use of CRT in schizophrenia. Patients with schizophrenia report lower levels of conscientiousness (Camisa et al., 2005), and many of the cognitive dysfunctions in schizophrenia are subserved by deficits in executive function. Accordingly, CRT for schizophrenia emphasizes improvement in executive functioning. CRT has been well studied in schizophrenia, with meta-analyses suggesting that (at least for individuals who are relatively stable) CRT results in small-to-moderate (effect sizes = .28 to .41) and durable improvements in cognitive functioning across multiple domains, including attention, working memory, and reasoning/problem solving (McGurk, Twamley, Sitzer, McHugo, & Mueser, 2007; Wykes, Huddy, Cellard, McGurk, & Czobor, 2011). CRT also results in small-to-moderate improvements in functional outcomes, especially if CRT is accompanied by additional forms of psychiatric rehabilitation (McGurk et al., 2007; Wykes et al., 2011). Studies that examine the neural changes connected to CRT for schizophrenia suggest that CRT is associated with functional and structural changes (e.g., in the integrity of interhemispheric white matter tracks) that reduce the neural differences between individuals with schizophrenia and healthy controls (Penadés et al., 2013; Wykes et al., 2002).

CRT could be used to enhance cognitive functions, such as executive function, that subserve conscientiousness. These techniques may provide an avenue for targeting underlying processes needed to promote more conscientious behavior in a way that is more engaging and fun (e.g., the use of video games vs. therapy

⁷ Studies applying CRT in populations characterized by executive dysfunction (e.g., due to brain damage and schizophrenia) have generally found improvements or no change in cognitive functions relevant to conscientiousness (e.g., executive function). However, in one study of healthy young and older adults, participants who underwent intensive, short-term cognitive training on a variety of cognitive tasks (including working memory) had smaller increases in self-reported conscientiousness and its order facet, compared with the typical maturation-related increases in conscientiousness observed in the no-training control group (Sander, Schmiedek, Brose, Wagner, & Specht, 2016). Although this finding could be interpreted as evidence that cognitive training does not benefit, and may even have iatrogenic effects on, conscientiousness, it should be viewed with caution given that participants were assigned to the training group on a first-come, first-served basis and given that conscientiousness was assessed only via self-report and only at baseline and 2-year follow-up. Further, the cognitive training did not generalize to other, untrained tasks, except perhaps in older adults (Schmiedek, Lövdén, & Lindenberger, 2010), and the training was not specifically targeted at increasing cognitive processes and behaviors related to conscientiousness.

sessions and homework), that circumvents the need for an individual to have clear insight into their behavior or the ability to mentalize, and that is more convenient (e.g., compared with attendance at therapy sessions) and less resource intensive (e.g., compared with therapist-led CBT). However, there are notable limitations of this approach for conscientiousness, including generalizability and dose. First, although the prospect of CRT has been met with great enthusiasm, many studies of CRT have suffered serious methodological limitations. Crucially, the generalizability of the trained skills has not been rigorously evaluated or established (Shipstead, Redick, & Engle, 2012). Many studies using CRT examine changes in performance on the training task(s) or perhaps untrained tasks tapping the same cognitive function; however, there is limited evidence that this training then translates to other cognitive functions, or to everyday behaviors. The cognitive functions related to low conscientiousness span several subtypes of executive functions, and more work is needed to fully specify the cognitive functions involved in conscientiousness. However, if generalizability to nontrained tasks is a limitation of CRT, it would greatly limit its utility as a broad-based intervention addressing conscientiousness. Second, the question of “dose” in CRT research is important, and a potential limitation if larger doses are required. There is no prescribed amount of training, and training times differ across studies, ranging from two sessions to 40 hours of training a week. The longer lengths of training would prove difficult for many, and particularly for those with lower levels of conscientiousness. However, some studies show changes in behavior and neural patterns after five sessions (less than 45 min per session; Eldar & Bar-Haim, 2010) or eight hours (Bellucci, Glaberman, & Haslam, 2003). Studies using these or even lower “doses” have reported moderate to large effect sizes for changes in global cognition (e.g., .38–.58), although the durability of these changes is not known. The “ideal” amount of training, including the number and spacing of both initial and booster sessions, is an empirical question, but one that must be considered from the standpoint of acceptability and feasibility.

Future Research

We have reviewed several existing interventions with the potential to increase conscientiousness. Many of these interventions entail repeatedly practicing behaviors and thought processes exhibited by highly conscientious individuals, consistent with the theory that practicing behaviors requiring self-control can increase overall self-regulation (Muraven, Baumeister, & Tice, 1999). Ideally, with enough practice, the cognitive processes and behaviors targeted for intervention will become less effortful and increasingly automatic (Magidson, Roberts, Collado-Rodriguez, & Lejuez, 2014). The ultimate goal would be for these processes and behaviors to generalize across a variety of behavioral domains, settings, and times, effectively amounting to an increase in overall conscientiousness. Future studies should consider three key related factors: selection of sample, relevant intervention components, and sources of support and motivation.

First, selection of an appropriate sample for intervention is critical. Future studies should recruit individuals from clinical settings (e.g., drug and alcohol treatment), as well as nonclinical settings that are more focused on promoting healthy behaviors. Rather than selecting individuals based on a diagnostic or behavioral category, selection

should instead target individuals based on levels of conscientiousness and constituent facets and processes, in particular those individuals with low levels of these factors (e.g., those in the bottom two quintiles). Many of the interventions discussed earlier are more efficacious in samples with lower levels of the construct being targeted (e.g., substance abuse, ADHD, and schizophrenia), provided they are able to engage in the intervention. In addition, increasing conscientiousness past a certain point may prove to be detrimental. Higher levels of conscientiousness have been associated with adverse outcomes in certain contexts, such as the onset of depression subsequent to losing one’s job (Boyce, Wood, & Brown, 2010). Further, although conscientiousness can be conceptually distinguished from perfectionism (Flett & Hewitt, 2007), in practice conscientiousness (and especially its industriousness facet) is associated both cross-sectionally and prospectively with higher levels of perfectionism (Stoeber, Otto, & Dalbert, 2009), which are characteristic of certain types of psychopathology such as anorexia nervosa (Bastiani, Rao, Weltzin, & Kaye, 1995). Relatedly, certain facets of conscientiousness (i.e., industriousness and order; Lepine, Colquitt, & Erez, 2000) but not others (i.e., self-control⁸; Moffitt et al., 2011) may be especially pernicious when high. Further, some (Carter, Guan, Maples, Williamson, & Miller, 2015) but not all (Wiese et al., 2017) studies suggest that extremely high levels of any facet (including self-control⁹) may not be optimal for various aspects of psychological well-being.

Second, selection of relevant intervention components will be key to delivering effective interventions. Like all behaviorally or symptom-defined groups, low conscientiousness is undoubtedly heterogeneous in its origins, and interventions should be tailored based on extensive assessment of participants. For example, instead of targeting the broad trait of conscientiousness or even its facets, relevant metacognitive techniques or CRT can be used to target subcomponent processes, effectively working “outward” toward the relevant behaviors, symptoms, and outcomes of interest. Interventions should be tailored to target specifically those subcomponent processes that are suboptimal or impaired and related to the functional behaviors and outcomes of interests (Tajik-Pavinchchi et al., 2014). Further, interventions directly targeting subcomponent processes can be combined with other psychological interventions, such as CBT or motivational interviewing (Rollnick & Miller, 1995), targeting other constructs that interfere with functioning of these subcomponent processes in the real world (e.g., motivation, anxiety; Conti & Heckman, 2014; Shackman et al., 2006). Additionally, given evidence that conscientiousness does not guarantee desirable behaviors and outcomes and that augmenting CRT with other forms of intervention can enhance outcomes (McGurk et al., 2007; Wykes et al., 2011), interventions will likely need to include functionally focused components (e.g., modules on managing substance use disorders, weight, and so on) to ensure that improvement in subcomponent processes transfers to the behaviors relevant to functional outcomes of interest.

Third, it may be necessary to include extra support and motivation to ensure adherence to interventions, especially with regards

⁸ Assessed via a composite measure combining observational ratings of behavior and multi-informant (i.e., teacher-, parent-, and/or self-) reports of impulsive aggression, hyperactivity, lack of persistence, inattention, and impulsivity (Moffitt et al., 2011).

⁹ Assessed via self-report on the International Personality Item Pool version of the NEO-PI-R Deliberation Scale.

to elements requiring real-world practice. Many of the interventions described here involve repeated practice of behaviors and cognitive processes consistent with conscientiousness, leading to a circular problem where full engagement in interventions designed to improve conscientiousness requires a certain level of conscientiousness. As noted previously, these interventions will ideally focus on individuals with low conscientiousness, who may lack the ability or motivation to adhere to the interventions and will likely require more support and/or motivation than individuals with high conscientiousness. One option is to provide enhanced support, especially in real-world settings, ranging from the use of “coaches” (Stevenson, Whitmont, Bornholt, Livesey, & Stevenson, 2002), to incorporating friends and family members into the intervention (McLean, Griffin, Toney, & Hardeman, 2003; Wing & Jeffery, 1999), to the use of an entire therapeutic community to support behavior change (Citrin & Dixon, 1977). In addition, although the relationship between conscientiousness and motivation remains to be fully clarified (Conti & Heckman, 2014; Roberts et al., 2014), explicit consideration of motivation is another option for enhancing adherence. Interventions should be enjoyable and/or focused on changing behaviors deemed important, two intrinsic motivators that enhance behavior change (Ajzen, 1991). However, it may be necessary to offer extrinsic motivation (e.g., money or gift certificates) tied to objective measures of behavior, a contingency-management technique that has been proven extremely effective at reducing substance use (Stitzer & Petry, 2006) and maintaining weight loss (Leahy et al., 2016), and may be critical for the effectiveness of cognitive interventions for ADHD (Hinshaw, 2006). Future research will need to investigate the most cost-effective approaches to providing support and extrinsic motivation.

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Of course, the approach outlined here relies on certain assumptions, namely, that conscientiousness and its links to important outcomes are well characterized across multiple units of analysis (Friedman, Kern, Hampson, & Duckworth, 2014; Roberts et al., 2014). Further, this approach has several implications for research methodology that go beyond the standard methodological recommendations for rigorously testing interventions (e.g., a well-matched control condition, objective measures of outcomes; see Simons et al., 2016, pp. 161–168, for an excellent review). First, conscientiousness may be subject to a Dunning–Kruger-type effect, where increased levels of conscientiousness may lead individuals to evaluate their conscientiousness more harshly. Second, because conscientiousness is multifaceted and because multiple measures/tasks are needed to assess even subcomponent processes due to task impurity and idiosyncratic variance (Duckworth & Kern, 2011), extensive batteries for assessment and intervention will be needed (especially in the case of CRT). Third, it will be important to measure only those real-world outcomes of interest to a given individual and/or to create composite measures combining multiple outcomes, as separately examining a large number of outcomes will likely yield weak results (Della Porta, 2013), a problem that would be further exacerbated by the necessary correction for multiple comparisons. Fourth, it will be important to assess factors other than conscientiousness that may moderate results, such as age, neuroticism (Reiss et al., 2014), and their interaction (Shanahan et al., 2014). Finally, relatively large sample sizes will likely be required to achieve adequate statistical power for mapping individual differences in conscientiousness.

As research continues to progress, new interventions may be developed to effectively alter various behaviors by targeting conscientiousness and related facets. The promise of basic research in experimental and personality psychology is to identify specific suboptimal processes that may be used to treat and prevent costly behaviors and syndromes. Armed with such information, it is possible to employ powerful research designs to advance the technology of interventions. Specifically, once identified, investigators can measure the dysfunctional process, manipulate it through intervention, measure the predicted change, and examine the extent to which change in the putative deficits yields desired changes in psychological and brain functioning and, more importantly, in clinical and functional outcomes. In contrast to generic and static interventions, this personalized approach promotes the initiation, and maintenance of behavior change.

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