Goal Models: A Lay Theory Perspective

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Successful pursuit of multiple goals (e.g., health, career, family goals) is critical to personal well-being and social prosperity. However, despite significant research on how people manage single goals or even dynamics among two goals, people's understanding of the relations among all of their goals (i.e., goal structure) has not been extensively researched. To address this gap, this dissertation builds on the rich traditions in social science that study differences in people's lay theories about the nature of things and how they work. Synthesizing diverse scientific theories of goal structures (e.g., control theory, spreading activation theory), I proposed a novel framework to study lay theories of goal structure, or *goal models* (i.e., individuals' beliefs about the organizing principles of the relations among goals): hierarchical, network, and sequential. To study goal models, I borrowed mind-mapping techniques and developed methods to assess and manipulate individuals' goal models. Results of the validation study (Study 1) provided initial evidence that there is diversity in how people represent their goals, and that this diversity is well-captured by the goal model framework. Since these goal models highlight different organizing principles, I argue that they can confer benefits or involve costs, depending on the situation. Subsequent studies (Studies 2 to 7) tested the corresponding implications of goal models across self-regulatory situations (e.g., managing chronic goal conflict, goal progress) and presented evidence for the predictive validity of each model. This research contributes to the extant literature (on goals, self-regulation, lay theories, etc.) by providing a theoretical framework and scientific methods to systematically understand the nature and impact of the way individuals structure their goals. The findings on divergent implications of goal models offer

practical insights into the dynamics of regulating multiple goals, helping to promote effective self-regulation.

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Introduction

A consistent refrain of modern life is the lament for the many and varied demands that we must balance. Regardless of whether one's ambitions are broad or narrow, whether one's resources are vast or limited, whether triumphs or defeats call more frequently, to live is to juggle multiple goals. To fulfil one's goals—the internal representations of desired end-states (Austin & Vancouver, 1996)—is important not only because it leads to the direct attainment of desired outcomes, but also because it has far-reaching effects on life satisfaction, self-esteem, and health (e.g., Emmons, 1986, 1996; Emmons & King, 1988; Gray, Ozer, & Rosenthal, 2017; McGregor & Little, 1998; Sheldon & Elliot, 1999). Not surprisingly, psychology has a long tradition of studying goals that can be traced back to the earliest days of the discipline; it remains one of the most studied topics in psychology (Austin & Vancouver, 1996; James, 1890).

Research has focused on identifying the content of goals (e.g., Dweck & Leggett, 1988; Elliot & Thrash, 2001; Higgins, 1997; Higgins et al., 1987), describing the process of a goal pursuit (e.g., Carver & Scheier, 1982; Gollwitzer, 1990; Latham & Locke, 1991; Lord & Levy, 1994; Powers, 1973), unpacking the dimensions of goals that influence judgments and behaviors (e.g., Cesario, Corker, & Jelinek, 2013; Elliot & McGregor, 2001; Kahneman & Tversky, 1979), and examining how to make goal pursuit more effective (e.g., Baumeister, Heatherton, & Tice, 1994; Kluger & DeNisi, 1998; Locke & Latham, 1990). Despite the extensive goal literature, historically most of the work in this area has been geared towards understanding the psychological impacts of and on single goals (Austin & Vancouver, 1996). It is only in the past two decades that the direct study of *multiple* goals has drawn increasing attention in the social sciences and become an influential topic within self-regulation and motivation research (Ballard, Yeo, Loft, Vancouver, & Neal, 2016; Heckhausen, Wrosch, & Schulz, 2010; Kruglanski et al.,

2002; Louro, Pieters, & Zeelenberg, 2007; N. E. Miller, 1944; Vancouver, Weinhardt, & Schmidt, 2010).

The core assumption within the study of multiple goals is that even a single goal cannot be understood in isolation from an individual's other goals. People have diverse, multiple goals that co-exist and influence each other in a system (Kruglanski et al., 2002; Lord & Levy, 1994). People are active agents who construct relations among their goals (Bettman, Luce, & Payne, 1998; Huang, Zhang, & Broniarczyk, 2012). Consequently, successful pursuit of a given goal not only depends on direct actions towards that goal, but also on how people manage the relations (both positive and negative) among their host of goals (Emmons & King, 1988). Thus, in order to understand why people succeed or fail at self-regulation, it is critical to consider goals within the systems or structures they inhabit. Yet to date, most research on self-regulation has focused on addressing the impact of goal content (e.g., promotion/prevention goals, intrinsic/extrinsic goals; Higgins, 1997; Ryan & Deci, 2000) and the relations between two goals (e.g., goal conflict; N. E. Miller, 1944). Relatively little research has examined the impact of goal structure as a whole (Tomasik, Knecht, & Freund, 2017). I propose that people's subjective theories about the relations among their goals may have important influences on self-regulation.

To begin addressing these questions, my dissertation integrates research on goal relations and structure, lay theories, and self-regulation to propose a novel framework for examining individuals' lay theories of goal structure, or *goal models*. Based on theoretical and empirical work on goal structure, I propose a novel framework with three major organizing principles that might underlie individuals' goal models: hierarchical, network, and sequential. This line of research by no means aims to address how goals are actually represented in the brain. However, prior work on other types of lay theories—laypeople's assumptions about the nature of things

and how they work—reveals that they are powerful in influencing human behaviors, regardless of whether people's lay theories are scientifically accurate (Dweck, Chiu, & Hong, 1995b; Hong, Chao, & No, 2009). I introduce the idea that the unique organizing principles of each goal model lead to both benefits and costs depending on the types of outcomes examined, the affordances of a given situation, and the sensitivities of the individual. Knowing these contingencies adds to our understanding of why people succeed (and fail) at key self-regulatory challenges and pushes the boundary of the self-regulation literature to consider the impact of goal structure. Moreover, as lay theories are malleable (Dweck et al., 1995b), this knowledge also provides actionable insights into guiding people to devise a suitable goal model in response to their specific multiple-goal challenges, contributing to the promotion of more effective self-regulation.

I first provide a brief review of prior work on goal structure and the significance of adopting a lay theory approach. By integrating these two previously unrelated literatures, I then introduce the goal model framework and discuss in detail the potential characteristics of each lay theory (i.e., hierarchical, network, and sequential). Drawing on self-regulation research, I offer propositions for how each goal model may affect self-regulatory experience and outcomes differently across multiple contexts. Seven empirical studies are then presented. As no extant empirical work that I know of examines individuals' lay theories of goal structure, I developed novel methods to assess (Study 1) and to manipulate goal models (Study 3). I also tested the proposed hypotheses of each of the three goal models in relation to different self-regulatory challenges (Studies 2 to 7). Last, I will discuss the implications of this framework and future directions.

Goal Structure

The study of goal structure involves the study of the interrelations among goals (Austin & Vancouver, 1996; Unsworth, Yeo, & Beck, 2014): To what extent do an individual's goals work with, against, and beside one another? To understand the potential organizing principles that unite diverse goals, it is useful to first consider the simpler case of potential relations among two goals and then consider how questions of a more comprehensive goal structure builds on, complements, and diverges from that simple system.

At the most general level, there are three primary possibilities for the ways in which an individual's goals may interact: they may have no direct influence on each other (i.e., neither harm or help), they may directly facilitate each other (e.g., running with friends promoting both social and fitness goals), or they may directly conflict with each other (e.g., relaxing on a beach to pursue leisure goals versus working overtime to advance one's career; Gray et al., 2017). Not surprisingly, goal facilitation and goal conflict have received the most attention (Boudreaux & Ozer, 2013; Emmons & King, 1988; Kelly, Mansell, & Wood, 2015; Kleiman & Hassin, 2013; Presseau, Tait, Johnston, Francis, & Sniehotta, 2013; Riediger & Freund, 2004). Goal facilitation happens when the pursuit of one goal increases the likelihood of the success of pursuing the other (e.g., "get good grades, manage my time better"; Gray et al., 2017). Goal conflict happens when the pursuit of one goal hinders or excludes the pursuit of the other (Gray et al., 2017). Goal facilitation and goal conflict have been primarily examined with respect to two goals. These goals tend to be situation-specific (e.g., work and family, academic and social) and examined in relative isolation from other possibly related goals (Kelly et al., 2015; c.f. Turner-McGrievy, Wright, Migneault, Quintiliani, & Friedman, 2014).

Research on goal structure examines the interrelations among goals, each represented as a unit. People can hold vastly diverse goals which can be as abstract as values and identities (Mischel & Shoda, 1995; Schwartz & Bilsky, 1987) or as concrete as motives, projects, tasks, and actions (Gollwitzer, 1990; Malaviya, Brendl, & Miguel, 2014; McGregor & Little, 1998; Schmuck & Sheldon, 2001; Unsworth et al., 2014). Moreover, goal structure research builds on the study of dual goal relations that goals can be mutually influential (e.g., work-family, academic-social). Goals and dyadic goal relations are integral units to a goal structure (Kelly et al., 2015; Tomasik et al., 2017). However, the focal concern of a goal structure goes beyond the study of goals as single or dyadic units.

Compared to the focus on single goals, goal structures consider multiple goals—both adjacent and non-adjacent—simultaneously. In contrast to the focus on direct relations between two focal goals (e.g., work-family), a goal structure takes into account both type of relations (e.g., direct and indirect relations, facilitation and inhibition relations, presence and absence of relations) and configurations of goals relations (e.g., number of goals a goal is connected to; Austin & Vancouver, 1996; Kruglanski et al., 2002). If goals are diverse building blocks and goal relations represent how well they fit with one another, goal structure is the architecture into which goals can form.

As a whole, a goal structure's impact on self-regulation has the potential to be more than just the sum of its parts (i.e., goals and relations). Within a goal structure, goals vary in their positions and interrelations. However, these variations do not necessarily reflect the actual layout of goals in the brain (Austin & Vancouver, 1996). Even though goal structure is principle-driven, its functioning is not entirely rigid. A modern view of goal structure is to see it as a dynamic system (Kruglanski et al., 2002; Scholer, 2014). This means that goal interrelations are governed

by systematic principles, but these interrelations can change (e.g., when interacting with individual and situational characteristics).

Prior work on theorizing about goal structure offers three major organizing principles for conceptualizing how goals operate in a system. First, many classic theories proposed that goals operate vertically with hierarchical relations. Goals vary in importance (and level of abstraction) and form structures that resemble a hierarchy (Carver & Scheier, 1982b; Lord & Levy, 1994), pyramid (Maslow, 1943), or ladder (Trope & Liberman, 2010; Vallacher & Wegner, 1987). Second, other theories have viewed goals as interconnected on a more equal playing field, as a web or associative network (A. M. Collins & Loftus, 1975; Hebb, 1955; Kruglanski et al., 2002; J. Y. Shah & Kruglanski, 2000), tripartite groups (Deci & Ryan, 2000; McClelland, 1987), or branching tree (Sattath & Tversky, 1977; Solomon, Greenberg, & Pyszczynski, 1991). Third, other perspectives emphasize goal pursuit over time, where goals are steps or phases (Gollwitzer, 1990; Orehek & Vazeou-Nieuwenhuis, 2013) that are salient at different points of a timeline (Heckhausen et al., 2010). These three classes of theories present distinct sets of organizing principles of goal structures. I will come back to discuss these differentiations and potential implications in more detail in the section of the proposed goal model framework.

Limited Work on Subjective Theories

Despite theoretical work on how to conceptualize goal structure, the body of empirical research on goal structure is limited. No research that I am aware of has systematically tested whether individuals differ in their endorsement of these organizing principles and its influence on how they view relations among their goals. Work that has more narrowly examined components of goal structure, however, suggests that studying lay beliefs about goal structure is a promising direction as they may exert critical influences on self-regulation and well-being.

For instance, seminal studies conducted by Emmons and King (1988) showed that the valence of relations in a goal structure can affect one's psychological well-being. They asked participants to freely list personal goals and then rate, for each pair of goals, the extent to which they viewed the pursuit of one goal as hindering or facilitating the pursuit of another. The higher the level of conflict among goals, the more individuals reported negative affect and psychosomatic symptoms. Subsequent studies using similar methods also reported similar results (Lauterbach & Newman, 1999; Sheldon & Emmons, 1995; Slade & Sheehan, 1979; Tomasik et al., 2017; see the meta-analysis in Gray et al., 2017).

Research in goal system theory also examines how specific configurations of a goal with its adjacent goals can affect goal activation and motivation. For example, J. Y. Shah, Friedman, and Kruglanski (2002) showed that a goal's level of activation was influenced by the activation of its neighboring goals. Specifically, an increasing commitment to a focal goal deactivated its connected non-committed goals and their associated means. This effect is presumably subconscious and beneficial for goal striving. In addition, the motivation to pursue a given means or sub-goal is also affected by the number of goals to which the means is connected. In a series of experiments, Zhang, Fishbach, and Kruglanski (2007) revealed that people perceived a given means to have lower instrumentality with respect to each goal when it served multiple goals versus a single goal. As a result, in situations when only one focal goal was activated and people needed to choose a means to pursue the goal, people were less motivated to pursue the means that served multiple goals (vs. another means that only serve specifically the focal goal).

A Lay Theory Approach

Social science has rich traditions in the study of differences in people's subjective beliefs about the nature of things and how they work, which are broadly called *lay theories* (Dweck,

1996; Dweck & Leggett, 1988; Furnham, 1988; Zedelius, Müller, & Schooler, 2017).[1] The term lay theories comes from the idea that people resemble lay scientists who collect information from experience and derive explanations for the way they believe the world works (Gelman, 2004; Heider, 1958; Hirschfeld, 2001; G. A. Kelly, 1955). These lay theories are defined as knowledge structures or assumptions that people hold to make sense of the environment (Chao & Kung, 2015; Dweck, Chiu, & Hong, 1995a; Hong et al., 2009; Plaks, 2017). Most lay theories are context-specific: a person can have a collection of diverse lay theories, each unique to a particular situation or domain (e.g., lay theories of personality, empathy, intelligence, relationships, and race; Chao & Kung, 2015; Dweck & Leggett, 1988; Kung, Eibach, & Grossmann, 2016; Levy, Stroessner, & Dweck, 1998; Tullett & Plaks, 2016). Like personality, although there are reliable individual differences in lay theories, it is possible that a person's lay theories change across both time and situations (Dweck et al., 1995b; Plaks, 2017). Evidence suggests that lay theories can be modified momentarily or changed reliably when trained over time (Chiu, Hong, & Dweck, 1997; Kung et al., 2018; Leith et al., 2014; Yeager et al., 2016). As many people, unlike scientists, do not formally test theories they hold, people's lay theories may not be scientifically correct, and many people may not even be able to clearly articulate the theories without prompting (Dweck et al., 1995a; Furnham, 1988). However, even though lay theories may not be true in reality, they are influential in guiding people's attitudes and behaviors and thus are important to understand (Zedelius et al., 2017).

Substantial evidence shows that lay theories have critical impact on psychological outcomes (see Dweck, 1995a; Plaks, 2017; Prentice & Miller, 2007; Zedelius et al., 2017). The

[1] Similar ideas are commonly referred to as implicit theories and implicit beliefs, and types of lay theories vary, e.g., inheritability, immutability, entitativity, and psychological essentialism (Bastian & Haslam, 2006; Chao & Kung, 2015; Gelman, Coley, & Gottfried, 1994; Hamilton, Sherman, & Rodgers, 2004; Hong et al., 2009; Medin & Ortony, 1989; Plaks, 2017; Rothbart & Taylor, 1992; Yzerbyt et al., 2004).

classic study of lay theories focuses on people's assumptions about whether certain attributes (e.g., intelligence, race) are fixed or malleable characteristics (Plaks, 2017; Zedelius et al., 2017). For instance, people have different lay theories of intelligence—the extent to which people believe intelligence is fixed versus malleable—and this variation is particularly relevant in achievement settings, predicting academic outcomes such as grades and academic motivation (e.g., Rattan, Good, & Dweck, 2012; Robins & Pals, 2002; Yeager et al., 2016). People also vary in their lay theories of race (or culture), which refers to beliefs about whether race is a malleable social construction or a fixed attribute that differentiates people into meaningful social categories (Chao & Kung, 2015; Hong et al., 2009; No et al., 2008). Lay theories of race are especially influential in cross-cultural settings, affecting intergroup outcomes such as stereotyping (Chao, Hong, & Chiu, 2013; Plaks, Malahy, Sedlins, & Shoda, 2012), prejudice (Jayaratne et al., 2006; Williams & Eberhardt, 2008), intergroup anxiety (Chao, Chen, Roisman, & Hong, 2007), and intergroup trust and cooperation (Kung et al., 2018).

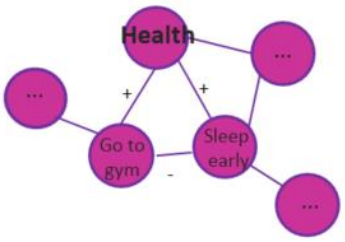
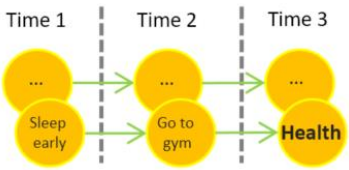
The perspective of distinguishing fixedness versus malleability beliefs is not the only framework in which people's lay theories can differ (Bastian & Haslam, 2006; Gelman, 2003; Yzerbyt, Judd, & Corneille, 2004). For example, in the domain of race, people also vary in the degree to which they believe racial groups share the same genetic dispositions (Plaks et al., 2012). Another example is in the domain of wisdom: lay people differ in their theories about what constitute as wisdom. People vary in the extent they believe a wise person to be practical, philosophical, and/or benevolent (Weststrate, Ferrari, & Ardelt, 2016); they also differ in viewing wisdom to be a matter of knowledge, cognitive ability, or emotional regulation (Grossmann & Kung, 2018). In short, the content of people's lay theories is flexible, and thus fits into diverse meaningful frameworks, usually depending on the domain.

From Scientific Theories to Lay Theories: A Goal Model Framework

Integrating the goal structure literature with a lay theory perspective, I argue that people may adopt different lay theories of structure to understand their goals (i.e., organizing principles among multiple goals)—I call these goal models. Just like other lay theories, individuals' goal models may not reflect how their goals are truly organized. Yet again, regardless of how goal structure truly operates, lay theories are powerful guides for one's subjective understanding of experiences and bases for actions (Furnham, 1988; Hirschfeld, 2001; Tversky & Kahneman, 1973). Therefore, lay people's goal models may have nontrivial influences on people's goal regulation. I used scientific theories of goal structures in the literature as the foundation for exploring variation in people's lay theories about goal structure. Based on this literature, I proposed three major organizing principles that might underlie individuals' goal models: hierarchical, network, and sequential. The summary of the framework is presented in Table 1.

When introducing this framework, I will describe each model's key organizing principles and signature characteristics in turn. Although it is possible that these principles may overlap and lay people can use multiple principles at the same time (Liberman & Trope, 2008; Lord & Levy, 1994), these queries remain to be tested. In theory, the three types of goal models represent organizing principles that are distinct from each other. Because these principles can be distinctive, it is critical to understand what specific influence each principle could exert on goal regulation. Drawing on self-regulation research, I propose how goal models may provide new insights into why and how people tend to succeed and fail at certain self-regulatory challenges. I will also describe the specific hypotheses that will be tested in my empirical studies, as examples of the implications of this new framework.

Table 1
A Goal Model Framework

	Hierarchical	**Network**	**Sequential**
Sample model (Circles represent goals)			
Organizing principle	Degree of Importance	Degree of Association	Time
Supporting theories	e.g., Action Identification Theory (Vallacher & Wegner, 1989), Control Theory (Carver & Scheier, 1982b; Powers, 1973), Construal Level Theory (Liberman & Trope, 2008), Goal Systems Theory (Kruglanski et al., 2002)	e.g., Accessibility Theory (Higgins, Bargh, & Lombardi, 1985), Spreading Activation Theory (A. M. Collins & Loftus, 1975)	e.g., Action Phase Model (Gollwitzer, 1990), Motivational Theory of Lifespan Development (Heckhausen et al., 2010)
Signature characteristics	Goals subsumed to important higher-order values and identities (e.g., I go to the gym and sleep early because I am a healthy person); lower-order goals serve higher-order goals.	Multiple and dynamic goal relations; more likely to reveal negative relations (e.g., to sleep early, I might not be able to go to the gym; though both promote good health).	Arranged by order of steps; highlight timing of goal-striving (e.g., I sleep early now, so that I can go to the gym tomorrow, and will get healthier); clear path to pursue a goal.
Proposed goal regulation implications	Rigidity, self-relevance	Awareness of dynamic (conflicting) goal relations	Sensitivity to progress
Hypotheses	Exacerbate negativity in goal striving among entity (vs. incremental) theorists (Studies 6 & 7)	Intensify chronic goal conflict experience (e.g., work-family conflict; Study 2) Induce (integrative) creative thinking (Study 3)	Amplify the (positive and negative) effects of goal progress on goal motivation (Study 4) Increase positivity in the goal-striving experience for people in locomotion (vs. assessment) mode (Study 5)
Key model index (Study 1)	Goal centralization	Goal interconnectedness	Goal disconnectivity

Three Emerging Goal Models: Differentiations and Implications

Hierarchical Models

As discussed earlier, many scientific theories of goal structure posit that goals operate vertically on a hierarchy (e.g., pyramid, ladder; Carver & Scheier, 1982b; Lord & Levy, 1994; Vallacher & Wegner, 1987). This class of approaches is called the hierarchical model. Hierarchical models organize goals of varying content (e.g., value, motive, actions) on different levels/ranks and have been the most influential in the study of goal structure (Austin & Vancouver, 1996). Although different hierarchical theories vary in the number of levels that they focus on and the terms used to describe each level (Bettman et al., 1998; Unsworth et al., 2014), they share several assumptions.

Degree of importance. The core assumption of a hierarchical model is the organizing principle that goals vary in their degree of importance. Within a hierarchy, goals fall into different ranks. Hierarchical theories posit that goals at the top of the hierarchy are the most important, abstract, and enduring, whereas goals at the bottom of the hierarchy are the least important, and the most concrete and transient (e.g., Carver & Scheier, 1982; Elliot, 2006; Kruglanski et al., 2002; Liberman & Trope, 2008; Vallacher & Wegner, 1987). Higher-order goals tend to be the person's identities and values (e.g., being healthy); lower order goals tend to be more concrete actions (e.g., going to the gym). Moreover, the levels of the hierarchy are interdependent such that one (or more than one) lower-order goal are means in place to serve the higher-order end-goal (Kruglanski et al., 2002). For instance, to be a healthy person, an individual goes to the gym regularly. Goals "know their place" within a hierarchical structure and priorities (higher-order goals) are clear.

Proposed implications and hypothesis. The use of a hierarchical model may affect people's perceptions of the structural relations among goals. One implication that I propose is rigidity in the view of goal relations. Although there is flexibility in hierarchical models (given that a higher-order goal can often be served by different lower-order goals), the structure itself is relatively rigid. Higher-order goals (e.g., values) tend to be more stable, staying in their position (Schwartz & Bilsky, 1987). For instance, the abstract goal "health" does not easily shift downwards to a lower-order position. Lower-order goals have 'no way out' but to serve the higher-order goal. This phenomenon is like people in a social hierarchy. Just as a social hierarchy solidifies differences between people of varying statuses and imposes a sense of order (e.g., Magee & Galinsky, 2008), the use of a hierarchical model may solidify differences between ranks of goals and may elevate the sense of rigidity in goal relations.

Further, another implication of a hierarchical model I propose is its emphasis on the self in goal regulation. As discussed earlier, within a hierarchy, higher-order goals tend to be abstract personal identities and values (e.g., being healthy), and lower-order goals tend to be concrete actions (e.g., going to the gym). By subsuming lower-order goals to higher-order goals (Schwartz, 1994), the hierarchical structure makes the personal meaning behind goal pursuit apparent: the higher order goal (i.e., being healthy) explains why people engage in the lower goal (i.e., going to the gym). While this vertical connection draws personal meaning to an action, it is also drawing more attention to the self (Fujita, Trope, Liberman, & Levin-Sagi, 2006; Johnson, Chang, & Yang, 2010; Oyserman, 2007). This makes the self relevant in both the success and failure of the attainment of the lower-order goal, which could have potential consequences for goal-regulation.

Rigidity and self-relevance in a hierarchical goal model may have both upsides and downsides to goal regulation. On the one hand, hierarchical models may provide a clear picture of the relative importance of goals, making goal prioritization efficient (Ballard, Yeo, Loft, et al., 2016; Ballard, Yeo, Neal, & Farrell, 2016). Moreover, hierarchical models may also highlight personal meaning behind goal striving, increasing the sense of purpose or clarity of self-concept that can result in many positive psychological outcomes (J. D. Campbell et al., 1996; Steger, Kashdan, Sullivan, & Lorentz, 2008). On the other hand, the stability and self-relevance of (higher order) identities and values can trickle down the hierarchy, instilling even transient (lower-order) goal challenges with personal meaning and permanence that make goals seem inescapable in a hierarchical model (e.g., I go to the gym to be a healthy person). These properties can be bad news for people who are fatalistic about their sense of self.

The self-regulation literature suggests that individuals differ in the extent to which they view the person to be fixed (entity theories) or malleable (incremental theories) on a continuum, called implicit person theory (Dweck, 1995a). Holding the belief that personal character traits cannot be changed, entity theorists have the need to prove themselves and tend to exhibit helplessness when facing failure or challenge (Chiu et al., 1997; Dweck et al., 1995b). In contrast, incremental theorists, who see personal character traits as malleable, experience challenges and failures as learning opportunities and focus on achieving mastery (Robins & Pals, 2002). In many cases, because entity theorists are more likely to see goal-striving as a fatalistic and self-threatening process, they report significantly more negative goal-striving experiences, such as lower self-esteem, lower satisfaction, and lower goal motivation (e.g., Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 1999; Dweck & Leggett, 1988). While most research that aims to help entity theorists focuses on changing their person theory altogether (Blackwell et

al., 2007; Yeager, Trzesniewski, & Dweck, 2013), little research has examined factors that can moderate the effect of the entity theory on goal motivations and outcomes (Kung et al., 2018).

Drawing on properties of hierarchical models, I argue that people's lay theory of goal structure may offer a new perspective to understand when the effects of entity (vs. incremental) theory are exacerbated and diminished. Specifically, a hierarchical model could be harmful to those who have strong entity (vs. incremental) beliefs about personal character traits. Its relative rigidity may enhance entity theorists' fatalistic assumption about goal pursuit, exacerbating their helpless reactions. Moreover, adding the characteristic that a hierarchical model tends to subsume goals to stable self-relevant traits and values, using a hierarchical model may also intensify entity theorists' proneness to self-threat in goal pursuit. Put together, I hypothesize that having a hierarchical goal model may exacerbate entity (vs. incremental) theorists' negative goal-striving experience (e.g., lower satisfaction and motivation). The current research will test the hypothesis as an illustration of the implication of the use of a hierarchical model (Studies 6 and 7). If the hypothesis is supported, the results will highlight the importance of understanding people's goal models as well as offering a new angle into understanding the effects of entity (vs. incremental) person theory in self-regulation.

Network Models

A different type of lay theory instead conceptualizes the model as a web or network. In early goal theories, goals are viewed as vectors with direction and magnitude in a life space that can form a network-like map (Lewin, 1943, 1951). Classic cognitive theories in the mental representation of concepts similarly proposed that mental representations, like goals, are connected like a web or neural-network (A. M. Collins & Loftus, 1975; Higgins et al., 1985). These ideas influenced modern theories of goals, presenting goals as an interconnected model

(e.g., needs theory; McClelland, 1987), also called an associative network (J. Y. Shah & Kruglanski, 2000).

Degree of association. The central idea of network models is the principle that goals are related by association. Associations are versatile: most of them are either faciliatory or inhibitory (Gray et al., 2017; Presseau et al., 2013). By association, the activation of a given goal can make it more or less likely that a connected goal is also activated (A. M. Collins & Loftus, 1975; Forster, Liberman, & Friedman, 2007). In a network model, the more relevant goals have more or stronger associations, and thus may be clustered together (A. M. Collins & Loftus, 1975). Yet, a network model should be less rigid than a hierarchical model. Goals in a network model are on a relatively equal playing field. Connecting goals by association, network models have fewer restrictions on both how and why goals are connected (A. M. Collins & Loftus, 1975). Goals can be connected in a network simply by semantic or domain relevance. For instance, 'going to the gym' and 'sleeping early' can be associated because they are both related to the domain of health. In short, as connection by association is less restricted, network models should generate a more interconnected structure.

Proposed implications and hypotheses. The use of a network model may influence perceptions of goal relations. First, network models may offer a more flexible view of goal relations. The association principle is more likely to highlight multiple relations among goals, drawing people's attention to how goals are related to one another with many possible direct and indirect pathways (e.g., going to the gym activates the health goal, and the health goal activates the goal to go to sleep early). Moreover, the association principle of network models can potentially reveal more dynamic relations among goals. Network models make salient the possibility that relations among two goals can be positive or negative. By drawing attention to

multiple relations, a network model may increase people's awareness of conflict among goals. For example, conflict can happen between "going to the gym at night" and "to go to sleep early", even though both facilitate the goal of "being a healthy person." By highlighting the dynamic (conflicting) relations among goals, network models may have implications for how people react to a conflict situation.

Managing goal conflict is an immense and inevitable challenge for most people. Goals often conflict with one another, presenting trade-off scenarios where achieving one goal frequently means sacrificing some other goal. While goal conflict is inevitable, people can vary in the extent to which they are aware of it (Frederick, Novemsky, Wang, Dhar, & Nowlis, 2009; Savary, Kleiman, Hassin, & Dhar, 2015). Most conflict research to date conceptualized this awareness as a result of individuals' abilities/personalities (e.g., Sharma & Bottom, 2013) and of situational characteristics (e.g., Jehn, 1997; A. K. Shah, Shafir, & Mullainathan, 2015). I argue that individuals' lay theory of goal structure also matters. The lay theory of goal structure may present a new way to understand why differences in conflict awareness and experience can occur. Specifically, I propose that the use of a network model may increase people's conflict awareness, which may be a double-edged sword in conflict situations, depending on whether the goal conflict can be easily resolved.

By nature, some goals are more likely to be in persistent conflict than others, such as work and family goals, academic and social goals (Fishbach & Dhar, 2005; Major, Klein, & Ehrhart, 2002). The tension between chronic goals is difficult to resolve, and a reminder of the conflict can cause added distress that hinders people from successfully resolving the conflict (e.g., Major et al., 2002). In this context, network models are potentially problematic. I propose that, despite its overall flexibility in the structure, by increasing the awareness of conflict in goal

structure, network models may exacerbate distress and undermine the ability to resolve chronic goal conflict. If so, the goal model framework would be critical for the understanding of conflict management. This is because the use of network (versus other) goal models may explain why people often have varying experience in similar goal conflict, and report varying levels of satisfaction and resolution (Curhan, Elfenbein, & Xu, 2006; Netemeyer, Boles, & McMurrian, 1996).

As an illustration of this proposition, I tested the association between the use of a network model and workers' experience in managing work-family conflict (Study 2). If the hypothesis is supported, people who adopt a network model to understand their goals will also report experiencing a higher intensity of the work-family conflict. The results will add knowledge of the role of goal models in understanding people's conflict management experience and outcomes.

Whereas conflict between chronic goals can be tenacious, other conflict situations tend to be relatively transient, such as making consumer choices (e.g., eat pizza vs. sushi, watch a comedy vs. documentary; Laran & Janiszewski, 2009). In these situations, the awareness of goal conflict may not always be harmful. In fact, because the awareness of conflict can be the precursor for a person's ability to integrate seemingly conflicting goals or ideas, conflict awareness may facilitate the attainment of synergistic outcomes (Frederick et al., 2009).

A common example of these conflict situations is those that call for creativity. Creativity is a key predictor of individual and organizational success (Anderson, Potočnik, & Zhou, 2014). Cognitive research on creativity suggests that creativity can be hard to come by because individuals are typically biased to ignore interconnections between ideas. For instance, workers falsely place more emphasis on their initial ideas and fail to converge them with subsequent

insights for a more creative product (e.g., Berg, 2014). Moreover, people tend to have exaggerated perceptions of how different opposing ideas are (Thompson, 1990), lacking the motivation to integrate seemingly unrelated ideas and missing out on creative solutions. By increasing people's awareness of the dynamic relations between conflicting ideas, I hypothesize that network models may increase integrative thinking and hence creative performance.

In one of the studies presented later (Study 3), I manipulated goal models and tested whether the use of a network model has a spill-over effect of creativity on tasks unrelated to the domain of the goals. If network models induce creative thinking, the findings will not only provide evidence for the importance of the goal model framework but also shed light on the understanding and promotion of creativity.

Sequential Models

Finally, the third model (sequential model) highlights an organizing principle that is silent in the previous two—time. Not surprisingly, time is another organizing principle emphasized in many theories of self-regulation. Classic phase models of self-regulation distinguish between deliberation (deciding what goal to pursue) and implementation (the act of goal pursuit itself; see Gollwitzer, 1990). Strategies for pursuing dual goals can be concurrent or sequential (i.e., one at a time; Laran, 2010; Orehek & Vazeou-Nieuwenhuis, 2013). Life-span development models organize people's life goals on a timeline (Heckhausen et al., 2010). These models examine how goal regulation unfolds over time; one's current location in the process affects relevant concerns, attention, and emotion.

Time. The central idea of a sequential structure is the principle of time. Goals in sequential models are arranged in chronological order or on a timeline, from one phase to another. Because time is linear, sequential models tend to shape like a chain(s). Goals in a

sequence are interdependent in that the completion of one goal leads to the initiation of another goal. In other words, the pursuit of a goal depends on the completion of a prior goal or step. For example, "to sleep early" can be viewed as a step prior to "going to the gym", and "going to the gym" can be viewed as a step prior to "attaining good health." In this example, not sleeping early enough (i.e., not fulfilling the prerequisite goal) implies an inability to attain the subsequent goal (e.g., insufficient energy to go to the gym). Therefore, concerns about the progress or timing of these chains are particularly salient in sequential models.

Proposed implication and hypotheses. By making salient the passage of time, I propose that a sequential model may increase people's sensitivity to goal progress. Goal progress is defined by how well and how quickly people are closing the gap between the current state and the desired end-state (Carver & Scheier, 1982; Johnson, Howe, & Chang, 2012). Goal progress information has critical implications for self-regulation. A person's progress to a goal provides informational feedback about whether the person should continue to invest in (and withdraw from) the goal (Carver & Scheier, 1982b; Earley, Northcraft, Lee, & Lituchy, 1990). It predicts critical self-regulatory outcomes such as affect, motivation, and success in goal-pursuit (Carver & Scheier, 1982; Johnson et al., 2012; Lord & Levy, 1994; Schmidt & DeShon, 2007).

Goal progress has been studied extensively and shows divergent effects on affect and motivation depending on the situation (see Fitzsimons, Friesen, Orehek, & Kruglanski, 2009). In single-goal settings where people are focused primarily on only one goal (among other present goals), high goal progress is usually motivating. To explain: as long as progress is not high enough to cause coasting (Carver, 2003), high progress induces positive affect and signals that further effort into the goal is warranted; on the contrary, low goal progress induces negative affect and signals that further effort into the goal might be futile (Ilies & Judge, 2005; Orehek,

Bessarabova, Chen, & Kruglanski, 2011). Despite some research that has examined how situations and framing effects can alter people's sensitivity to goal progress in single-goal settings (e.g., Huang, Jin, & Zhang, 2017; Koo & Fishbach, 2008), relatively little is known about mindsets that can change people's reaction to progress information. I propose that, by highlighting the role of time, the sequential model may serve as a critical mindset that predicts sensitivity to progress and have critical implications in progress-related self-regulatory contexts.

The use of a sequential model may have both upsides and downsides in single-goal settings depending on how much progress a person has made. By increasing sensitivity to progress, sequential models may amplify the (positive and negative) affective responses of goal progress and influence goal motivation. When goal progress is high, a sequential model can be beneficial as sensitivity to progress may increase proactivity toward pursuing the goal. In contrast, when goal progress is low, a sequential model can be harmful as sensitivity to progress may reduce proactivity toward pursuing the goal. The present research will test this hypothesis (Study 4). Considering the nuance that extreme high progress can reduce effort as it reaches a certain threshold that causes people to coast (Carver, 2003), the study will only examine the effect of less extreme high progress. If it is true that sequential models moderate reactions to progress information, the results will contribute to the progress literature by uncovering a new antecedent of sensitivity to progress.

Further, beyond state-level differences in progress, another perspective to look at progress is the degree to which an individual is sensitive to progress and movement in general among other critical features of self-regulation. Regulatory mode theory posits that these tendencies can be categorized as two distinct motivational functions: making critical evaluation and comparisons (assessment mode) versus generating action and change (locomotion mode;

Higgins, Kruglanski, & Pierro, 2003). Being in a locomotion (vs. assessment) mode increases preference for change and state-to-state movement (Scholer, Eitam, Stadler, & Higgins, 2017), encourages people to make progress (at the expense of making the right choice; Mannetti et al., 2009), and enhances attraction toward straightforward means that lead to a single end-goal (Orehek, Mauro, Kruglanski, & van der Bles, 2012). Given that people with different regulatory modes focus on different information in self-regulation, it is critical to consider how ways to increase (or sustain) their motivation and satisfaction may also differ (Orehek et al., 2012). However, the extant literature is limited in offering what these strategies can be.

To this end, I propose that the way individuals understand their goal relations matter. Specifically, because sequential models highlight the passage of time, they are more likely to fit a locomotion (vs. assessment) mode in the pursuit of goals. Regulatory fit is a positive state that happens when people's regulatory orientation (e.g., locomotion, assessment) matches with their manner of goal pursuit and sustain the regulatory orientation (Avnet & Higgins, 2003; Higgins, 2000, 2005). When there is fit, people tend to "feel right" about it and become more engaged in the goal pursuit, typically resulting in a more positive goal-striving experience (Higgins, 2005). Goal models could be a factor that influences people's manner of goal pursuit, and therefore affect their fit experience. Sequential models organize goals in a linear fashion and present goals as consecutive steps from the beginning to the end. This structure may create a sense of movement from one goal stage to another (compared to the other two models). Locomotors are sensitive to movement and change in self-regulation (Higgins et al., 2003), and the use of a sequential model may help sustain their orientation in the pursuit of goals. Some indirect evidence supports this claim, arguing that people with a locomotion mode find value in a one-and-only path to pursue a goal (vs. having alternative paths; Orehek et al., 2012), which

resembles the signature property of a linear construction in a sequential model. In short, sequential models seem to fit those who have a locomotion (vs. assessment) mode and may lead to more positivity in their self-regulation experience. This fit hypothesis will also be tested in the current work (Study 6), not only as an illustration of the implications of sequential models, but also to provide new insights into promoting better goal-striving experience in ways that fit a person's regulatory mode.

Summary of the Goal Model Framework

In sum, synthesizing diverse scientific theories of goal structures (e.g., control theory, spreading activation theory), three major organizing principles emerge. *Hierarchical Models* highlight goals in terms of their relative importance, subsuming lower-order goals as actions in service to personal identity or values; *Network Models* highlights relations among goals as associations in a web or neural-network, revealing multiple and dynamic relations among goals; *Sequential Model*s arrange goals on a chronological or logical timeline, making salient the concern of progress or timing. Because of their popularity in the literature, these principles may also reflect the varying lay theories of goal structure people have in understanding the relations among their goals. The potential implications of goal models for self-regulation are diverse and critical and the current research will test some of these implications. Results will enrich the literature by illuminating whether and how goal models have distinct impacts on self-regulation experience and outcomes.

I will present a series of studies conducted to examine the goal model framework and its implications for self-regulation. This empirical research serves three aims. First, it examines the validity of the goal model framework to generate new knowledge for the understanding of lay theories and goal structure. Second, it develops the methods that allow for the assessment and

manipulation of goal models to facilitate the scientific study of lay theories of goal structure. Third, it tests some of the proposed implications of the goal models to add new insights into factors influencing our success (and failure) in self-regulation effectiveness.

Overview of Studies

Since no prior work has examined lay theories of goal models, Study 1 developed a novel assessment method and tested various forms of construct validity (e.g., content validity, divergent validity). Subsequently, Studies 2-7 explored specific implications of goal models (i.e., predictive validity). I conducted three pairs of studies, each testing hypothesized effect(s) related to the tradeoffs of each goal model. Specifically, the studies investigated whether network models are related to more salient chronic goal conflict (Study 2), yet also increase integrative creativity (Study 3); whether sequential models amplify the motivational response to goal progress (Study 4), and whether this depends on individual differences in regulatory mode (Study 5); and whether hierarchical models lead people who believe strongly that the self is fixed (vs. incremental) to be less satisfied (Study 6) and motivated (Study 7) in goal striving.

Study and sample details are summarized in Table 2. The studies were conducted between 2014 to 2017. In studies conducted more recently (Studies 2, 3 and 5), I performed power analyses before data collection to determine the target sample size. Estimates of a priori power analyses and sensitivity power analyses (Faul, Erdfelder, Buchner, & Lang, 2009) are reported in detail in Table 2. Moreover, no data analysis was conducted before data collection for a given study was complete and all exclusion criteria in the study are reported. All self-created measures, namely the goal model methods, are presented verbatim in the appendices. Together, these studies provide a systematic examination of the goal model framework and its implications across many self-regulation contexts.

Table 2

A Summary of Study Details and Basic Sample Demographics

	Study 1			Study 2	Study 3	Study 4	Study 5	Study 6	Study 7
Sample									
N	141 (Sample A)	100 (Sample B)	94 (Sample C)	245	191	139	217	94[a]	200
Year	2014	2015	2014	2017	2017	2016	2017	2014	2016
Country	Canada	Hong Kong	Canada	Australia, Canada, USA, UK	Canada	Canada	Canada	Canada	Canada
Source	Psych participant pool	Business participant pool	Waterloo campus	Prolific Academic	Psych participant pool	Psych participant pool	Psych participant pool	Waterloo campus	Psych participant pool
Sample size and power considerations[b]	No a prior power analysis. The sample size was determined by a rule-of-thumb of about 50 per group (i.e., 150 in total) and the availability of participants in a semester. The target sample size was doubled given the uncertainty of the actual size of the effect.			The minimum sample size was 250 for .95 statistical power to detect a medium-sized effect. I aimed to recruit 300.	The minimum sample size was 159 for .80 statistical power to detect a medium-sized effect. I aimed to recruit 200.	No a priori power analysis. The sample size was a result of the availability of participants in a semester.	The minimum sample size was 159 for .80 statistical power to detect a medium-sized effect. I aimed to recruit 200.	No a prior power analysis. The sample size was a result of the availability of participants in two months.	No a prior power analysis. The sample size was a result of the availability of participants in a semester.
Sensitivity: The smallest detectable effect size [c]	A small-to-medium effect (η_p^2 = .03)			A small-to-medium effect (η_p^2 = .03)	A small-to-medium effect (η_p^2 = .05)	A medium effect (η_p^2 = .07)	A small-to-medium effect (η_p^2 = .05)	A medium-to-large effect (η_p^2 = .08)	A small-to-medium effect (η_p^2 = .04)
Design									
Target goal model of study	All			Network	Network	Sequential	Sequential	Hierarchical	Hierarchical
Goal model method	Assessment			Assessment	Manipulation	Manipulation	Assessment	Assessment	Manipulation
Focal outcome(s)	Validity measures			Work-family conflict	Integrative & divergent creativity	Academic motivation	Self-esteem & life satisfaction	Self-esteem & life satisfaction	Academic motivation

Relevant table(s)/figure(s)	Tables 2-6, Figures 1-2			Table 7, Figure 3	Tables 8-9, Figures 4-6	Tables 10-11, Figure 7	Table 12, Figure 8-9	Table 13, Figure 10-11	Table 14, Figure 12
Basic demographics									
Age median	19	19	21	37	19	19	21	21	19
% Female	80	53	58	47	72	74	78	58	82
Race									
% White	53	6	35	87	35	39	35	35	39
% Black	1	0	1	3	4	1	5	1	1
% Asian	37	94	60	7	48	46	49	60	49
% Middle Eastern	6	0	0	0	2	3	3	0	3
% Hispanic	3	0	2	3	1	1	1	2	1
% Other	0	0	2	0	10	10	7	2	7

Note. [a]Same sample as Study 1 Sample C. [b]All power analyses used the standard .05 alpha error probability and the medium effect-size value of $\eta_p^2 = .06$. [c]Sensitivity analysis reports the smallest significant effect size the given sample size can detect (Faul et al., 2009). All sensitivity analyses used the standard .80 power and .05 alpha error probability (two-tailed).

Study 1: Validity of the Goal Model Framework and Its Assessment

Study 1 was conducted to validate a new method to assess goal models. I borrowed techniques from concept-mapping (e.g., to develop a goal model assessment task. In the task, participants freely created a concept map of their goals to represent their goal model. Afterward, participants were presented the prototype(s) and description of the three proposed models. They rated how similar their model was to each proposed goal model and identified the goal model that had the closest fit with the drawing of their goal model. For clarity, I will refer to participants' goal model drawing as their 'goal map,' whereas I will refer to the three proposed goal models as goal models.

Using this self-report categorization method has its advantages. Since participants vary in their visualization skills, their drawn models might not make all goal-structure relevant information accessible. Hence, participants should have a deeper insight into their goal map and a more accurate assessment of their own model. This self-identification method is not uncommon in social sciences and is often preferred especially when the assessment of a construct requires deep and personal insights (e.g., adult attachment scale; N. L. Collins & Read, 1990). The validity of this method was put to the test.

I conducted several analyses to test the validity of the goal model assessment method. They included tests of discriminant validity, content validity, convergent validity, and objectivity or intersubjective agreement. Results of these validity tests not only generate evidence for the utility of the goal model assessment method, but also for goal models as a theoretical framework if the ways individuals spontaneously organized their goals indeed fit onto the proposed three goal models. The specific aim of each analysis is explained as follows.

Discriminant validity concerns the measurement's ability to differentiate concepts that are independent (D. T. Campbell & Fiske, 1959). In the current research, it would be informative to know whether participants' responses can empirically separate the three goals models. Discriminant validity would be high if participants view their goal model to be uniquely similar to one of the three proposed goal models; discriminant validity would be low if participants view their goal model to be equally (dis)similar to all goal models. To test discriminant validity, I included items measuring participants' perception of the similarity between their goal map and the prototype of the proposed models.

Content validity concerns whether the three types of goal model covered most, if not all, variations in how participants represented their goal structures (Haynes, Richard, & Kubany, 1995). If content validity is high, participants should rate their goal model to be highly similar to (at least) one of the goal model prototypes, and if content validity is low, participants should rate their goal model not to be similar to any of the goal model prototypes. Participants' self-report perception of the similarity between their goal map and the prototype of the proposed models allows the test of content validity.

Convergent validity refers to the degree to which the focal measurement is associated with other operationalizations that are theoretically similar (D. T. Campbell & Fiske, 1959). Given the novelty of the goal model framework, not surprisingly there were no similar measures in the literature that were developed to directly identify structural differences of goal models. However, building on graph theory and the sociological study of structural differences of a social network, I developed indices based on social network indices (Borgatti, Mehra, Brass, & Labianca, 2009) that could operationalize properties of specific structures of goals and used them to test convergent validity of goal models.

Last, to empirically address the validity of the self-report nature of the assessment method, I examined the extent to which participants' self-report ratings aligned with third parties' ratings (e.g., Dunning, Heath, & Suls, 2004), which can broadly be called objectivity. Typically, objectivity suffers in self-report measures of socially desirable characteristics, such as perspective taking and wise reasoning (Brienza, Kung, Santos, Bobocel, & Grossmann, 2017). Though there was no apparent reason to expect any of the three proposed goal models to be particularly socially desirable (c.f. Duckworth, 2016), whether people can report their goal models rather objectively is an empirical question. To test this question, I recruited coders to independently assess participants' goal models. If objectivity is high, the coders' ratings and the participants' own rating of their goal models will be highly consistent.

Method

Power, participants, and design. As a proof-of-concept study, statistical power and generalizability are especially critical. To this end, several steps were taken in the study design to increase sample size and sample diversity. To increase the cultural and academic diversity of the study sample, I recruited participants through three sources. The first sub-sample (Sample A; n = 144) was recruited through the University of Waterloo Psychology Participant Pool, where participants completed the study for one course credit. The second sub-sample consisted of business undergraduates (Sample B; n = 103) recruited through the Hong Kong University of Science and Technology Management Studies Participant Pool. This sample has mostly Hong Kong Chinese, and they participated in the study for one course credit. The last sub-sample was recruited at booths set up at the University of Waterloo libraries and student centers (Sample C; n = 100), and participants received a snack bar and entered into a draw for 50-dollar cash prizes as the remuneration of their participation (see Table 2 for details of sample demographics). The

three sub-samples are collapsed for the main analyses, totaling 347 participants. Among them, 12 did not complete the study or had missing data, resulting in a final sample of 335 for analysis.

In the study, participants completed two separate paper-and-pencil survey booklets. One booklet comprised the goal model assessment task, in which participants drew a model to represent the relations among their goals. The other booklet contained a battery of individual differences measures, including exploratory individual differences measures[2] and demographic questions. To avoid order effects, participants completed one booklet at a time, and the order of the booklets and the order of scales inside the personality booklet were counterbalanced. Survey order did not affect the patterns of results.

Goal model assessment. In this task, participants first thought about their goals in life, and were given a black color pen to visualize their goals:

> "In the space below, please think about your goals in life, and create a diagram or concept map to organize and present your goals visually. Please label all elements of your map/diagram/figure."

After drawing their goal map, they were presented three goal model prototypes with descriptions, as shown in Figure 1. They were asked to read all the descriptions and then identify how similar each of the models were to the participants' goal map.

[2] In the current and following studies, I included various types of personality (e.g., Big Five) and thinking style measures. Details are presented in full in Appendix J (and online as well for the preregistered studies). Because these measures were not the main focus of the study and did not affect the main finding presented, results of these measures are not reported in text for parsimony.

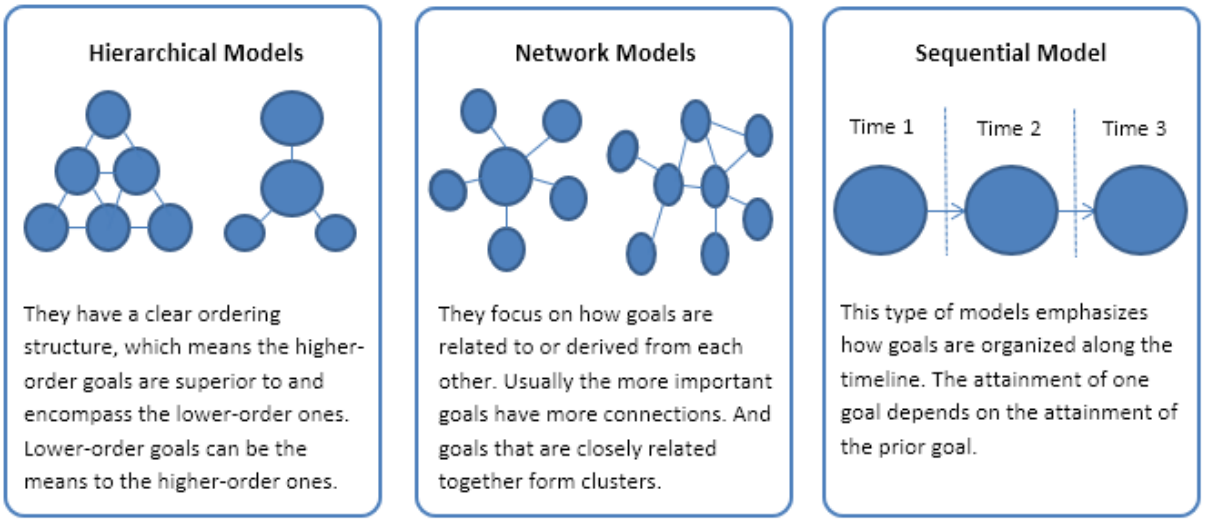


Figure 1. Goal Model Prototypes and Their Descriptions in Goal Model Assessment.

Similarity rating toward goal model prototypes. To assess the similarity of participants' goal map to each type of goal model, participants responded to the question, "How much do you think each of the examples is similar to your own view of goals?" For each model prototype, they rated similarity on a scale from 1 (*Not at all similar*) to 7 (*Extremely similar*). The order was fixed for all participants: they first rated hierarchical, then network, and last sequential. The variation in these similarity ratings was used to examine whether laypeople could differentiate the three models and to test how much the conceptualization of the models overlap with each other (i.e., discriminant validity).

Self-categorization of goal models. Afterward, participants self-identified their goal model by ranking the three models from "1 – the closest fit" to the "3 – the least close fit." Participants' choice of the most closely fitting model was used as the categorization of participants' goal model (see Appendix A for full instructions).

Indication of goal relations. To measure participants' goal relations, participants were instructed to use different color pens to make indications on their goal map. Critically, they were

told not to add or erase any goals already on the goal map, and only make indications of the goal relations. Specifically, they used a blue and red pen to indicate the valence of any existing relations among their goals. They were told to use a "+" sign to indicate cases where the pursuit of a given goal facilitates/helps the pursuit of the associated goal; to use a "-" sign to indicate cases where the pursuit of a given goal hinders/excludes the pursuit of the associated goal.

Transforming goal maps into numerical matrices. To analyze goal relations quantitatively, I borrowed graph theory methods and transformed information on the goal maps into numerical matrices (Hanneman & Riddle, 2005). I trained 8 coders to do the transformation in Excel. In brief, the coders used goal names as the header column and header row of a matrix, and then recorded the relations in the cell between each pair of the goals (see full instructions in Appendix B). To minimize error, I randomly assigned each goal map to two coders and compared their matrices (inter-rater reliability: *r*s > .94).[3] Discrepancies were resolved through discussion and the final revised matrices were used in the analysis. These matrices were used to calculate goal model indices that represent variations in proposed goal structural properties and test convergent validity (see details in the result section).

Goal importance. To explore whether there were robust differences in single goal properties across goal models, I included an item measuring goal importance in the survey. Goal importance captures many vital goal content properties, such as goal commitment (Talevich, Read, & Walsh, 2014) and abstractness (Vallacher & Wegner, 1987). For each of the goals on the goal map, participants answered the question of 'How important is each goal to you at this point in your life?" from 1 (*Not at all important*) to 11 (*Very important*).

[3] I calculated a basic network density score (i.e., number of relations divided by the maximum possible number of relations) for each coder's matrix (Hanneman & Riddle, 2005). The degree of deviation from a perfect positive correlation (i.e., 1.00) represents the level of inconsistency in coding.

Task Experience. Last, to understand participants' subjective experience in the goal model assessment task, at the end of the survey I included several Likert-scale items. They measured the extent to which participants felt the task was simple (from 1 = *Not at all* to 5 = *Very simple*), felt the task was strange (from 1 = *Not at all* to 5 = *Extremely*), and how well they felt their goal map represented how they see their goals (from 1 = *Not at all* to 5 = *Extremely representative*).

Results and Discussion

Descriptive analyses. In the total sample, thirty-eight (11%) participants categorized their goal map as a hierarchical model, one hundred and thirty-five had a network model (40%), and one hundred and sixty-six had a sequential model (49%). Sample diagrams from participants are presented in Appendix C.

This overall distribution of goal models was consistent across national samples: the distribution did not differ across the Canadian (Samples A & C) and Hong Kong samples (Sample B), χ^2 (2) = .34, p = .845. Moreover, there was no significant difference in the distribution across gender, χ^2 (2) = 3.00, p = .223, age, χ^2 (2) = 3.46, p = .177, race, χ^2 (12) = 11.57, p = .481, and program major, χ^2 (14) = 17.74, p = .219. Interestingly, there was a trend that older participants tended to have a hierarchical model, B = .08, SE = .05, Wald(1) = 2.52, Exp(B) = 1.08, p = .113, perhaps due to their great integration of goals and clarity of self-concept (J. D. Campbell et al., 1996). This is a pattern that would need to be re-examined in a sample of a wider age range.

Participants thought the goal model assessment task was moderately simple (M = 3.36, SD = 1.12), not particularly strange (M = 2.42, SD = 1.09), and their goal map adequately represented their goals (M = 3.35, SD = .97). These ratings did not differ as a function of

participants self-categorized goal models, *p*s > .264. These descriptives suggest that, from the participants' perspective, the task seemed to be viable and useful for assessing their goal models.

Discriminant validity (among the goal models). To test discriminant validity, I examined ratings of similarity toward the goal model prototypes (within-subjects: hierarchical, network, sequential) as a function of participants' self-categorized goal model (between-subjects: hierarchical, network, sequential). Because of the mixed design, I conducted a mixed-model ANOVA. Results showed a significant interaction, $F(4, 666) = 123.39$, $p < .001$, $\eta_p^2 = .43$, suggesting that the pattern of similarity ratings differed as a function of participants' self-categorized goal model.

To unpack the result, I created three dummy variables and each contrasted one goal model with the other two (e.g., Hierarchical Model: hierarchical = 1, network = 0, sequential = 0). For each dependent variable, I conducted three separate t-tests, using one goal model dummy variable at a time. This analytic strategy allows the test of a target goal model effect, in comparison to the two other models. These contrasts were used because they were conceptually straightforward and they matched closely with my predictions (i.e., testing how the use of one model differed from the other two).[4] Results of the t-tests are reported in Table 3.

[4] Alternatively, one could use multiple dummy-coding or effects-coding in multiple regression to look at how a goal model differ from one other specific goal model or from the grand mean, respectively. The use of these alternative analytical strategies yielded similar patterns of results and the same interpretations of the findings.

Table 3
Independent t-tests: A Goal Model (vs. Other Two) Predicting Similarity toward Each Goal Model Prototype (Study 1)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Hierarchical Prototype	1. Hierarchical	5.97	1.08	2.65***	.27	9.79	<.001	[2.12, 3.18]	.22
	2. Network	3.95	1.58	-.92***	.19	-4.80	<.001	[-1.30, -.55]	.07
	3. Sequential	4.00	1.68	-.18	.19	-.92	.358	[-.56, .20]	<.01
Network Prototype	1. Hierarchical	3.07	1.51	-.73*	.31	-2.34	.020	[-1.35, -.12]	.02
	2. Network	5.96	1.20	2.25***	.16	13.86	<.001	[1.93, 2.57]	.37
	3. Sequential	3.60	1.82	-1.87***	.17	-10.88	<.001	[-2.20, -1.53]	.26
Sequential Prototype	1. Hierarchical	3.53	1.69	-1.06**	.34	-3.11	.002	[-1.74, -.39]	.03
	2. Network	3.62	1.62	-2.23***	.19	-11.84	<.001	[-2.60, -1.86]	.30
	3. Sequential	6.23	1.31	2.56***	.17	15.18	<.001	[2.23, 2.90]	.41

Note. N = 335: 38 hierarchical (11%), 135 network (40%), and 166 sequential (49%). For each dependent variable, three separate t-tests were conducted, each testing the contrast of one goal model: Hierarchical contrast (hierarchical vs. network and sequential); Network contrast (network vs. hierarchical and sequential); Sequential (sequential vs. hierarchical and network). Individual tests are numbered separately. * $p < .05$; ** $p < .01$; *** $p < .001$.

As evident in Figure 2, participants who adopted a hierarchical model viewed their goal map to be highly similar to the hierarchical model prototype, and less similar to the network or sequential model prototypes. Likewise, participants who adopted a network model viewed their goal map to be highly similar to the network model prototype, and less similar to the hierarchical or sequential model prototypes. Last, participants who adopted a sequential model viewed their goal map to be highly similar to the sequential model prototype, less similar to the network model prototype, and equally similar to the hierarchical prototype (compared to the average across those who used a hierarchical or network model). These results provided evidence for the discriminant validity of all three goal models.

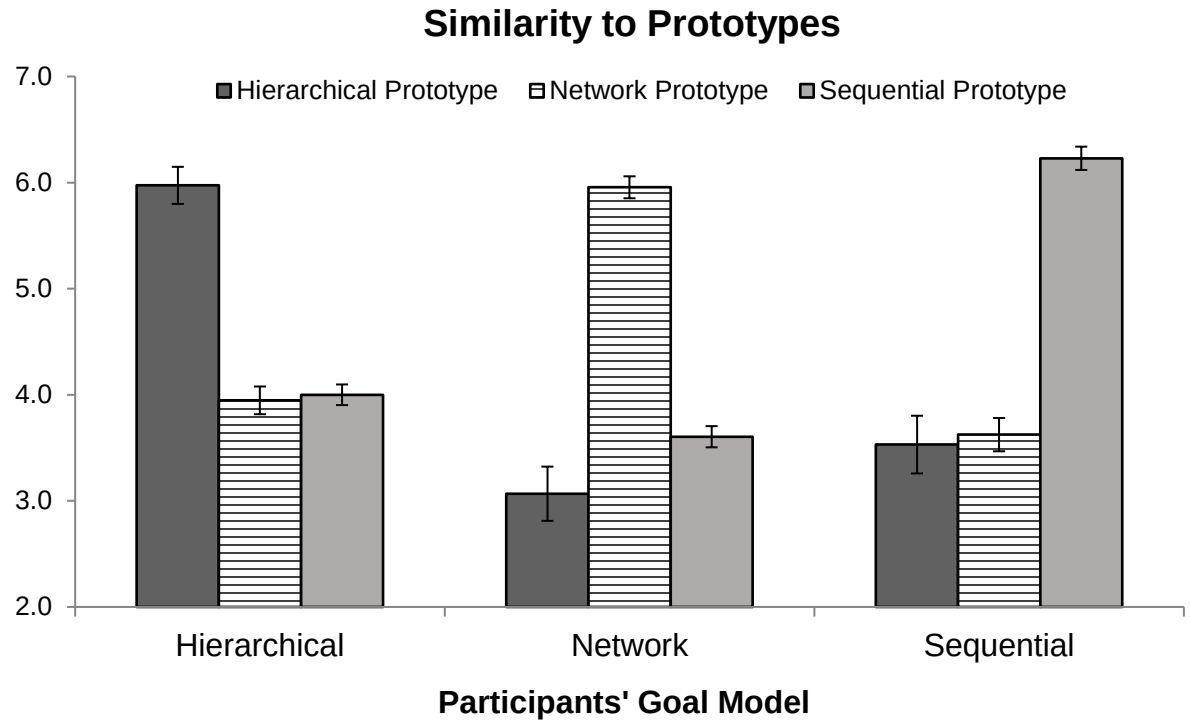


Figure 2. The Similarity Rating (toward each Goal Model Prototype; scale from 1 = *Not at all similar* to 7 = *Extremely similar*) as a Function of Goal Models (Study 1).

Content validity. Content validity concerns the coverage of a construct. To show content validity, participants' goal model should be highly similar to *at least* one of the goal model prototypes. Therefore, it is informative to analyze the pattern of participants' highest similarity rating—the highest similarity score a participant gave to any of the three goal models. For instance, if a participant rated a 7 (out of 7) for the similarity between his or her goal map to the hierarchical model, a 5 for the network model, and a 3 for the sequential model, the participant's highest similarity score would be 7 (i.e., *Extremely similar*)—content validity is high. In contrast, if a participant rated a 1 between his or her goal map to the hierarchical model, a 1 for the network model, and a 1 for the sequential model, the participant's highest similarity score would

be 1 (i.e., *Not at all similar*). This would mean that none of the proposed goal models fit the way the participant viewed his or her own goal model—content validity is low.

Statistics of participants' highest similarity scores showed a median of 7 (the highest point of the scale) and a mean of 6.34 (SD = .82). A one-sample t-test showed that the mean value significantly differed from the mid-point (i.e., 4.00) of the scale, $t = 52.18$, $p < .001$, 95%CI[2.25, 2.42]. Results suggested that the three goal models captured many variations of participants' goal models, demonstrating high content validity of the goal model framework.

Convergent validity. I developed indices based on social network indices to test convergent validity of goal models. Social network indices are useful descriptive measures of the variation in social structures (Borgatti et al., 2009). In social network analyses, people serve as nodes and the relations between people serve as ties. The basic property of a social structure is its size, measured by the number of nodes in the structure. Further, people form positive and negative relations with people. Therefore, another property that is of interest would be the average number of positive and negative ties per goal in the structure; some called similar concepts the 'ambiance' of the social network (Chua, 2013; Emmons & King, 1988).

Social structures also differ regarding how cohesive they are. Some structures are centralized to a single or few people (who usually control the resources, e.g., leaders), like a hierarchical organization. The degree to which a structure resembles a hierarchy is measured by an index called centralization (Freeman, 1978; i.e., the degree to which the structure revolves around a small number of nodes). Some social networks are less centralized and have many nodes that have a lot of connections. This represents a high-density network, which can be measured with the h-index (i.e., the maximum number of nodes that have at least the same number of ties; Hirsch, 2005). Last, some social networks may form a chain of connections

where one person connects to another, and there is little overlap in relations. As this social structure can be easily broken when few of the relations are dissolved, the degree to which a structure resembles a chain is captured by an index called connectivity (i.e., the minimum number of nodes, or ties, that must be removed to leave a disconnected network; White & Harary, 2001).

Goal model indices. Measurements of the structural variations in social networks are applicable in the study of properties of goal structures. This is because the basic graph theory assumptions of the existence of nodes and ties apply to goals as well. In a multiple-goal space, goals serve as nodes and the relations between goals serve as ties. Translating indices of social structures into goal structures, I created a set of goal model indices that measure the properties of goal structures (see Table 4).

Table 4
Goal Model Indices: The Conceptualization and Operationalization (Convergent Validity)

Goal Model Index	**Original Network Index**	**Calculation**	**Key Reference(s)**
Goal space	Network size	Number of nodes in the structure	Borgatti, Everett, & Johnson, 2013
Goal facilitative ambiance	Social facilitative ambiance	Average number of facilitative (positive) ties per node	Chua, 2013; Emmons & King, 1988
Goal conflict ambiance	Social conflict ambiance	Average number of inhibitory (negative) ties per node	Chua, 2013; Emmons & King, 1988
Goal centralization	Centralization (of degree)	Degree to which a network revolves around a single or few nodes $= (\sum_{i=1}^{n} [\, C_D(n^*) - C_D(\mathrm{i})] \,)/(N-1)(N-2)$	Freeman, 1978
Goal interconnectedness	H-index	The maximum number of nodes that each has at least the same number of ties	Hirsch, 2005
Goal disconnectivity	Disconnectivity	One minus the proportion of nodes that must be removed to disconnect the remaining structure	Borgatti, Everett, & Freeman, 2002; White & Harary, 2001

Note. $C_D(n^*)$ = the highest number of ties of any node in the structure (i.e., highest degree centrality); $C_D(i)$ = the number of ties of a node; N = number of nodes in the structure. Ties were undirected.

The number of goals within a goal model serves as the measure of the *size of a goal space*. The average number of facilitative and inhibitory ties per goal signifies the ambiance within which a goal operates, and hence can be a measure of *goal facilitative* and *conflict ambiance*. Theoretically, because a network model stimulates the thinking of multiple and dynamic goal relations, it should reveal more relations. Particularly, it should reveal more negative relations, relative to the other goal models, a hypothesis that will be tested.

Moreover, borrowing social network cohesion measures, *goal centralization* is the degree to which a goal model revolves around a single or few nodes (Freeman, 1978), which can be an alternative operationalization of a hierarchical goal model; the h-index that measures density of a

structure can represent the level of '*goal interconnectedness'* (Austin & Vancouver, 1996), which can be an alternative operationalization of a network model. Last, *disconnectivity* captures the degree to which a structure can be easily broken apart. Because structures resembling a chain require the removal of few nodes or ties to break the remaining structure apart, the disconnectivity score can be an operationalization of a sequential model.

Based on the numerical matrix created from the participant's goal map, I calculated the indices using Excel and the social network analytic software *UCINET* (Borgatti et al., 2002). I used the valenced matrix in the calculation of goal facilitative ambiance and conflict ambiance, and the unvalanced matrix (i.e., treating positive and negative relations equally, as "1") in the calculation of other indices. Both were undirected. Using the goal model indices, I examined the convergent validity of the goal model assessment method. If convergent validity is high, participants' self-categorized goal model should predict its alternative operationalization calculated in goal model indices (e.g., adopting a network model is associated with a higher score of goal conflict ambiance). Descriptives and intercorrelations of these indices are reported in Table 5.

Table 5
Descriptives and Intercorrelations of Goal Model Indices

Index	*M*	*SD*	1	2	3	4	5	6
1. Goal Space	7.54	3.46						
2. Goal Importance	8.75	1.34	-.08					
3. Facilitative ambience	.96	.85	-.24***	.07				
4. Conflict ambience	.09	.16	-.11*	.04				
5. Centralization	.36	.28	-.08	.03	-.13*	-.13*		
6. Interconnectedness	2.18	1.17	.21***	-.06	.36***	.01	-.13*	
7. Disconnectivity	.38	.33	.04	-.01	-.08	.23***	-.22***	-.50***

Note. $N = 335$. * $p < .05$; ** $p < .01$; *** $p < .001$.

To test convergent validity, I conducted t-tests to examine the differences in the goal model indices as a function of goal models. Table 6 summarizes the full results.

Table 6
Independent t-tests: Goal Models Predicting Goal Model Indices (Study 1)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Goal space	1. Hierarchical	7.55	3.40	-.06	.59	-.10	.923	[7.22, 8.00]	< .01
	2. Network	7.87	3.38	.51	.38	1.33	.185	[-.24, 1.26]	.01
	3. Sequential	7.27	3.54	-.46	.37	-1.24	.216	[-1.20, .27]	< .01
Goal importance	1. Hierarchical	8.77	1.49	.02	.23	.09	.926	[-.43, .48]	< .01
	2. Network	8.64	1.25	-.18	.15	-1.18	.239	[-.47, .12]	< .01
	3. Sequential	8.83	1.38	.16	.15	1.10	.274	[-.13, .45]	< .01
Facilitative ambience	1. Hierarchical	1.01	.77	.05	.15	.31	.755	[-.24, .33]	< .01
	2. Network	.97	.91	.00	.10	.04	.972	[-.18, .19]	< .01
	3. Sequential	.94	.82	-.02	.09	-.23	.816	[-.21, .16]	< .01
Conflict ambience	1. Hierarchical	.05	.12	-.04	.03	-1.35	.180	[.01, .20]	.01
	2. Network	.11	.18	.03	.02	1.80	.073	[.00, .07]	.01
	3. Sequential	.08	.16	-.02	.02	-.89	.372	[-.05, .02]	< .01
Centralization	1. Hierarchical	.45	.32	.10*	.05	2.09	.037	[.01, .20]	.01
	2. Network	.41	.30	.08*	.03	2.46	.014	[.02, .14]	.02
	3. Sequential	.30	.24	-.12***	.03	-3.80	< .001	[-.17, -.06]	.04
Interconnectedness	1. Hierarchical	2.05	.96	-.18	.20	-.89	.375	[-.57, .22]	< .01
	2. Network	2.50	1.27	.53***	.13	4.15	< .001	[.28, .78]	.05
	3. Sequential	1.95	1.07	-.43***	.13	-3.46	.001	[-.68, -.19]	.04
Disconnectivity	1. Hierarchical	.39	.34	.01	.06	.25	.799	[-.10, .13]	< .01
	2. Network	.30	.34	-.14***	.04	-3.84	< .001	[-.21, -.07]	.04
	3. Sequential	.44	.30	.13***	.04	3.58	< .001	[.06, .20]	.04

Note. N = 335. T-tests were conducted with one dummy variable (goal model) at a time (e.g., Hierarchical: hierarchical = 1, network = 0, sequential = 0). For each dependent variable, individual tests are numbered separately.
* $p < .05$; ** $p < .01$; *** $p < .001$.

As expected, compared to the other two models, hierarchical models scored higher on goal centralization, $t = 2.09$, $p = .037$, in which goals were likely to be subsumed by a single or a few goals. Network models (vs. the other two models) had a marginally higher level of goal conflict ambiance, $t = 1.80$, $p = .073$, a higher level of goal interconnectedness, $t = 4.15$, p

< .001, and a lower level of disconnectivity, t = -3.84, p < .001. These suggested that network models were more likely to show more negative relations and more connections between goals. Sequential models (vs. the other two models) scored lower on centralization, t = -3.80, p < .001, lower on interconnectedness, t = -3.46, p < .001, and higher on disconnectivity, t = 3.58, p < .001, which indicates a more linear structure that is relatively easy to be broken apart. Exploratory analyses controlling for average goal importance rating and goal space did not change the pattern of the above results; this suggests that the observed findings were likely a result of the way participants structured their goals, not the properties of single goals.

Overall, these findings suggest that the proposed goal models varied in their structural properties, as illustrated in the form of goal model indices. They provide strong support for convergent validity of the goal model assessment method and the proposed goal model framework.

Objectivity. To test the degree of objectivity in self-categorizing goal models, I recruited and trained two coders (who had no knowledge of participants' own ratings) to assess each participant's goal map independently. The coders were first trained on the definitions of goal models, and they were then presented with participants' goal maps one at a time in a random order. They rated on the same similarity scales that participants used in the survey and categorized each goal map with its closest fit model.

After the coding was completed, I conducted inter-rater reliability analyses to calculate scores of how consistent the ratings were among the participant and the two coders. First, kappa reliability scores were calculated (Cohen, 1960; Light, 1971) to assess the degree to which the participant and coders consistently categorized a goal map as the same goal model. The resulting kappa score indicated a fair-to-good level of agreement, $\varkappa$ = .49 (Fleiss, Levin, & Paik, 2003;

Landis & Koch, 1977). Second, Cronbach's alphas were calculated to evaluate the degree to which the participant and coders' similarity ratings of a goal map to each goal model were consistent. These alpha scores indicated a high level of agreement, $\alpha_{hierarchical} = .71$, $\alpha_{network} = .84$, and $\alpha_{sequential} = .83$. In sum, the results suggested that the self-report goal model assessment converged on the third parties' assessment, generating support for the objectivity in the use of self-categorization to identify goal models.

Summary and implications. Altogether, results from the diverse validation analyses showed that the newly developed goal model assessment task is a valid method to elicit a visualization of people's goals and assess their goal model. A goal map can be categorized as one of the goal models as a self-report measure or by third-party evaluation. Importantly, the variation in the structure of goal maps participants drew fit well under the proposed three goal models: hierarchical, network, and sequential, with high discriminant validity among them. This goal model framework also seemed to cover most typical variation in lay theories of goal model, as suggested by the goal model assessment's high content validity. Further, each model converged on critical indicator(s) of its signature properties (convergent validity), providing further evidence for the existence and systematic variation of the different goal models.

Having validated the goal model assessment method, the following studies aim to explore the diverse implications of goal models (i.e., predictive validity). Each goal model highlights a distinct organizing principle of goals, and I hypothesize that these differences have a nontrivial impact on self-regulation as it creates trade-offs in self-regulatory effectiveness depending on the situation. Specifically, goal models may differentially heighten the awareness of certain characteristics in a self-regulatory context (e.g., sensitivity to goal conflict and goal progress

information) which may confer both costs and benefits. In the following, I designed three sets of studies, each targeted to test some of the unique implications of goal models.

Study 2: Network Models and Workers' Heightened Work-Family Conflict

The first set of studies (Studies 2 and 3) were designed to examine the implications of network models for self-regulation, namely increasing tensions in chronic goal conflict and increased creativity. Managing goal conflict is an immense challenge for most people. Goals often conflict with one another, presenting trade-off scenarios where achieving one goal frequently means sacrificing some other goal. While goal conflict is inevitable, people can vary in the extent to which they are aware of it. This tendency, I propose, depends in part on how people organize their goals.

Notably, network models highlight multiple relations among goals, emphasizing how goals are related to one another with many possible pathways. Network models also highlight the dynamic relations among goals, as they acknowledge the possibility that relations among two goals can be positive or negative. This awareness of trade-offs can be a double-edged sword. I hypothesize that, by increasing the awareness of multiple and dynamic relations among goals, network models will exacerbate the tensions among goals that tend to be in chronic conflict (e.g., work-family goals, academic-social goals; Carlson, Kacmar, & Williams, 2000; Fishbach & Dhar, 2005; Study 2). However, in some situations, the awareness of trade-offs is beneficial. For instance, the awareness of trade-offs may help people realize the connections between seemingly unrelated ideas, which could result in enhanced creativity (Study 3).

Study 2 aims to explore whether adopting a network model is associated with the heightened experience of tensions between chronic goals. Given that most workers (male and female) report experiencing at least some enduring conflict between work and family goals

(Shockley, Shen, DeNunzio, Arvan, & Knudsen, 2017), this study recruited full-time and married workers as participants. The study assessed workers' model of their life goals and tested whether those who reported using a network model would also report experiencing more work-family conflict.

Method

Power, participants, and design. Participants were recruited on Prolific Academic, an online platform for an international sample of adult participants (Peer, Brandimarte, Samat, & Acquisti, 2017), to complete an online survey for £3.25. To be eligible for the survey, a participant needed to be a full-time employee, married or common-law married, living with the spouse, fluent in English, and currently residing in an English-speaking country. This procedure aimed to ensure that participants have experience of work-family conflict (and external validity of its measure) and can understand the English survey materials. Three-hundred and four individuals participated in the survey. Among them, 59 either did not complete the survey or had missing data in the focal tasks (e.g., did not complete the goal model assessment task), resulting in a final sample of 245 for analysis. In the survey, participants first reported their demographics, completed an online version of the goal model assessment task, and then completed a battery of work-related questions, including a measure of perceived work-family conflict. Study details are reported in Table 2. The sampling plan, procedure, and materials of the current study were pre-registered (available at https://osf.io/p6h24).

Goal model assessment (online version). Given that participants would complete the study on the internet, I created an online version of the goal model assessment task (adapted from Study 1; see instructions in Appendix D). To begin the survey, participants were instructed to prepare a piece of White paper and a device that could take and upload images online (e.g.,

smartphone, tablet). Similar to the standard goal model assessment, participants thought about their life goals and freely visualized them in a concept map on the paper. Afterward, participants made indications on their goal map to label their goals and to indicate any goal relation(s). Then they completed the standard measure of goal importance (from 1 = *Not at all important* to 11 = *Very important*). At the end of the survey, participants took a picture of their goal map and had an option to either upload the image onto the survey or email the image to the researcher (using an anonymous email provided by Prolific).

In this study, participants did not self-code their goal models. Two coders, blind to the hypothesis, were trained and presented with participants' goal map in random order. The coders independently categorized each participants' goal map into the best fitting goal model, achieving a good-to-substantial level of agreement, $\varkappa = .67$ (Fleiss et al., 2003; Landis & Koch, 1977). The final goal model categorization after the coders discussed to resolve the discrepancy was used as the predictor variable in the current study.

Work-family conflict. Next, the participants responded to a standard work-family conflict scale. This scale is commonly used in the organizational health literature and measured participants' subjective experience of conflict between work and family (Netemeyer et al., 1996). The scale consisted of 10 items, capturing both the interference of work demands with family life (e.g., 'My job produces strain that makes it difficult to fulfill family duties.') and the demands from family life with work (e.g., 'Family-related strain interferes with my ability to perform job-related duties.'). Participants responded to the scale from 1 = *Strongly disagree* to 7 = *Strongly agree*. The higher the score means the more intense experience of work-family conflict. The average of all items formed the work-family conflict index, used as the dependent measure ($\alpha = .93$).

Results and Discussion

In this sample, I hypothesized that workers who had a network model (vs. hierarchical and sequential model) would be more likely to experience higher work-family conflict. To test the hypothesis, I used a dummy variable to contrast network model (= 1) versus hierarchical and sequential models (= 0) to predict work-family conflict index in a t-test. This planned contrast allows the direct test of the target network model effect, in comparison to the two other models. As shown in Figure 3, results suggested that workers who had a network model (vs. the other two models) reported experiencing significantly more work-family conflict, $t = 2.22$, $p = .027$. Statistics of this focal analysis and other exploratory analyses are presented in Table 7.

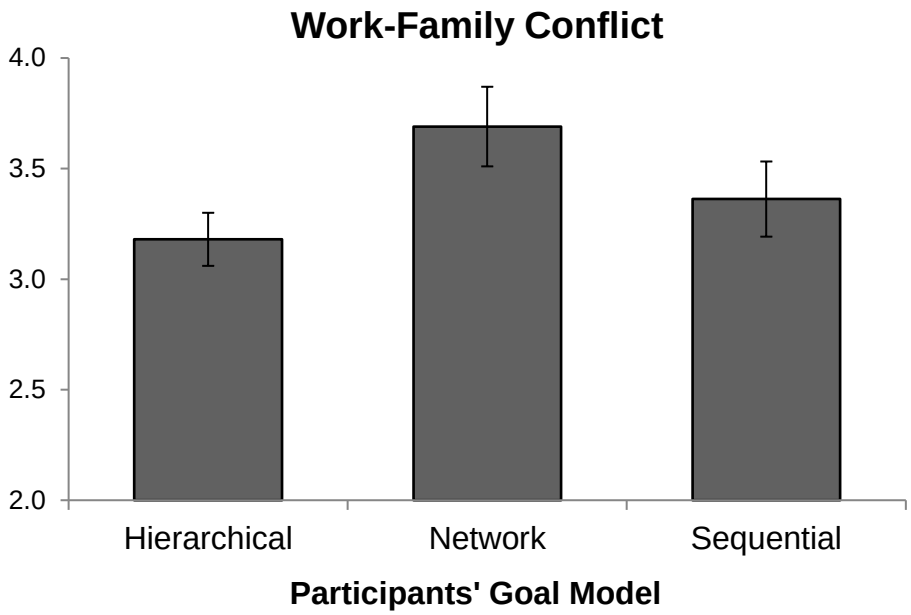


Figure 3. The Level of Work-Family Conflict as a Function of Goal Models (Study 2; scale from 1 = *Strongly disagree* to 7 = *Strongly agree*).

Table 7
Independent t-tests and GLMs: Network Models (vs. Other Models) Predicting Work-Family Conflict, and Exploratory Analyses (Study 2)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Focal t-test									
Work-family conflict	1. Network	3.69	1.18	.45*	.20	2.22	.027	[.05, .85]	.02
Exploratory t-tests									
Work-family conflict	2. Hierarchical	3.18	1.41	-.34*	.17	-1.98	.049	[.67, -.002]	.02
	3. Sequential	3.36	1.30	.03	.20	.15	.881	[-.36, .42]	< .01
Goal space	1. Hierarchical	8.80	5.37	1.4*	.63	2.23	.026	[.16, 2.64]	.02
	2. Network	7.82	4.37	-.41	.76	-.54	.591	[-1.90, 1.09]	< .01
	3. Sequential	7.02	4.95	-1.49*	.73	-2.05	.041	[-2.92, -.06]	.02
Goal importance	1. Hierarchical	8.64	1.43	.18	.19	.95	.345	[-.19, .54]	< .01
	2. Network	8.35	1.35	-.28	.22	-1.25	.213	[-.71, .16]	.01
	3. Sequential	8.58	1.44	.02	.22	.11	.911	[-.40, .45]	< .01
Exploratory GLMs including controls[a]									
Work-family conflict	1. Hierarchical	3.16	1.42	-.35*	.17	-1.99	.048	[-.69, .00]	.02
	Goal space			-.01	.02	-.64	.523	[-.05, .02]	< .01
	Goal Importance			.05	.06	.83	.406	[-.07, .17]	< .01
	2. Network	3.70	1.34	.45*	.21	2.21	.028	[.05, .86]	.02
	Goal space			-.01	.02	-.83	.408	[-.05, .02]	< .01
	Goal Importance			.05	.06	.86	.392	[-.07, .17]	< .01
	3. Sequential	3.37	1.36	.03	.20	.14	.886	[-.37, .43]	< .01
	Goal space			-.02	.02	-.91	.362	[-.05, .02]	< .01
	Goal Importance			.04	.06	.66	.509	[-.08, .16]	< .01

Note. N = 245: 129 hierarchical (53%), 55 network (22%), and 61 sequential (25%). [a]Adjusted means (with control variables) of each goal model are reported. Goal model predictors are dummy-coded variables (e.g., Hierarchical: hierarchical = 1, network = 0, sequential = 0). For each dependent variable, individual tests are numbered separately. * $p < .05$; ** $p < .01$; *** $p < .001$.

Interestingly, results uncovered a non-hypothesized pattern. Workers who had a hierarchical model (vs. the other two models) reported experiencing significantly less work-family conflict, t = -1.98, p = .049, an avenue for future studies that I will return to in the general discussion. Exploratory analyses controlling for the number of goals in participants' goal map

(goal space) and the average level of importance of their goals did not change the pattern of the above results. This generated additional support to the assumption that the ways participants structured their goals, namely goal models, and not the properties of single goals were likely driving the observed findings.

These findings provided initial evidence that workers who had a network model of life goals were also more likely to report more work-family conflict. This supported the proposition that, by increasing conflict awareness, network models may exacerbate the tensions among goals that are not easily abandoned, such as work and family goals. However, given the study design was correlational, there is no evidence to support the direction of the effect. Just as it is possible that a network model might intensify a person's work-family conflict, the work-family conflict might increase the use of a network model to represent the person's goals, an alternative hypothesis that is interesting to test on its own. In short, further experimental work is needed to address the causal relation between network models and conflict experience.

Study 3: Network Models Predict Integrative Creative Thinking

Study 3 had two aims. First, extending the results of the previous study, this study tested an upside of network models. Whereas heightened awareness of goal interconnections could be harmful to goals bound in chronic tensions, it could be beneficial for tasks that require insights into interconnections of ideas, namely creativity (Mellers et al., 2014; Tadmor, Galinsky, & Maddux, 2012).

There are two major categories of creativity: integrative creativity (a.k.a. convergent creativity) and divergent creativity (see Eysenck, 2003). Integrative creativity is the ability to converge seemingly unrelated ideas onto a meaningful idea, whereas divergent creativity is the ability to generate multiple distinct ideas from a mundane idea. Theoretically, the acuteness of

interconnections among diverse ideas should be more closely related to integrative thinking than divergent thinking. Thus, network models are likely to have a stronger positive impact on integrative (vs. divergent) creative performance.

Second, Study 3 also served the aim of developing a goal model manipulation task. Having the ability to manipulate goal model experimentally is critical because it allows the direct test of the causal impact of goal models. This enhances internal validity of goal model research and strength of the causal argument being tested. Based on the goal model assessment method, a goal model manipulation was developed and its effectiveness was evaluated in the current study. Using the goal model manipulation, this study induced participants' goal models and measured their creativity in subsequent unrelated creativity tasks.

Method

Power, participants, and design. This experiment had a between-subjects design (Condition: network, hierarchical, sequential models). The participants were recruited via the University of Waterloo Psychology Participant Pool and they completed a lab study for one course credit. In two semesters, two hundred and thirty-nine participated in the study. Among them, thirty-six had completed the divergent creativity task before and were ineligible for analysis (Steffens, Gocłowska, Cruwys, & Galinsky, 2016), and an additional twelve had missing data on the key measures. Excluding these participants resulted in a final sample of 191 for analysis. Participants came to the lab and were randomly assigned to complete one of the three conditions of the goal model manipulation task (66 hierarchical, 62 network, and 63 sequential). Afterward, they did an integrative and a divergent creativity task on the computer that was unrelated to the goal model task. The order of the two creativity tasks was randomized by the computer and did not affect the pattern of the results. Finally, participants completed a

battery of exploratory measures, which included manipulation check questions about the goal model manipulation task.

Goal model manipulation. This manipulation task was developed based on the goal model assessment method validated in the prior studies. There were three conditions, each meant to induce one type of goal model. Participants came to the lab and received a paper-and-pencil booklet that asked them to create a goal map of what they did at school to achieve their goal of university success. Participants' goal model was manipulated by the prototype model presented in the booklet. As illustrated in Figure 4, each participant received a figure of one of three goal models (with a brief explanation of the structure) and was told to follow the structure of the figure to create their goal map (see full materials in Appendix E).

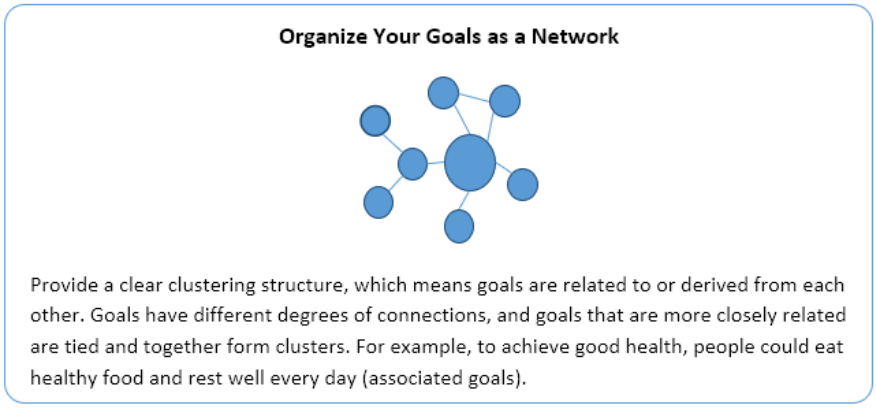


Figure 4. Sample Description of A (Network) Goal Model in the Goal Model Manipulation Task.

To make it more intuitive for participants to follow the instructions, the task provided an unfinished diagram—as seen in Figure 5—where the focal goal was already drawn according to the prototype. Participants completed the diagram and drew as many goals as they wanted. In essence, this manipulation kept the focal goal across conditions constant, while altering the structure participants used to organize their focal goal in relation to other idiosyncratic goals (see Appendix F for sample diagrams from participants). Following the goal model manipulation,

participants completed the standard measure of the importance of each goal (same as prior studies).

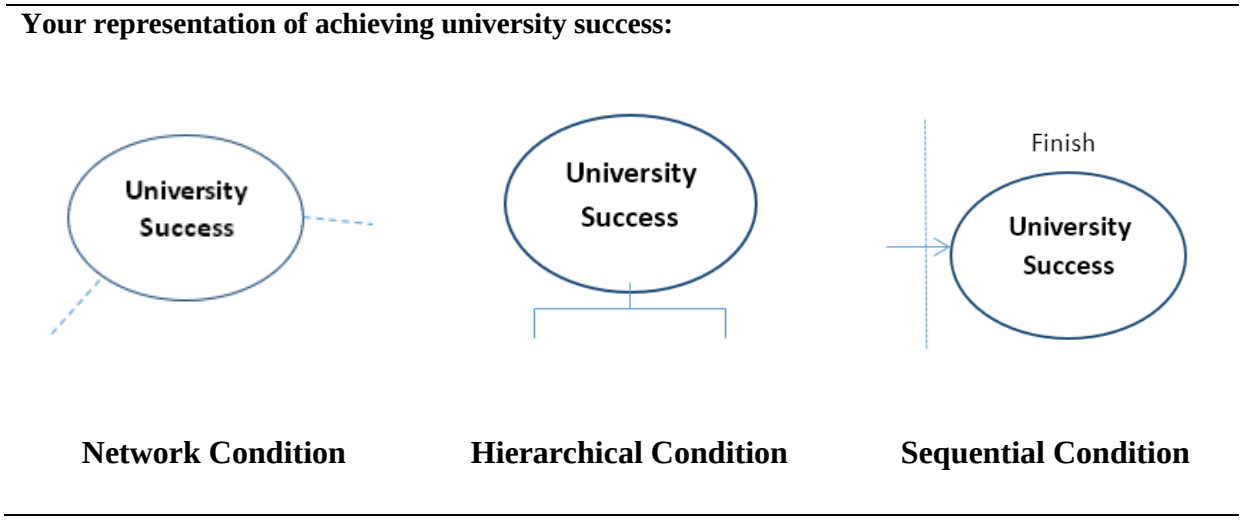


Figure 5. The Unfinished Diagrams for Participants to Complete in the Goal Model Manipulation Task.

As a manipulation check, I included items at the end of the experiment to measure the degree to which participants followed certain goal organizing principles when creating their goal map. Participants responded to each item on a scale from 1 = *Strongly disagree* to 7 = *Strongly agree*. The items measured the use of the principle of goal importance (4 items, α = .91; e.g., "I classified my goals by order of importance."), the principle of goal interconnections (4 items, α = .74; e.g., "I paid a lot of attention to the ways that goals were related to each other."), and the principle of time (4 items, α = .91; e.g., "I organized my goals in chronological orders."; see full scale in Appendix G).[5]

[5] Prior to the study, I conducted scale validation analyses. In short, using a separate sample (n = 495), I conducted an exploratory factor analysis and observed that the three goal model subscales emerged to be three unique factors (average eigenvalues = 2.98). Further, in another sample (n = 515), confirmatory factor analysis results demonstrated that the subscales are related to but distinct from each other, and the current configuration produced the greatest model fit (CFI = .989, PCLOSE = .947, RMSEA = .037).

Integrative creative thinking. Integrative creativity was measured in a creative story-rewriting task (adapted from Leung & Chiu, 2010). Participants were given a short summary of the story of Snow White. They were told to use their wildest imagination to rewrite the story, but the story needed to be based on the original fairy tale (see the task in Appendix H). In doing so, this task challenged participants' ability to connect seemingly unrelated ideas, however wild they are, to form a new and coherent story in their own version. Hence, the outcome of the task can be operationalized as integrative creative thinking.

To evaluate participants' performance on the task, I recruited and trained four coders who were blind to the hypothesis to evaluate each participant's story independently and in random order. For each story, the coders rated creative performance on a 7-point scale, from 1= *Not at all* to 7 = *Extremely creative* (Leung & Chiu, 2010). The reliability among the coders was high (α= .85), so I averaged their ratings to form an integrative creativity index for each participant as a dependent measure.

Divergent creative thinking. Divergent creativity was measured with the standard unusual uses task (Guilford, 1950; Torrance, 1974). In this task, participants were given two minutes to generate as many creative uses of a brick as possible (see Appendix I). This task challenged participants' ability to expand the one central idea (i.e., the brick) to as many and as diverse ideas as possible, without any constraint on the interconnections and coherence between these ideas. Therefore, the outcome of the task can be operationalized as divergent creative thinking. To evaluate participants' performance on the task, I recruited and trained three coders (not the same coders for coding integrative creative thinking) who were blind to the hypothesis to evaluate each use independently and in random order.

A participant's performance in the unusual uses task was the combination of three sub-scores: fluency, flexibility, and originality (Kurtzberg, 1998; Tadmor, Tetlock, & Peng, 2009; Torrance, 1974). The fluency sub-score was the number of ideas each participant generated. The flexibility sub-score was the number of semantic categories a participant used out of a list of 27 categories (e.g., using a brick as a weapon, as a doorstep). The list was adopted from a pre-existing list of 19 categories (Markman, Lindberg, Kray, & Galinsky, 2007), with an addition of 8 categories generated in consensus by the coders to fit all participants' uses (e.g., smoothing tool, extinguishing tool). The interrater reliability, $\varkappa = .82$, was substantial (Fleiss et al., 2003; Landis & Koch, 1977). The coders discussed the discrepancy and agreed on the final category of each use participants generated. Finally, the originality sub-score was measured by coders' subjective evaluation of how novel the use was on a scale from 1 = *Not at all* to 7 = *Extremely creative* ($\alpha = .79$). The originality score of a participant was the average score across all the coders and the uses participants generated. These three creativity scores were highly consistent ($\alpha = .85$). Hence, the average of the three standardized sub-scores for each participant formed the index of divergent creative thinking, used as a dependent variable.

Results and Discussion

Manipulation check. To test the effectiveness of the goal model manipulation, I examined ratings of goal organizing principles (within-subjects: importance, interconnection, time) as a function of the goal model condition (between-subjects: hierarchical, network, sequential). Because of the mixed design, I conducted a mixed-model ANOVA. Results showed a significant interaction, $F(2, 668) = 88.80$, $p = < .001$, $\eta_p^2 = .21$, suggesting that participants' goal organizing principle differed depending on their goal model condition.

To unpack the result, I created dummy variables to contrast each goal model with the other two (e.g., Hierarchical Model: hierarchical = 1, network = 0, sequential = 0). These variables allow the significant test of the difference between the target goal model and the two other models. Results of the t-tests are reported in Table 8.

Table 8
Independent t-tests: Manipulation Check Analyses, Goal Model Condition Predicting Goal Organizing Principles (Study 3)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Importance	1. Hierarchical	4.67	1.37	.82***	.24	3.42	.001	[.35, 1.29]	.06
	2. Network	3.74	1.72	-.58*	.25	-2.36	.019	[-1.07, -.10]	.03
	3. Sequential	3.96	1.62	-.26	.25	-1.05	.296	[-.75, .23]	.01
Interconnection	1. Hierarchical	4.62	1.21	-.18	.18	-1.03	.307	[-.53, .17]	.01
	2. Network	4.92	1.13	.26	.18	1.43	.154	[-.10, .61]	.01
	3. Sequential	4.69	1.17	-.07	.18	-.38	.702	[-.43, .29]	< .01
Time	1. Hierarchical	3.57	1.47	-.71**	.26	-2.72	.007	[-1.23, -.20]	.04
	2. Network	3.42	1.41	-.90***	.26	-3.44	.001	[-1.42, -.39]	.06
	3. Sequential	5.12	1.82	1.62***	.24	6.71	< .001	[1.15, 2.10]	.19

Note. N = 191: 66 hierarchical (35%), 62 network (32%), and 63 sequential (33%). Goal model predictors are dummy-coded variables (e.g., Hierarchical: hierarchical = 1, network = 0, sequential = 0). For each dependent variable, individual tests are numbered separately. * $p < .05$; ** $p < .01$; *** $p < .001$.

When creating their goal map, participants in the hierarchical condition focused more on importance, $p = .001$; participants in the sequential condition focused more on time, $p < .001$. Unfortunately, participants in the network condition did not report focusing more on interconnection relative to the other two conditions, $p = .154$. This null difference was likely an artifact due to the interconnection items being relevant to not just the network condition. Specifically, those in the hierarchical and sequential condition seem to also endorse strongly on the interconnection items (e.g., "I paid a lot of attention to the ways that goals were related to each other."). Importantly, results also showed that those in the network condition reported focusing significantly less on both importance, $p = .019$, and time, $p = .001$. Overall, results

suggested that the goal model manipulation successfully induced different focal organizing principles in participants' goal model.

Creativity. Next, I investigated the creativity outcomes. The zero-order correlation between integrative and divergent creativity scores was $r = .19$, $p = .009$. This relatively small correlation supported the notion that the two creativity processes are related but unique from each other. I hypothesized that a network model might induce greater creative thinking, and particularly so for an integrative creativity task. To test this hypothesis, I conducted t-tests using a dummy variable (contrasting network vs. the other two models) to predict the creativity outcomes. Results are illustrated in Figure 6.

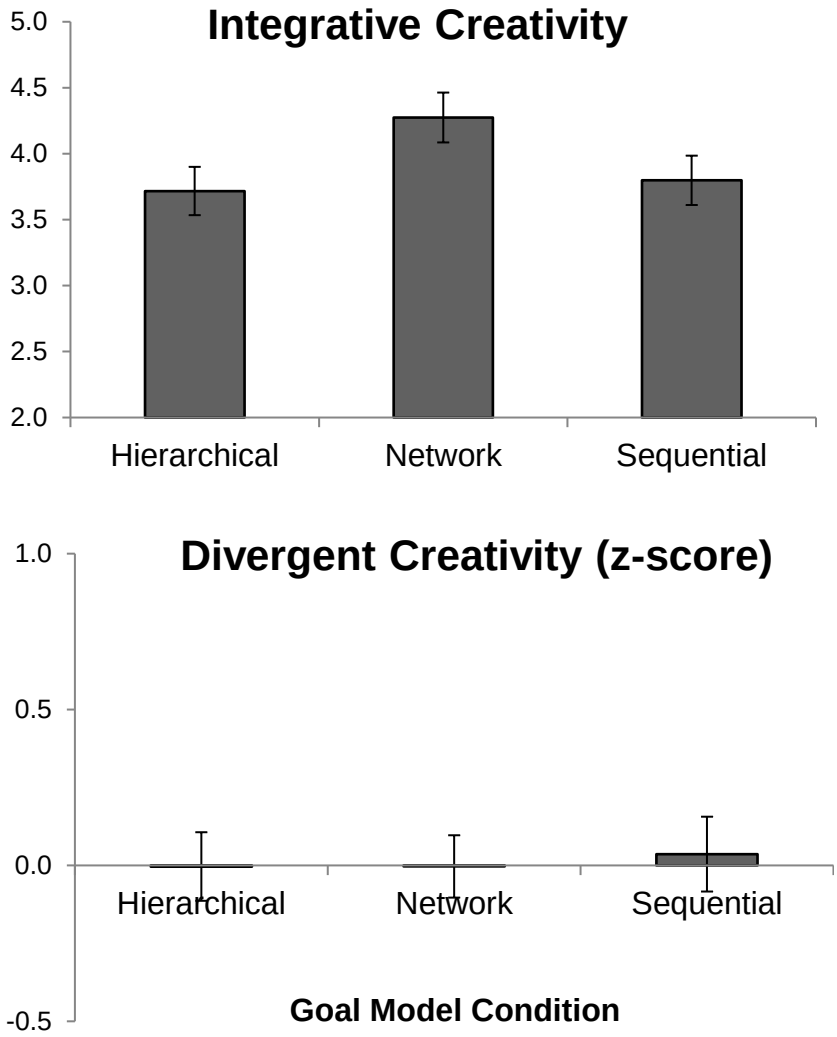


Figure 6. A Panel of Integrative and Divergent Creative Performance as a Function of Goal Model Condition (Study 3; Integrative creativity: scale from 1= *Not at all* to 7 = *Extremely creative*).

Participants in the network condition (vs. the other two) showed a greater performance in the integrative creativity task, $p = .025$—supporting the hypothesis that a network model can induce integrative creative thinking. In contrast, the network condition did not affect divergent creative performance, $p = .889$. This null finding echoed the speculation that there could be a boundary condition for when network models can increase creativity. The full results (including other model comparisons and exploratory analyses) are presented in Table 9.

Table 9

Independent t-tests and GLMs: Network Model Condition (vs. Other Two Conditions) Predicting Creativity Measures, and Exploratory Analyses (Study 3)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Focal t-tests									
Integrative creativity	1. Network	4.27	1.41	.52*	.23	2.26	.025	[.07, .97]	.03
Divergent creativity	1. Network	-.003	.82	-.02	.14	-.14	.889	[-.29, .25]	< .01
Exploratory t-tests									
Integrative creativity	1. Hierarchical	3.72	1.54	-.32	.23	-1.39	.166	[-.77, .13]	.01
	2. Sequential	3.80	1.50	-.19	.23	-.82	.413	[-.64, .27]	< .01
Divergent creativity	1. Hierarchical	-.003	.93	-.02	.14	-.15	.882	[-.29, .25]	< .01
	2. Sequential	.036	.92	.04	.14	.29	.772	[-.23, .31]	< .01
Goal space	1. Hierarchical	12.71	5.51	1.66*	.80	2.08	.039	[.08, 3.23]	.02
	2. Network	13.45	4.71	2.70***	.80	3.39	.001	[1.13, 4.27]	.06
	3. Sequential	8.70	4.33	-4.37***	.75	-5.82	< .001	[-5.85, -2.89]	.15
Goal importance	1. Hierarchical	8.50	1.28	-.20	.19	-1.05	.293	[-.58, .17]	.01
	2. Network	8.58	1.01	-.08	.19	-.39	.695	[-.46, .31]	< .01
	3. Sequential	8.82	1.42	.28	.19	1.46	.146	[-.10, .66]	.01
Exploratory GLMs including controls[a]									
Integrative creativity	1. Hierarchical	3.66	1.48	-.41	.23	-1.82	.070	[-.86, .03]	.02
	Goal space			.04	.02	1.72	.087	[-.01, .08]	.02
	Goal Importance			-.18*	.09	-2.02	.045	[-.35, .00]	.02
	2. Network	4.22	1.50	.45	.23	1.92	.057	[-.01, .91]	.02
	Goal space			.02	.02	.98	.326	[-.02, .06]	.01
	Goal Importance			-.18*	.09	-2.00	.047	[-.35, .00]	.02
	3. Sequential	3.91	1.55	-.01	.25	-.03	.974	[-.50, .48]	< .01
	Goal space			.03	.02	1.35	.178	[-.01, .08]	.01
	Goal Importance			-.17	.09	-1.93	.055	[-.35, .00]	.02
Divergent creativity	1. Hierarchical	-.05	.88	-.08	.13	-.61	.544	[-.35, .18]	< .01
	Goal space			.03*	.01	2.31	.022	[.00, .05]	.03
	Goal Importance			-.07	.05	-1.34	.181	[-.17, .03]	.01
	2. Network	-.07	.89	-.11	.14	-.76	.450	[-.38, .17]	< .01
	Goal space			.03*	.01	2.36	.019	[.00, .06]	.03
	Goal Importance			-.07	.05	-1.30	.196	[-.17, .04]	.01
	3. Sequential	.15	.92	.21	.15	1.46	.146	[-.07, .50]	.01
	Goal space			.03**	.01	2.64	.009	[.01, .06]	.04
	Goal Importance			-.07	.05	-1.35	.179	[-.17, .03]	.01

Note. N = 191: 66 hierarchical (35%), 62 network (32%), and 63 sequential (33%). [a]Adjusted means (with control variables) of each goal model are reported. Goal model predictors are dummy-coded variables. For each dependent variable, individual tests are numbered separately. * $p < .05$; ** $p < .01$; *** $p < .001$.

Exploratory analyses controlling for goal space and goal importance reduced the significant level of the focal result on integrative creativity (p = .057) but not the overall pattern of the findings. This added partial support to the argument that participants' goal structure (rather than properties of single goals) led to the observed results. In addition, two interesting effects emerged from the exploratory analyses that future research may examine further. First, goal importance appeared to have an independent negative effect on integrative creativity—the more a person's goals were important (on average), the worse the integrative creativity performance. Second, goal space seemed to affect divergent creativity positively—the more goals a person has, the higher the divergent creativity performance. This association might be a result of people who were generative thinking of both more goals and ideas spontaneously.

Overall, Study 3 made several contributions. It directly adds evidence for predictive validity of (network) goal models, supporting the proposition that a goal model framework has critical implication for self-regulation. A network model showed an upside that it could induce creative thinking. Specifically, a network model increased creativity in a task that required meaningfully connecting unrelated ideas. The finding fits well with the postulation about the implication of network models. A network model emphasizes the interconnections among goals. Through increasing awareness of these multiple and dynamic goal relations, a network model unlocks an integrative mindset, resulting in a spill-over effect on a subsequent unrelated task measuring integrative creative performance.

Further, the outcomes predicted by network models are nontrivial, such as creative performance. Creativity is a highly desirable ability and it predicts extensive benefits across life domains (e.g., good problem-solving, high job performance; Anderson et al., 2014). Study 3 not only uncovered a novel antecedent of creativity, but also provided a way to help individuals

increase creativity because a person's goal model can be changed. This may be good news for the study of creativity intervention as many extant strategies may not be efficient or effective (e.g., Scott, Leritz, & Mumford, 2004). The goal model manipulation in the current study took participants 12 minutes (on average; *SD* = 3.92) and served as an efficient alternative method to boost creativity. Yet it is critical to note that the effect size was small ($\eta_p^2 = .03$). Future research should continue exploring its effectiveness, for instance, how long the manipulation effect will last and its generalizability to other tasks to understand both its utility and limits.

Lastly, the development of a goal model manipulation method in itself brings theoretical and practical implications. The current research suggests that the goal model manipulation was effective, showing meaningful variations in manipulation check questions and creativity outcomes. The ability to temporarily alter people's goal models allows future research to study goal models experimentally and draw causal inferences. In addition, as goal models may be helpful in distinct self-regulatory contexts, the manipulation also serves as the foundation of the future development of specific goal model interventions to help improve people's self-regulation effectiveness (e.g., increasing creativity in the integrative task, dissipating perceived tensions among goals).

In the following pair of studies, I will examine the implication of sequential models. Specifically, the studies focus on how sequential models may amplify people's sensitivity and reaction to progress (Study 4) and satisfy some people's preference for movement (Study 5).

Study 4: Sequential Models Increase Sensitivity to Progress

Sequential models, relative to other two, make time salient. I proposed that people organizing their goals in sequential models should be more sensitive to goal progress, amplifying the effects of goal progress on goal motivation (e.g., Johnson et al., 2012).

To test this proposition, this study manipulated participants' model of academic-related goals and their perceptions of academic goal progress. Afterward, participants' academic motivation was measured. If sequential models heighten people's sensitivity toward goal progress, we should observe that participants in the sequential model condition will be more affected by the goal progress manipulation. In other words, participants in the sequential model condition should vary more in their levels of academic motivation (compared to the two other models) as a function of the goal progress condition.

Method

Power, participants, and design. This study had a 2(Goal progress: high vs. low) × 3(Goal models: hierarchical, network, sequential) between-subjects design. Participants were recruited through the University of Waterloo Psychology Participant Pool and they participated in the lab study for one course credit. I tried to recruit as many participants as possible in one semester. In the end, 148 people participated in the study. Among them, 9 people had missing data and were excluded, resulting in a final sample of 139 participants. In this study, participants came to the lab and were randomly assigned to complete one of the three versions of the standard goal model manipulation task (51 hierarchical, 37 network, and 51 sequential). They were then randomly assigned to one of the two goal progress conditions (67 high, 72 low) using a validated paradigm (Fishbach & Dhar, 2005) and reported their subsequent level of academic motivation.

Goal model manipulation. This study had the same goal model manipulation task used in Study 3, except the focal goal was an academic success (in the current study) to match the manipulation of academic goal progress. No goal model manipulation check and goal importance measure were included.

Goal progress manipulation. Borrowing an existing paradigm from Fishbach and Dhar (2005), participants were randomly assigned to be in a high or low progress condition. In the manipulation, participants were asked to indicate the time that they have spent on their course work in the past day. Critically, participants completed their answers on a paper-and-pencil survey that had been partially filled by a bogus participant. The experimenter told the participant that, in order to save paper, they could use this survey again as the last participant only answered the first question. The answer to the first question on the survey was the amount of time spent on their course work in the past day. It was filled by the bogus participants to be either 30 minutes (low standard) or 5 hours (high standard). The response was crossed out but still apparent. This manipulation has been shown in prior work to lead participants with a low comparison standard to think that they made high progress, whereas to lead participants with a high comparison standard to think that they made low progress (Fishbach & Dhar, 2005).

Immediately after the manipulation, a manipulation check was included and asked participants to indicate on a 5-point scale the rate of their progress toward completing their academic tasks (1 = *Not at all* to 5 = *Extremely*).

Academic motivation. Last, participants reported their academic motivation using a standard scale (Lockwood, Jordan, & Kunda, 2002). The scale has 10 items, each describes a behavior the participant can engage in for academic success (e.g., “I plan to focus more on my studies”, “I plan to study harder for tests and exams.”). Participants responded on a scale from 1

= *Not at all true* to 7 = *Very true* to indicate the extent to which they wanted to engage in these behaviors. The scale is reliable ($\alpha = .84$) and the average score across the items was used as the index of academic motivation, the dependent variable.

Results and Discussion

Manipulation check. Unlike the original study (Fishbach & Dhar, 2005), participants' response to the manipulation check did not differ across the two conditions. One possibility is that a decent number of participants reported having spent 5 or more hours on studying in the past day (43 people; 22% of the sample), reducing the impact of the high standard comparison (5 hours) in creating a perception of low progress. Additionally, the progress manipulation itself seemed to affect participants' self-report study time. Participants in the low progress condition that had a high comparison standard (5 hours) reported having studied significantly more (M = 4.35, SD = 2.71) than those in the high progress condition (M = 3.04, SD = 1.86) that had a low comparison standard (30 minutes), $t(137) = 3.30$, $p = .001$. This might be a result of self-presentation motive: participants exaggerated the amount of time they studied the previous day when they received a high comparison standard. To examine the true conditional effect, I also conducted supplementary analyses testing the effect of sequential model condition controlling for participants' own study time.

Academic motivation. As a sequential model makes salient the role of time, I hypothesized that participants in the sequential condition (vs. hierarchical and network conditions) should vary more in their levels of academic motivation as a function of the goal progress condition. In other words, those in the sequential condition (vs. the other two conditions) should report higher motivation when progress was high and report lower motivation

when progress was low. To test this hypothesis as a whole, I created a contrast-coded variable (see Table 10).

Table 10
Contrast Coding of the Hypothesis (Study 4)

	Progress Condition	**Goal Model Condition**		
Contrast weights		Sequential	Others	*M*
	High	2	1	1.5
	Low	-2	-1	-1.5
	M	0	0	0

This contrast analysis provides an efficient and precise way to test a theory-driven hypothesis when there are multiple levels of condition (see Furr & Rosenthal, 2003). The contrast-coded variable had four levels (2, 1, -1, -2), corresponding to the expected conditional effects (goal model and progress) on motivation. Results of the contrast analysis are presented in Table 11.

Table 11
Contrast Analysis: Sequential Model Condition Amplifying the Effect of Progress Condition on Motivation, and An Exploratory Analysis (Study 4)

DV	Predictor	*M*	*SD*	*B*	*SE*	*F*	*p*	95%CI	η_p^2
Focal t-tests									
Motivation	Contrast	5.42	.93	1.12*	.54	4.29	.040	[.05, 2.18]	.03
Exploratory test including controls[a]									
Motivation	Contrast	5.42	.90	1.26*	.54	5.45	.021	[.19, 2.32]	.04
	Study time			-.01	.03	.16	.694	[-.08, .05]	< .01

Note. N = 139: 51 hierarchical (37%), 37 network (27%), and 51 sequential (37%). [a]Adjusted means were reported. * $p < .05$; ** $p < .01$; *** $p < .001$.

As predicted, there was a significant contrast effect, $p = .040$. Participants in the sequential condition (vs. the other two conditions) had a significantly greater difference in motivation as a function of the progress condition—supporting the hypothesis that the sequential model increased sensitivity to progress. Supplementary analyses controlling for participants'

self-report study time did not change the pattern of the result, $p = .021$. The distribution of motivation across conditions is shown in Figure 7. Means and standard errors across hierarchical and network conditions were presented independently for transparency.

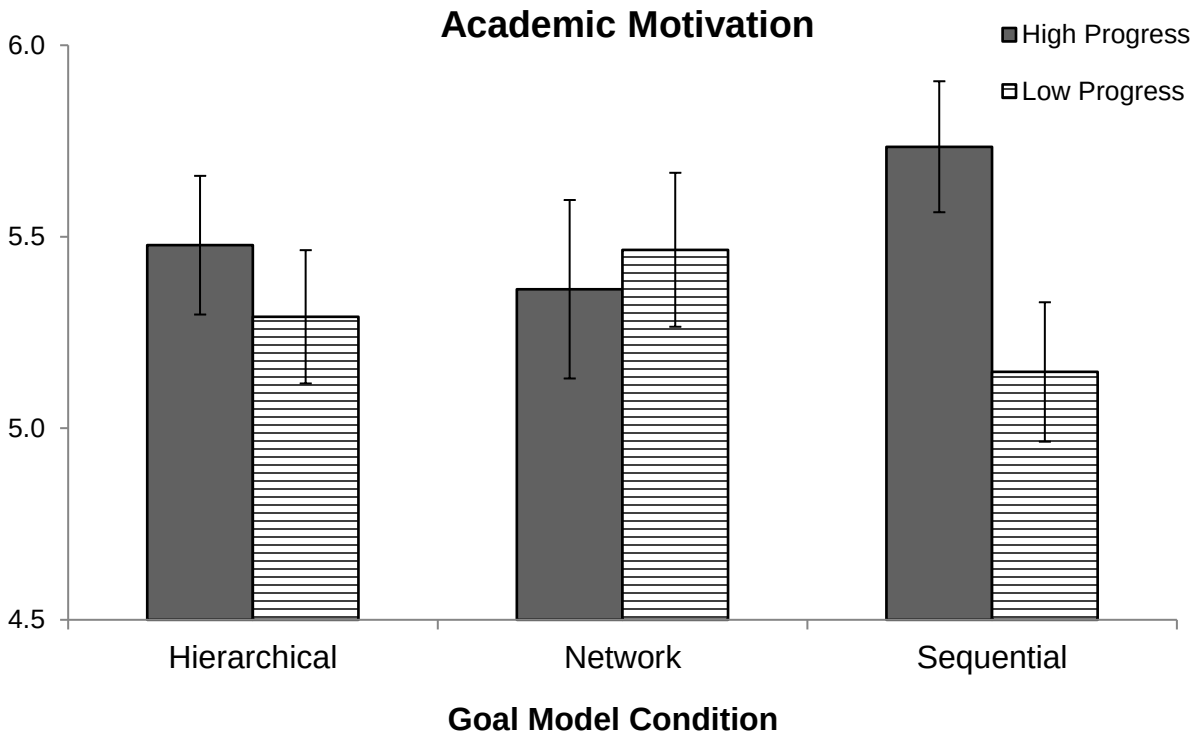


Figure 7. Academic Motivation as a Function of Goal Progress Condition and Goal Model Condition (Study 4; scale from 1 = *Not at all true* to 7 = *Very true*).

Study 4 results suggested that the way people organized the relations of their goals could affect their level of sensitivity toward goal progress. Because both goal models and goal progress were manipulated, there was causal evidence for sequential models to amplify people's progress sensitivity and motivational responses. This provides yet another demonstration that goal models have critical implications for self-regulation and adds new evidence for the predictive validity of goal models. Specifically, as goal progress information is central to people's ability to self-

regulate (Carver & Scheier, 1982b), sequential models may have other important implications for self-regulation related to time and change. Going beyond state-level differences in goal progress, studies have shown that individuals can differ in their general preference for making constant movement (progress) in self-regulation (Higgins et al., 2003). The next study tested whether sequential models would satisfy some people's preference for movement in regulation and create a more positive experience for them in goal pursuit.

Study 5: Sequential Models and Locomotion Fit

People vary in their preference for change and movement in self-regulation. Based on regulatory mode theory, these tendencies can be classified into one of two regulatory modes: an assessment mode (i.e., making critical evaluation and comparisons) versus a locomotion mode (i.e., generating action and change; Higgins et al., 2003). Regulatory modes can vary both chronically as an individual difference and state-by-state driven by the situation (Avnet & Higgins, 2003). People often choose strategies that support or fit their regulatory mode. For instance, people with a locomotion (vs. assessment mode) are less likely to procrastinate (Pierro, Giacomantonio, Pica, Kruglanski, & Higgins, 2011), are more likely to reconcile a conflict and move on (Webb, Coleman, Rossignac-Milon, Tomasulo, & Higgins, 2017), and prefer leadership styles that advocate forceful actions (Kruglanski, Pierro, & Tory Higgins, 2007).

As reviewed in the introduction, when people's regulatory mode matches with the manner they pursue their goals in a given situation, it helps sustain their regulatory orientation and creates a fit experience (Higgins, 2005)—people "feel right" and more engaged in the goal pursuit. The value from fit can transfer into engagement in the goal-pursuit experience, increasing their motivation and satisfaction in goal striving (Avnet & Higgins, 2006). For example, people in a locomotion (vs. assessment) mode perceive more value in their final choice

when they use a strategy of progressive elimination (i.e., removing worst alternatives until the final decision) versus full evaluation (i.e., comparing attributes of all alternatives simultaneously; Avnet & Higgins, 2003). They are also more satisfied with their job if they work under a leader who gives a clear sense of direction (Benjamin & Flynn, 2006).

Because sequential models highlight the passage of time and a sense of movement from one goal stage to another, I hypothesized that sequential models could match a locomotion (vs. assessment) mode and create fit. This hypothesis of fit could result in two predictions. First, if a sequential model (compared to the other two models) is a better fit to the locomotion mode, it is possible that being in a locomotion mode would lead people to represent their goals in a sequential model. Second, if the fit is true, locomotors should be more satisfied with their goal striving when they represent their goals sequentially. These two predictions are compatible with each other, so it is possible that both can be observed simultaneously.

To test these two predictions, this study manipulated participants' regulatory mode, and assessed goal models and indicators of positive subjective experience of striving life goals, namely life satisfaction and self-esteem. If the first prediction is supported, we will observe that people in the locomotion (vs. assessment) condition will be more likely to organize their goals in a sequence (vs. network or hierarchy). If the second prediction is supported, we will observe an interactive effect between regulatory mode condition and goal model—people in the locomotion (vs. assessment) condition who adopt a sequential model would report perceiving more positive life goal striving experiences, captured as higher life satisfaction and self-esteem.

Method

Power, participants, and design. Participants were recruited through the University of Waterloo Psychology Participant Pool to complete the study for one course credit. In three

semesters, 233 participated in the study. Among them, 16 did not complete the study, resulting in the final sample of 217 participants (see Table 2 for sample demographics and further details). Participants' demographic information was collected via a mass survey conducted online through the participant pool prior to the actual study. In the study, participants came to the lab, and they were first randomly assigned to either complete a locomotion (n = 103) or assessment mode (n = 114) induction task and then completed the standard goal model assessment (same as Study 1). Finally, they responded to a battery of scale items, including our focal measure of self-esteem and life satisfaction. The sampling plan, procedure, and materials of the current study are pre-registered, and the full details are available at osf.io/tn7jy.

Regulatory mode induction. This study used the standard regulatory mode induction technique (Avnet & Higgins, 2003). Participants were randomly assigned to one of the two conditions (locomotion vs. assessment), where they recalled examples from their experience that would activate the regulatory mode. In the locomotion condition, participants recalled several experiences where they acted like a "doer," finished one project and did not wait long to start a new one, and decided to do something and could not wait to get started. In the assessment condition participants recalled examples of when they compared themselves with other people, thought about their positive and negative characteristics, and critiqued work done by others or themselves.

Goal model assessment. After the regulatory mode induction, participants completed the standard goal model assessment task in a booklet and responded to the measure of the importance of each goal. Same as Study 1, participants self-categorized their goal models into hierarchical, network, or sequential, which was used as either the dependent measure or the predictor variable depending on the prediction being tested.

Self-esteem. I used the 10-item Rosenberg Self-Esteem scale to measure participants' satisfaction with the self (Rosenberg, 1965). A sample item includes "On the whole, I am satisfied with myself" from 1 = *Strongly disagree* to 7 = *Strongly agree* (α= .93).

Life satisfaction. I measured participants' global life satisfaction with the standard Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). A sample item includes "I am satisfied with my life" from 1 = *Strongly disagree* to 7 = *Strongly agree* (α= .87).

Self-esteem and life satisfaction were strongly correlated, $r = .63$, $p < .001$, as expected (e.g., E. Diener & Diener, 1995); however, given that they are theoretically distinct constructs and might show divergent effects, they were analyzed as two separate dependent measures.

Results and Discussion

Does regulatory mode condition predict goal model? First, I tested the hypothesis of whether regulatory mode predicts the way participants model their life goals. Because the goal model variable was categorical and had three groups, a multinomial logistic regression was performed to model the relationship between Regulatory Mode Condition (locomotion vs. assessment) as the predictor and participants' goal model (sequential, network, and hierarchical) as the outcome. The results showed that the fit between the statistical model and data was not satisfactory, χ^2 (2, 217) = 3.00, $p = .223$. Compared to participants in the assessment condition, participants in the locomotion condition were not more likely to use a sequential model than a hierarchical model, $B = .43$, $SE = .39$, Wald(1) = 1.23, $p = .268$, nor more like to use a sequential model than a network model, $B = .23$, $SE = .30$, Wald(1) = 5.68, $p = .451$. In sum, the first hypothesis was not supported, and the study found no evidence that locomotion mode predicts people's use of a sequential model to structure their goals.

Sequential × locomotion fit. Next, I examined the second hypothesis: the fit between the sequential models and a locomotion mode leading to greater positivity in goal striving. To test the target interaction, I conducted a general linear model analysis. In the analysis, I examined the interaction effect between the sequential model (dummy variable contrasting with the other two models) and regulatory model condition (effect-coded: locomotion = 1; assessment = -1) on self-esteem and life satisfaction.[6]

As illustrated in Figure 8, results revealed a nonsignificant but trending interaction effect between sequential model and regulatory mode condition on self-esteem, $p = .099$ (see detailed statistics in Table 12). This suggested that the use of a sequential model might affect participants' self-esteem depending on their regulatory mode. Simple effect analyses were conducted to unpack the interaction. Among those in the locomotion condition, participants who had a sequential model reported marginally higher self-esteem, $B = .42$, $SE = .24$, $t = 1.72$, $p = .088$, 95%CI[-.06, .89], $\eta_p^2 = .03$—providing some support, albeit weak, for the fit hypothesis. There was no effect of sequential models for people in the assessment condition, $p = .490$.

Since participants were recruited from the psychology participation pool, there was secondary data available that happened to include the same measure of participants' self-esteem prior to the study in the same academic term. As exploratory analyses, I used this pre-study self-esteem as a potential control to enhance the sensitivity to detect the conditional effects on self-esteem. Controlling for participants' pre-study self-esteem revealed a more robust pattern of results: self-esteem measured during the study varied significantly as a function of the sequential model and regulatory mode condition, $p = .030$. Simple effect analyses showed no effect of sequential model for people in the locomotion condition, $p = .328$; in contrast, participants who

[6] Different from Study 4, the effect of regulatory mode condition on the dependent variables was unclear; therefore, Study 5 did not employ contrast coding. Effect-coding goal models produced the same patterns of results.

had a sequential model reported significantly lower self-esteem in the assessment condition, B = -.31, SE = .15, t = -2.12, p = .037, 95%CI[-.60, -.02], η_p^2 = .04. This pattern of simple effects was not what I initially predicted—I expected that the positivity in goal-striving would be driven primarily by a fit (not a nonfit) experience. However, this nonfit effect is consistent with the overall fit hypothesis: the match between people's regulatory mode and sequential models matters, affecting the quality of goal-striving experience.

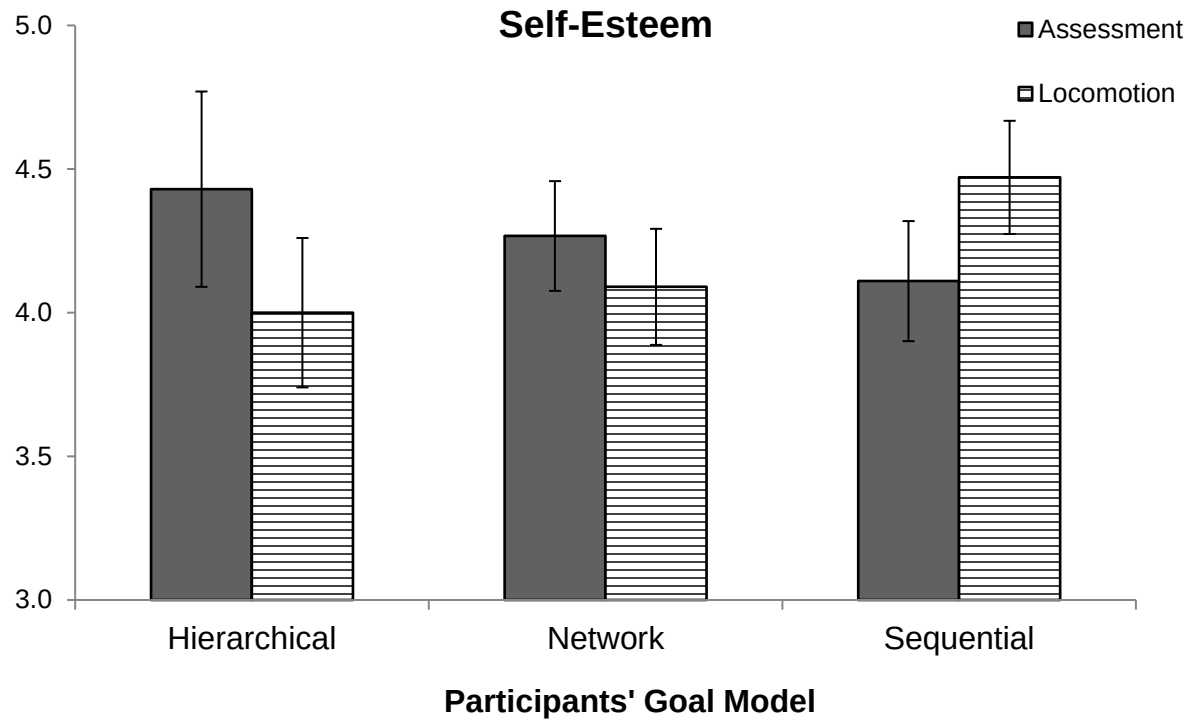


Figure 8. Self-esteem as a Function of Regulatory Mode Condition and Goal Models (Study 5; scale from 1 = *Strongly disagree* to 7 = *Strongly agree*).

As shown in Figure 9, there was no significant interaction between sequential model and regulatory mode condition on life satisfaction, p = .519 (see also Table 12). No simple effects were significant. There was no secondary data of pre-study life satisfaction available as a control variable. Exploratory analyses controlling for the number of goals and average goal importance

in the goal map did not change the pattern of the above results. The full results (including other model comparisons and exploratory analyses) are presented in Table 12.

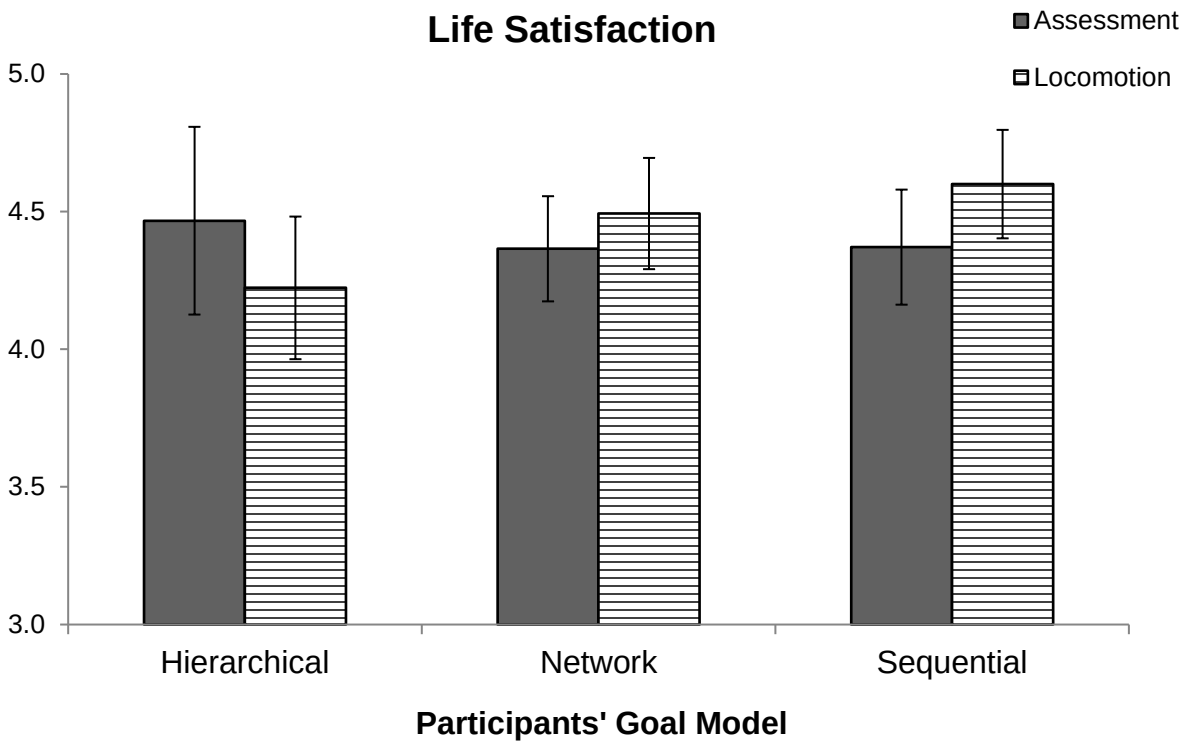


Figure 9. Life Satisfaction as a Function of Regulatory Mode Condition and Goal Models (Study 5; scale from *1* = Strongly disagree *to 7* = Strongly agree).

Table 12
GLMs and Independent t-tests: Sequential Model × Regulatory Mode Condition Interaction Predicting Self-esteem and Life Satisfaction, and Other Exploratory Analyses (Study 5)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Focal GLMs									
Self-esteem	1. Sequential	4.30	1.24	.11	.18	.60	.549	[-.25, .47]	< .01
	Reg. mode condition			-.12	.11	-1.09	.278	[-.35, .10]	.01
	Sequential × Reg. mode condition			.30	.18	1.66	.099	[-.06, .67]	.01
Life satisfaction	1. Sequential	4.49	1.14	.09	.18	.49	.624	[-.27, .45]	< .01
	Reg. mode condition			.00	.11	-.01	.992	[-.23, .23]	< .01
	Sequential × Reg. mode condition			.12	.18	.65	.519	[-.24, .48]	< .01

An Exploratory GLM controlling for pre-study self-esteem[a]									
Self-esteem	1. Sequential	4.19	.81	-.094	.10	-.95	.341	[-.29, .10]	< .01
	Pre-study self-esteem			.85	.04	23.17	<.001	[.78, .92]	.72
	Reg. mode condition			-.08	.06	-1.25	.212	[-.20, .05]	< .01
	Sequential × Reg. mode condition			.21	.10	2.189	.030	[.02, .41]	.02
Exploratory GLMs									
Self-esteem	1. Hierarchical	4.16	1.43	-.02	.24	-.10	.919	[-.49, .44]	< .01
	Reg. mode condition			.04	.10	.44	.658	[-.15, .24]	< .01
	Hierarchical × Reg. mode condition			-.26	.24	-1.10	.272	[-.73, .21]	.01
	2. Network	4.18	1.35	-.07	.18	-.39	.700	[-.43, .29]	< .01
	Reg. mode condition			.05	.12	.41	.679	[-.19, .28]	< .01
	Network × Reg. mode condition			-.14	.18	-.75	.455	[-.50, .22]	< .01
Life satisfaction	1. Hierarchical	4.31	1.34	-.11	.24	-.48	.631	[-.58, .35]	< .01
	Reg. mode condition			.09	.10	.91	.367	[-.11, .29]	< .01
	Hierarchical × Reg. mode condition			-.21	.24	-.90	.370	[-.68, .25]	< .01
	2. Network	4.43	1.45	.01	.18	.03	.980	[-.36, .36]	< .01
	Reg. mode condition			.04	.12	.29	.771	[-.20, .27]	< .01
	Network × Reg. mode condition			.03	.18	.15	.885	[-.33, .39]	< .01
Exploratory t-tests									
Goal space	1. Hierarchical	11.02	5.39	.66	.90	.73	.468	[-1.12, 2.43]	< .01
	2. Network	11.96	5.29	2.52***	.70	3.62	<.001	[1.15, 3.89]	.06
	3. Sequential	8.67	4.44	-3.00***	.70	-4.31	<.001	[-4.37, -1.63]	.08
Goal importance	1. Hierarchical	8.71	1.11	.28	.25	1.11	.269	[-.22, .78]	.01
	2. Network	8.20	1.43	-.49	* .20	-2.46	.015	[-.88, -.10]	.03
	3. Sequential	8.67	1.58	.32	.20	1.57	.118	[-.08, .71]	.01
Exploratory GLMs including controls[a]									
Self-esteem	1. Sequential	4.22	1.35	.07	.19	.36	.717	[-.31, .45]	< .01
	Reg. mode condition			-.14	.12	-1.21	.229	[-.37, .09]	.01
	Sequential × Reg. mode condition			.33	.18	1.77	.078	[-.04, .69]	.01
	Goal space			.00	.02	-.17	.861	[-.04, .03]	< .01
	Goal importance			.10	.06	1.52	.131	[-.03, .22]	.01
Life satisfaction	1. Sequential	4.43	1.39	.13	.19	.70	.487	[-.24, .51]	< .01
	Reg. mode condition			-.01	.12	-.10	.918	[-.24, .21]	< .01
	Sequential × Reg. mode condition			.13	.18	.72	.473	[-.23, .49]	< .01
	Goal space			.02	.02	1.24	.215	[-.01, .06]	.01
	Goal importance			.07	.06	1.19	.237	[-.05, .20]	.01

Note. N = 217: 41 hierarchical (19%), 91 network (42%), and 85 sequential (39%); 114 locomotion (53%), 103 assessment (47%). [a]Adjusted means reported. Goal model predictors are dummy-coded. For each dependent variable, each individual test is numbered. * $p < .05$; ** $p < .01$; *** $p < .001$.

In contrast to my prediction, regulatory mode condition did not predict use of goal models. The simple explanation is that there is no relation between regulatory mode and the way people organize their goals. Alternatively, if we entertain the possibility that it is true that regulatory mode can affect the way people organize their goals, the null finding might be the result of sampling error or a weak regulatory mode manipulation (e.g., the change in participants' regulatory mode was insufficient or required more time for it to internalize and affect goal models). These possibilities require future research with a larger sample size and/or varied regulatory mode manipulation paradigms to explore.

The results lent partial support to the fit hypothesis that by highlighting time and sensitivity to goal progress, sequential models could help satisfy the preference of locomotion, predicting more positive goal striving experiences. The results were relatively weak; no effects were found for life satisfaction and the effects on self-esteem were not robust. However, to the extent that there is a possible relation between regulatory mode and goal structure on self-esteem, this suggests new possibilities for considering how goal structure can aid or inhibit engagement. Goal pursuit might not always feel enjoyable, for example, especially when laborious craftsmanship and endurance is needed for the course of long-term goals (Duckworth, Shulman, et al., 2015; Duckworth, Eichstaedt, & Ungar, 2015). This study suggests that the extent to which people enjoy and finish the course of goal pursuit may depend in part on how they structure their goals (and how that structure fits with their more general motivational orientation; c.f. Duckworth, 2016).

The benefits of a goal model are likely contingent on the person and the situation. For some people, a goal model may help (e.g., locomotors with a sequential model), for others, a specific goal model may hurt. Continuing this perspective, the upcoming sets of studies examine

how hierarchical models may interact with people's beliefs about the nature of the self to predict their satisfaction and motivation in goal pursuit.

Study 6: Hierarchical Models Moderate the Effects of Implicit Person Theory on Self-Esteem and Life Satisfaction

As reviewed in the introduction, individuals differ in the extent to which they view the person to be fixed (entity theory) or malleable (incremental theory) on a continuum, called implicit person theory (Dweck et al., 1995b). Holding the belief that a person cannot be changed, entity theorists have the need to prove themselves and tend to exhibit helplessness when facing failure or challenge (Chiu et al., 1997; Dweck, Chiu, & Hong, 1995). In contrast, incremental theorists, who see person characteristics as malleable, experience challenges and failures as learning opportunities and focus on achieving mastery (Robins & Pals, 2002).

I proposed that the way in which people organize their goals can potentially exacerbate the rigid view of the self and helpless reactions among entity theorists, particularly so when the goal model highlights how the ultimate goal is highly important, self-relevant, and stable. Following this logic, I theorized that hierarchical models would likely intensify the helpless reactions of entity theorists. To test the hypothesis, this study assessed individuals' goal models, implicit person theory, and positive life goal striving experience which was captured as higher life satisfaction and self-esteem (same as Study 5).

Method

Power, participants, and design. Participants were recruited at multiple campus locations (e.g., library) at the University of Waterloo. After two months, we collected a sample of 100 participants and stopped the recruitment. Six participants had missing data and were excluded, resulting in 94 in the final sample (same sample used in Study 1; sample C). In this

study, participants completed two separate paper-and-pencil survey booklets to receive a snack bar and enter into a draw for cash prizes. One booklet comprised a goal model assessment, in which participants drew a model to represent the relations among their goals. In the other booklet, participants responded to a battery of scale items, including our focal measures—implicit person theory, self-esteem, and life satisfaction. To avoid order effects, the order of completion of the booklets and the order of scale inside the personality booklet were counterbalanced. These orders did not affect the patterns of our results.

Goal model assessment. Same as Study 1, participants completed the standard goal model assessment task in a booklet and reported the level of importance of each goal in their goal map. They self-categorized their goal models into a hierarchical, network, or sequential model, which will be used as the predictor variable.

Implicit person theory. In a separate survey booklet, participants responded to the below measures on a scale ranging from 1 = *Strongly disagree* to 7 = *Strongly agree*. We employed the full 8-item version of the implicit person theory scale (Levy et al., 1998). Participants responded to each item, such as "Everyone is a certain kind of person, and there is not much that they can do to really change that," and "People can substantially change the kind of person they are" (reverse-coded). Item scores were averaged to obtain the overall person theory score, so that higher scores indicated a stronger endorsement of an entity (vs. incremental) theory about the self (α= .92). Participants' person theory scores were normally distributed. Its mean equals to 3.57 (SD = 1.39) sitting close to the mid-point of the scale (i.e. 4.00), suggesting that the points of +/- 1SD of the mean score can meaningfully represent entity versus incremental theorists respectively. Person theory scores were centered and used as a predictor in the analysis.

Self-esteem. I used the 10-item Rosenberg Self-Esteem scale to measure participants' satisfaction with the self (Rosenberg, 1965; same as Study 5; α= .89).

Life satisfaction. I measured participants' global life satisfaction with the standard Satisfaction with Life Scale (Diener et al., 1985; same as Study 5; α= .86). As in Study 5, self-esteem and life satisfaction (r = .59, p <.001) were analyzed as two separate dependent measures.

Results and Discussion

Consistent with past research (e.g., Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013; Robins & Pals, 2002), there were negative but nonsignificant correlations between people's entity (vs. incremental) person theory and self-esteem, r= - .17, p = .107, and life satisfaction, r = -.12, p = .245. I hypothesized that self-esteem and life satisfaction would vary as a function of people's goal model and person theory: hierarchical models may trigger negativity in goal-striving experience among those who held a strong entity person theory. To test this interaction, I conducted general linear model analysis (same as Study 5). I created a dummy variable contrasting hierarchical (= 1) versus the other two models (= 0) and tested its interaction effect with person theory on self-esteem and life satisfaction.[7]

As seen in Figure 10, there was a significant interaction between hierarchical model and person theory on self-esteem, p = .027 (see detailed statistics in Table 13). This suggested that hierarchical models moderated the relation between person theory and self-esteem. Specifically, among people who had a hierarchical model, a stronger entity theory was associated with lower self-esteem, B = -.44, SE = .14, t = 3.19, p = .006, 95%CI[-.73, -.15], η_p^2 = .39. Moreover, simple

[7] Alternatively, one could use two dummy or effect-coded goal model variables simultaneously in the analysis (e.g., use sequential as the baseline: hierarchical = 1, network = 0, sequential = 0, and hierarchical = 0, network = 1, sequential = 0). These varied categorical coding methods produced the same pattern of results and drew the same conclusion. Given the focal interest in hierarchical models and consistency in coding with previous studies, I retained the use of contrast coding to highlight the effect of the target goal model, the hierarchical model, versus the other models.

effect analyses showed that among those who had a strong entity person theory (+1SD), the use of a hierarchical model was associated with significantly lower self-esteem, $p = .004$. Among those who had a strong incremental person theory (-1SD), however, the hierarchical model showed no effect, $p = .947$. The finding supported the hypothesis that the hierarchical model exacerbated the negative goal-striving experience of entity theorists.

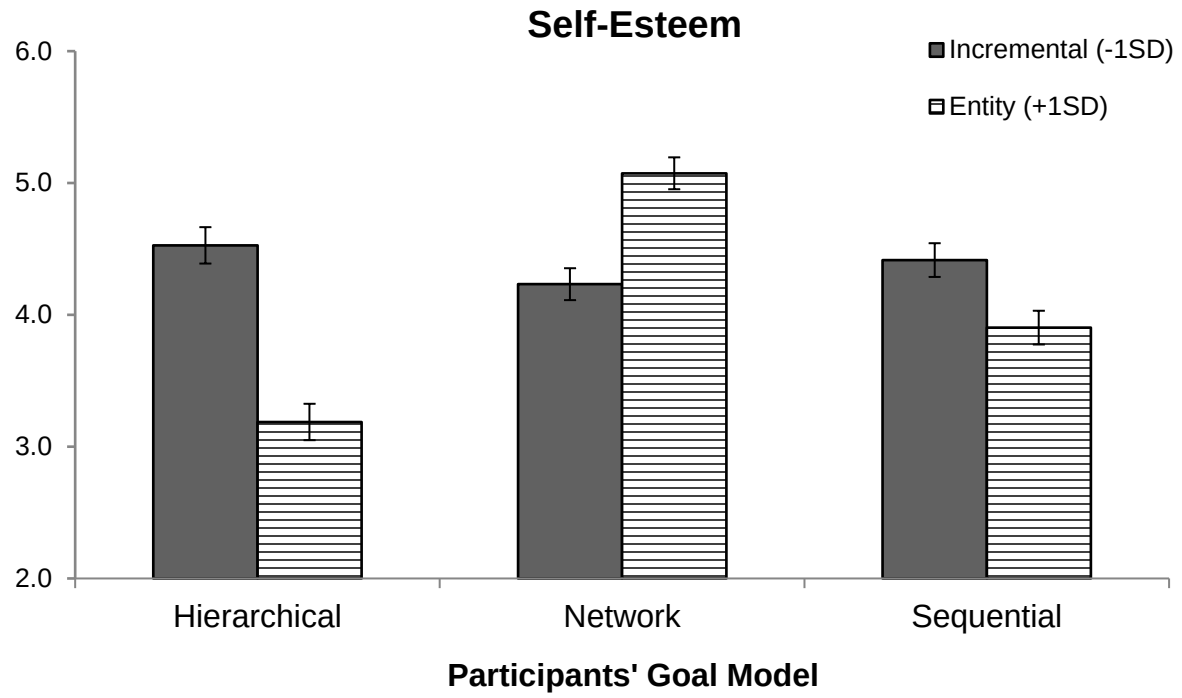


Figure 10. Self-esteem as a Function of Implicit Person Theory and Goal Models (Study 6; scale from 1 = *Strongly disagree* to 7 = *Strongly agree*).

Analyses of life satisfaction showed parallel results (see Figure 11). There was a significant interaction between hierarchical model and person theory on life satisfaction, $p = .029$, suggesting that hierarchical models also moderated the relation between person theory and life satisfaction. Among people who had a hierarchical model, a stronger endorsement of the entity theory was associated with lower life satisfaction, $B = -.49$, $SE = .16$, $t = -3.10$, $p = .007$, 95%CI[-.82, -.16], $\eta_p^2 = .38$. In addition, among those who had a strong entity theory (+1SD),

the use of a hierarchical model was associated with significantly lower life satisfaction, $p = .018$. Among those who had a strong incremental theory (-1SD), however, hierarchical models had no impact, $p = .566$. Results again supported the hypothesis.

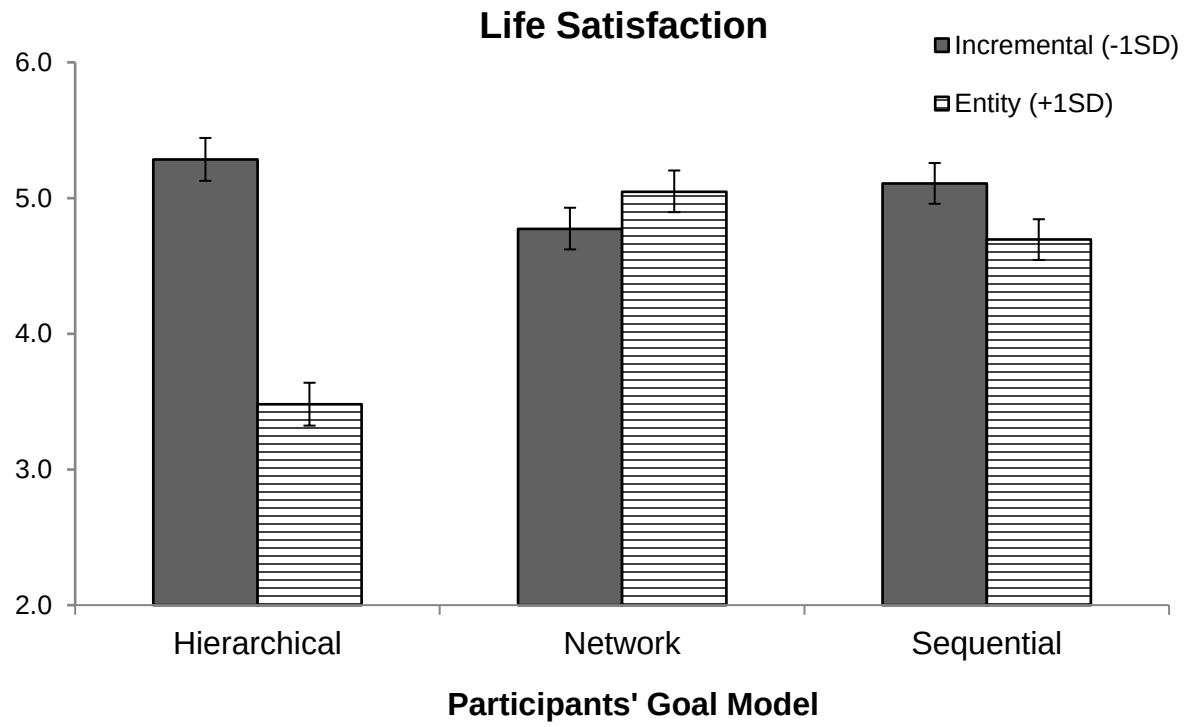


Figure 11. Life Satisfaction as a Function of Implicit Person Theory and Goal Models (Study 6; scale from 1 = *Strongly disagree* to 7 = *Strongly agree*).

Other model comparisons and exploratory analyses are presented in Table 13. Exploratory analyses controlling for the number of goals and average goal importance in the goal map did not change the pattern of the above results. It is noteworthy that, though not hypothesized, results showed that network models moderated the relations between person theory and life satisfaction, $p = .005$. There was a nonsignificant yet similar trend for self-esteem, $p = .107$. Specifically, network models seemed to buffer against the negative impact of an entity theory on self-esteem and life satisfaction—an observation that suggests implications

for future studies and will be addressed later in the general discussion. Sequential models, on the other hand, showed no moderating effects.

Table 13
GLMs and Independent t-tests: Hierarchical Model × Implicit Person Theory Interaction Predicting Self-esteem and Life Satisfaction, and Other Exploratory Analyses (Study 6)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Focal GLMs									
Self-esteem	1. Hierarchical	4.40	1.11	-.53	.27	-1.97	.052	[-1.05, .00]	.04
	Person theory			-.04	.09	-.43	.672	[-.21, .14]	< .01
	Hierarchical × Person theory			-.40*	.18	-2.25	.027	[-.76, -.05]	.05
	Simple effects								
	Hierarchical at +1SD person theory (entity)	3.19	1.11	1.07**	.36	-2.95	.004	[-1.79, -.35]	.09
	Hierarchical at -1SD person theory (incremental)	4.53	1.11	.02	.36	.07	.947	[-.69, .74]	< .01
Life satisfaction	1. Hierarchical	3.98	1.25	-.41	.33	-1.25	.214	[-1.06, .24]	.02
	Person theory			< .001	.11	< .001	> .999	[-.21, .21]	< .01
	Hierarchical × Person theory			-.49*	.22	-2.21	.029	[-.93, -.05]	.05
	Simple effects								
	Hierarchical at +1SD person theory (entity)	3.78	1.25	-1.08*	.45	-2.40	.018	[-1.97, -.19]	.06
	Hierarchical at -1SD person theory (incremental)	4.99	1.25	.25	.44	.58	.566	[-.62, 1.13]	< .01
Exploratory GLMs									
Self-esteem	1. Network	4.91	.87	.17	.22	.75	.455	[-.27, .61]	.01
	Person Theory			.21*	.09	-2.28	.025	[-.40, -.03]	.06
	Network × Person theory			.28	.17	1.63	.107	[-.06, .62]	.03
	Simple effects:								
	Network at +1SD person theory (entity)	5.07	.87	.55	.32	1.73	.087	[-.08, 1.17]	.03
	Network at -1SD person theory (incremental)	4.23	.87	-.21	.33	-.65	.517	[-.87, .44]	< .01

	2. Sequential	4.90	1.17	.15	.22	.69	.494	[-.29, .59]	.01
	Person theory			-.15	.11	-1.38	.171	[-.37, .07]	.02
	Sequential × Person theory			.05	.16	.31	.761	[-.27, .36]	< .01
Life satisfaction	1 Network	4.27	1.18	-.06	.26	-.22	.824	[-.58, .46]	< .01
	Person theory			-.29*	.11	-2.59	.011	[-.51, -.07]	.07
	Network × Person theory			.59**	.20	2.91	.005	[.19, 1.00]	.09
	Simple effects:								
	Network at +1SD person theory (entity)	5.00	1.18	.75*	.37	2.00	.049	[.00, 1.49]	.04
	Network at -1SD person theory (incremental)	4.82	1.18	-.87*	.39	-2.22	.029	[-1.64, -.09]	.05
	2. Sequential	4.46	1.39	.29	.27	1.07	.290	[-.25, .82]	.01
	Person theory			-.04	.13	-.32	.749	[-.31, .22]	< .01
	Sequential × Person theory			-.15	.19	-.76	.452	[-.53, .24]	.01
Exploratory t-tests									
Goal space	1. Hierarchical	7.33	3.51	-.07	.92	-.08	.940	[-1.89, 1.75]	< .01
	2. Network	7.92	3.77	1.21	.73	1.65	.101	[-.24, 2.66]	.03
	3. Sequential	6.60	3.46	-1.11	.72	-1.56	.123	[-2.54, .31]	.03
Goal importance	1. Hierarchical	8.80	1.12	.17	.33	.51	.614	[-.49, .82]	< .01
	2. Network	8.56	1.32	-.18	.27	-.66	.514	[-.70, .35]	.01
	3. Sequential	8.70	1.28	.06	.26	.24	.810	[-.46, .58]	< .01
Exploratory GLMs including controls[a]									
Self-esteem	1. Hierarchical	4.38	1.01	-.51	.27	-1.94	.056	[-1.04, .01]	.04
	Person theory			-.06	.09	-.73	.468	[-.24, .11]	.01
	Hierarchical × Person theory			-.33	.18	-1.82	.072	[-.70, .03]	.04
	Goal space			.02	.03	.69	.495	[-.04, .08]	.01
	Goal importance			.11	.09	1.32	.191	[-.06, .29]	.02
Life satisfaction	1. Hierarchical	3.95	1.26	-.44	.33	-1.31	.193	[-1.09, .22]	.02
	Person theory			-.01	.11	-.07	.946	[-.22, .21]	< .01
	Hierarchical × Person theory			-.46*	.23	-2.03	.045	[-.92, -.01]	.05
	Goal space			.01	.04	.14	.888	[-.07, .08]	.00
	Goal importance			.07	.11	.63	.531	[-.15, .28]	.01

Note. $N = 94$: 18 hierarchical (19%), 36 network (38%), and 40 sequential (43%). [a]Adjusted means reported. Goal model predictors are dummy-coded variables (e.g., Hierarchical: hierarchical = 1, network = 0, sequential = 0). For each dependent variable, each individual test is numbered. * $p < .05$; ** $p < .01$; *** $p < .001$.

Overall, results supported the hypothesis that goal model interacted with person theory to predict the quality of goal striving experience. Representing goals on a hierarchy seemed to exacerbate the entity theorists' negativity in the striving of life goals, showing lower self-esteem and life satisfaction. The next and final study followed up on this proposition in the lab, manipulating goal model to test the causality of this proposition.

Study 7: Hierarchical Models Moderate the Effects of Implicit Person Theory on Motivation

Study 6 provided initial evidence that hierarchical models interact with person theory to influence people's goal-pursuit experience. However, because it was a correlational study, one cannot be certain about the direction of the effects. Therefore, the current study experimentally manipulated people's goal models and measured their level of motivation to pursue the focal goal in the manipulation. Building on past research that entity theorists tended to be less motivated at school (e.g., giving up early, less excited about challenging goals; Blackwell et al., 2007; Robins & Pals, 2002), this study manipulated undergraduates' model of academic goals and extended Study 6 to examine whether goal models would interact with person theory to predict their academic motivation.

Method

Power, participants, and design. The experiment had a between-subject design (Condition: hierarchical, network, and sequential models). Two hundred participants were recruited through the University of Waterloo Psychology Participant Pool and participated in the lab study for one course credit. In the lab, participants were randomly assigned to complete one of the three versions of standard goal model manipulation task (59 hierarchical, 73 network, and

68 sequential). Afterward, they responded to the measure of person theory and academic motivation among a battery of filler measures.

Goal model manipulation. This study used the same goal model manipulation task as in Study 4, where participants were instructed to think about academic success as their focal goal and organize idiosyncratic goals related to the goal. Following the goal model manipulation, participants completed the standard measure of importance of each goal.

Person Theory. Same as Study 6, I used the standard implicit person theory scale (Levy et al., 1998) and the higher the score reflected the stronger the entity (vs. incremental) theory about personal character traits (8 items; α= .92). Participants' scores were normally distributed. Its mean equals to 3.41 (*SD* = 1.32) sitting close to the mid-point of the scale (i.e. 4.00), suggesting that the points of +/- 1SD of the mean score can meaningfully represent entity versus incremental theorists respectively. Person Theory scores were centered and used as a predictor in the analysis.

Academic motivation. I included two scales to measure academic motivation. The first scale was the same scale used in Study 4 to measure participants' academic motivation to do well in their coursework (10 items; α = .76; Lockwood et al., 2002). The second scale was a 2-item scale that measured motivation in a more idiosyncratic manner (Kay, Laurin, Fitzsimons, & Landau, 2014): "Think about the work you will have to do in order to achieve academic success. How interested are you in doing this work?", and "Think about the temptations you will have to resist in order to achieve academic success. How interested are you in resisting these temptations?" Participants responded to these items on a scale from 1 = *Not at all* and 7 = *Extremely* (*r* = .56). The two scales converged and together formed one common factor (eigenvalue = 3.31) in a principle component analysis. For parsimony's sake, all motivation item

scores were averaged to form a latent academic motivation score as the outcome variable (α = .80).[8]

Results and Discussion

I hypothesized that participants' academic motivation would vary as a function of their goal model condition and person theory. Specifically, the hierarchical condition would reduce academic motivation among those had strong entity (vs. incremental) theory. To test this interaction effect, same as Study 6 I conducted general linear model analysis. I created a dummy variable contrasting hierarchical (= 1) versus the other two models (= 0) and tested its interaction effect with person theory on motivation.

As illustrated in Figure 12, there were no main effects of person theory or conditions on academic motivation, *p*s > .246. As predicted, however, there was a marginally significant hierarchical condition × person theory interaction, $p = .053$ (see detailed statistics in Table 14). This suggested that the relation between participants' person theory and academic motivation might depend on the goal model condition. Among people in the hierarchical condition, there was no significant trend that a stronger entity theory was associated with lower motivation, $t = -1.15$, $p = .256$. However, simple effect analyses showed that the hierarchical condition tended to harm motivation of those who had a strong entity theory (+1SD), $p = .087$; whereas among those who had a strong incremental theory (-1SD) the hierarchical condition had no impact, $p = .267$. These findings provide mixed support for the hypothesis that hierarchical model may aggravate the negative goal-striving reactions of entity theorists, reducing their motivation.

[8] Analyzing the motivation scores separately yielded the same patterns of results.

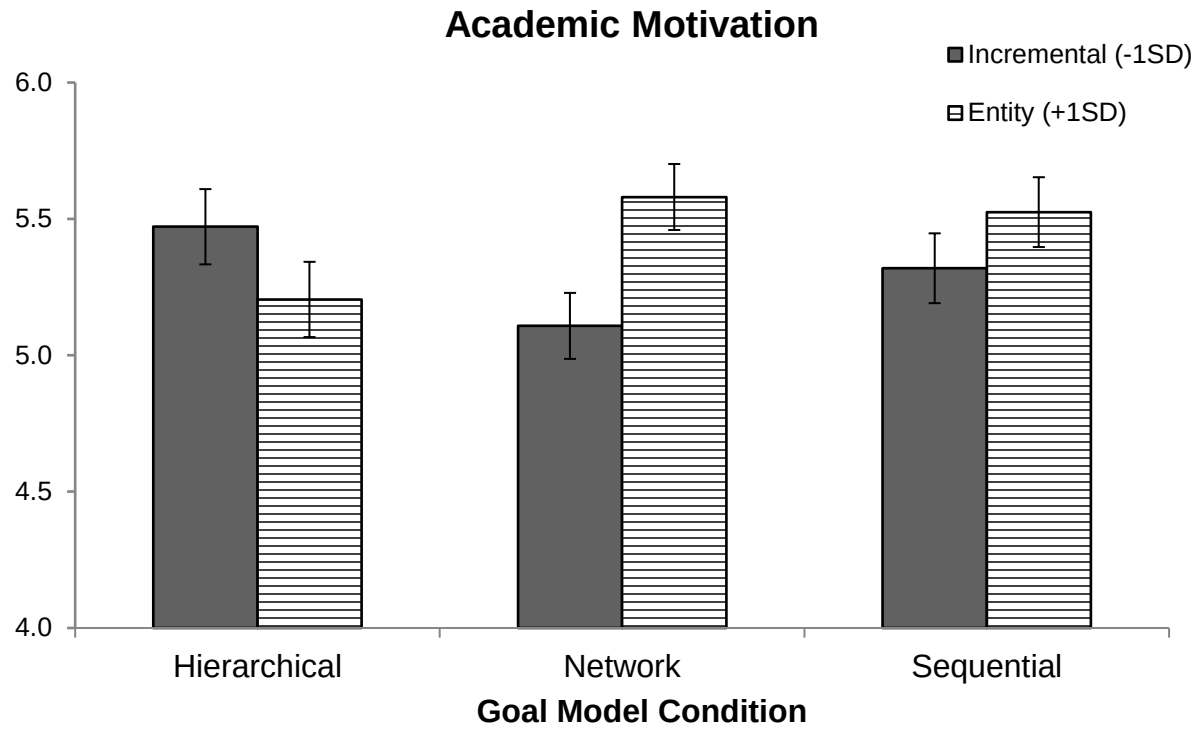


Figure 12. Academic Motivation as a Function of Implicit Person Theory and Goal Model Condition (Study 7; scale from 1 = *Not at all/Not at all true* and 7 = *Extremely/Very true*).

Other model comparisons and exploratory analyses are presented in Table 14. Exploratory analyses controlling for the number of goals and average goal importance in the goal map did not change the pattern of the results. Interestingly, consistent with Study 6 there was an emerging interaction between the network condition and person theory, $p = .096$. Contrasting the effect of the hierarchical condition, among people in the network condition, a stronger entity theory tended to be associated with higher motivation, $B = .18$, $SE = .10$, $t = 1.88$, $p = .064$, 95%CI[-.82, -.16], $\eta_p^2 = .38$. Network model seemed to be beneficial for people who endorsed a strong entity person theory (+1SD), but the effect was not significant, $p = .290$. Also consistent with Study 6, the sequential condition showed no moderating impact, $p = .824$.

Table 14

GLMs and Independent t-tests: Hierarchical Model × Implicit Person Theory Interaction Predicting Academic Motivation, and Other Exploratory Analyses (Study 7)

DV	Predictor	*M*	*SD*	*B*	*SE*	*t*	*p*	95%CI	η_p^2
Focal GLMs									
Motivation	1. Hierarchical	5.30	.84	-.04	.15	-.27	.791	[-.34, .26]	< .01
	Person theory			.13*	.06	2.08	.038	[.01, .25]	.02
	Hierarchical × Person theory			-.23	.12	-1.95	.053	[-.46, .00]	.02
	Simple effects								
	Hierarchical at +1SD person theory (entity)			-.34	.20	-1.72	.087	[-.73, .05]	.01
	Hierarchical at -1SD person theory (incremental)			.26	.23	1.11	.267	[-.20, .72]	.01
Exploratory GLMs									
Motivation	1. Network	5.31	1.05	-.02	.14	-.14	.892	[-.30, .26]	< .01
	Person Theory			.00	.06	-.06	.951	[-.13, .12]	< .01
	Network × Person theory			.18	.11	1.67	.096	[-.03, .40]	.01
	Simple effects:								
	Network at +1SD person theory (entity)			.22	.21	1.06	.290	[-.19, .63]	.01
	Network at -1SD person theory (incremental)			-.26	.20	-1.33	.185	[-.64, .13]	.01
	2. Sequential	5.41	.97	.12	.14	.81	.417	[-.17, .40]	< .01
	Person theory			.05	.07	.82	.414	[-.08, .18]	< .01
	Sequential × Person theory			.02	.11	.22	.824	[-.19, .24]	< .01
Life satisfaction	1 Network	4.27	1.18	-.06	.26	-.22	.824	[-.58, .46]	< .01
	Person theory			-.29*	.11	-2.59	.011	[-.51, -.07]	.07
	Network × Person theory			.59**	.20	2.91	.005	[.19, 1.00]	.09
	Simple effects:								
	Network at +1SD person theory (entity)	5.00	1.18	.75*	.37	2.00	.049	[.00, 1.49]	.04
	Network at -1SD person theory (incremental)	4.82	1.18	-.87*	.39	-2.22	.029	[-1.64, -.09]	.05

	2. Sequential	4.46	1.39	.29	.27	1.07	.290	[-.25, .82]	.01
	Person theory			-.04	.13	-.32	.749	[-.31, .22]	< .01
	Sequential × Person theory			-.15	.19	-.76	.452	[-.53, .24]	.01
Exploratory t-tests									
Goal space	1. Hierarchical	9.15	3.67	.84	.63	1.34	.180	[-.39, 2.07]	.01
	2. Network	10.62	4.31	3.24***	.55	5.90	< .001	[2.16, 4.32]	.15
	3. Sequential	5.84	2.11	4.12***	.53	-7.80	< .001	[-5.17, -3.08]	.23
Goal importance	1. Hierarchical	8.99	1.28	-.05	.18	-.28	.778	[-.41, .31]	< .01
	2. Network	8.83	1.18	-.31	.17	-1.82	.071	[-.65, .03]	.02
	3. Sequential	9.27	1.05	.37*	.17	2.13	.035	[.03, .71]	.02
Exploratory GLMs including controls[a]									
Motivation	1. Hierarchical	5.36	.94	-.02	.14	-.13	.897	[-.30, .27]	< .01
	Person theory			.14*	.06	2.33	.021	[.02, .25]	.03
	Hierarchical × Person theory			-.30**	.11	-2.67	.008	[-.52, -.08]	.04
	Goal space			.02	.02	.94	.346	[-.02, .05]	< .01
	Goal importance			.30***	.06	5.18	< .001	[.18, .41]	.12

Note. N = 200: 59 hierarchical (30%), 73 network (37%), and 68 sequential (34%). [a]Adjusted means reported. Goal model predictors are dummy-coded variables (e.g., Hierarchical: hierarchical = 1, network = 0, sequential = 0). For each dependent variable, each individual test is numbered. * $p < .05$; ** $p < .01$; *** $p < .001$.

Overall, results partially supported my hypothesis that the combination of an entity person theory and hierarchical models may trigger negativity in goal-pursuit, lowering goal-pursuit motivation. This finding provided a conceptual replication of the results from Study 6 and a new example for goal models' predictive validity.

General Discussion

The current work offers a novel framework to examine people's lay theories of goal structure. It introduces validated methods to assess (Study 1) and manipulate people's goal models (Study 3), which can be categorized by self-report (e.g., Study 1) or by independent raters (e.g., Studies 1 and 2). Classes of scientific theories seem to translate well into meaningful differences in the ways lay people subjectively construct the relations among their goals: hierarchical, network, and sequential. These models have distinct qualities, and my research presents evidence that they can have both positive and negative implications for self-regulatory outcomes depending on the situation, task, and individual. Network models were associated with heightened (work-family) goal conflict experiences (Study 2), yet boosted creativity in situations where idea integration was needed (Study 3). Sequential models increased goal motivation when goal progress was high but reduced goal motivation when goal progress was low (Study 4), and they tended to result in a more satisfying goal-striving experience only among people who preferred change and movement (i.e., locomotion; Study 5). Hierarchical models exacerbated negativity (e.g., lower self-esteem) in goal striving, but only among those who believed more strongly that the self is fixed versus malleable (Studies 6-7). Together, these findings bring new insights into the dynamics of multiple goals.

Contributing to the Broad Literature on Goals

This work sheds new light on the significance of goal structure in understanding multiple-goal dynamics. Many goal theories have assumed that both adjacent and nonadjacent goals co-exist and influence each other in an organized system (e.g., control theories, spreading activation theory, goal system theory; Carver & Scheier, 1982a; A. M. Collins & Loftus, 1975; Kruglanski et al., 2002). However, despite extensive research on goal-related constructs,

traditionally the literature has focused on understanding single goals and the relations between two goals. Scarce evidence directly speaks to whether and how a person's goal structure as a whole can affect his or her self-regulation. The current work addresses this gap by demonstrating that the impact of people's lay theory of goal structure is nontrivial. Goal models predicted various vital self-regulatory outcomes such as creativity (Study 3) and life satisfaction (Studies 5 and 6).

Moreover, goal structure has a unique influence on goal-regulation over and beyond goal content. The studies consistently showed that the effects of goal models held (and often became stronger) when controlling for the number of goals and the average importance of goals. This reveals a critical insight into goal regulation: the impact of people's goal structure is more than just the sum of its parts, and future research needs to take the impact of goal structure as a whole seriously. The present research on lay theories of goal structure begins to understand these goal structure influences, enriching our understanding of multiple-goal dynamics and paving the way for future goal research to explore other goal structural implications systematically.

Furthermore, this goal model framework integrates traditionally isolated literatures related to the study of multiple goals or goal structure. Different scientific theories of goal structures are popular in distinct literatures (Unsworth et al., 2014). For instance, control theory is popular in the study of goal prioritization in industrial/organizational psychology (e.g., Ballard, Yeo, Loft, et al., 2016; Schmidt & DeShon, 2007); goal system theory is often used to understand the relation of adjacent goals in social psychology (e.g., Köpetz, Faber, Fishbach, & Kruglanski, 2011); motivational theory of lifespan development is frequently discussed in understanding goal content in development psychology (e.g., Heckhausen et al., 2010). Because these literatures often operate in parallel, insights across disciplines are often not synthesized. By

actively integrating these theories, however, the goal model framework provides a platform for idea exchanges among these literatures. It builds the groundwork for comparing the organizing principles of the goal theories and for future research to advance the literature by synergizing these principles.

Advancing the Understanding of and Assessment of Lay Theories

The understanding of laypeople's subjective beliefs is the foundation of many social science disciplines, and the current research contributes to this literature in several ways. It uncovers a new set of lay theories that has critical psychological implications. The lay theories literature has documented a wide range of lay theories that map onto the ways people make sense of the nature of things and how the world works, such as the personality (Levy et al., 1998), intelligence (Blackwell et al., 2007), social relations (Chen, Chiu, & Chan, 2009; Kung et al., 2016), and race/ethnicity (Chao & Kung, 2015; Hong et al., 2009; Plaks et al., 2012). However, even though people manage multiple goals daily, there is limited knowledge of how laypeople understand their goals. The goal model framework is the first to propose and test that there are meaningful differences in the way people understand and think about the structure of relations among their goals.

In addition, the findings provide support to several fundamental assumptions in the lay theories literature. First, lay theory contents are diverse and flexible. They are not confined by the well-known distinction between fixed-versus-malleable beliefs (Gelman, 2003; Zedelius et al., 2017). Goal models posit distinct organizing principles that reflect the varying ways a goal structure can be meaningfully constructed. Second, lay theories are impactful regardless of whether they are true in reality (Furnham, 1988; Heider, 1958). People's goal models may not necessarily reflect the actual relations among goals in the brain. Yet the current studies showed

that these subjective beliefs about goal structure, either assessed or manipulated, have a systematic influence on self-regulatory outcomes.

Third, the goal model framework illustrates a fundamental, yet often neglected, property of lay theories as conceptual structures. Lay theories are at their core "knowledge structures" (e.g., Dweck, Chiu, & Hong, 1995a; Hong, Levy, & Chiu, 2001), which creates a meaning system or conceptual framework for people to understand the relations among ideas (Dweck, 1996). Essentially, a lay theory itself is a cognitive structure of ideas. Nevertheless, past research on lay theory has focused on understanding people's lay theories of the nature or the content of ideas (e.g., personality, wisdom), and there is no research to support the core assumption that lay theories are conceptual structures themselves. This research puts the "structure" back to the study of lay theories as knowledge structures, and the goal model framework offers both a theoretical and an empirical illustration of the different ways people can do so in the domain of goals.

Additionally, highlighting lay theories as conceptual structures provides not only theoretical but also methodological advances—this work provides a way to study lay theories as knowledge structures empirically. In Study 1, based on graph theory methods (Borgatti et al., 2009), I developed a structural analysis in the form of goal model indices to unpack the structure of goal models. This method is not confined to the study of goals; on the contrary, it is versatile and meaningful in the broad study of lay theories. The same structural analysis can be modified and applied to the study of other conceptual frameworks. For instance, beyond the study of the lay theory of (the nature of) personality—whether personality is fixed or malleable (Dweck & Leggett, 1988)—this structural analytical method allows the evaluation of people's lay theory of the structure of their personality. Using extant indices, one may assess people's beliefs about the degree of interconnection among their personality traits (i.e., interconnection index) and the

extent to which a small number of personality traits dominate the structure (i.e., centralization index). As seen in these examples, the use of the structural analysis has the potential to unlock diverse novel lay theory phenomena. In sum, this research paves the way to a more nuanced and sophisticated understanding of lay theories, providing both theoretical and methodological advances to the literature.

What is New and What is Next for Goal Models in the Study of Self-Regulation

By showing that the way people construe the relations among their goals matter for self-regulation, the current work adds a new perspective to the understanding of why and when people succeed and fail at self-regulatory challenges. To increase one's ability to self-regulate, most scholars and educators traditionally advise people to practice self-control (e.g., Duckworth & Seligman, 2017), avoid temptation or focus on long-term goals (e.g., Fujita, 2011), set specific difficult goals (e.g., Locke & Latham, 1990), or devise contingency plans (i.e., if-then plan, e.g., Gollwitzer, Gawrilow, & Oettingen, 2010). Most strategies focus heavily on the qualities of either the self or a goal; less research has looked at how structuring and re-structuring relations among goals play a role in self-regulation (e.g., Milkman, Minson, & Volpp, 2014; Scholer, 2014). To this end, the current studies show that people's beliefs about goal structure matter for self-regulation. Goal models influence effectiveness in self-regulation across different contexts, and they bring new and more nuanced insights into a number of subfields in self-regulation.

Conflict management. The literature on conflict management suggests that managing goal conflict is a challenging experience for many. To improve one's ability to resolve conflict effectively is key to not only personal but also social prosperity (Emmons & King, 1988; Gray et al., 2017). The current research contributes to the literature by showing that self-regulation in conflict situations is related to people's beliefs about the relations among their goals.

Particularly, network models seem to be especially relevant to conflict management. Network models increased integration of conflicting ideas (Study 3), yet were associated with heightened personal conflict experience (Study 2). This presents mixed blessings, and future research should continue to explore contexts in which network models help or hurt.

One common high-stakes conflict situation is negotiation. Effective negotiation happens when negotiators can trade off on the crucial issues to create a win-win—mutually beneficial outcome for both parties (Pruitt, 1981). Negotiators can vary in what they want to achieve for each of the issues, which are their goals in the negotiation. Negotiators can also vary in how they understand the relations among their goals in general (i.e., general goal model) and their goals in the negotiation in particular (i.e., negotiation-specific goal model; Liu, Friedman, Barry, Gelfand, & Zhang, 2012). As lay theories have been shown to be powerful in negotiation contexts (Kray & Haselhuhn, 2007), it is possible that negotiators' goal models may influence how they approach resolving issues in the negotiation, which could matter for the negotiation outcomes. For example, through highlighting interconnections among negotiation issues, network models may increase negotiators' likelihood to realize trade-offs. This insight may in turn facilitate a higher level of win-win (Weingart, Bennett, & Brett, 1993). Yet this positive effect may also depend on the length of the negotiation process—how long the negotiators need to work on the issues together.

In many one-shot negotiations, negotiators do not have a continuous working relationship after the deal is made; but in multi-round negotiations, negotiations tend to have a longer-term working relationship where they negotiate similar issues over and over again. The present research suggests that network models are associated with heightened conflict experience in more chronic goal pursuits. In long-term conflict situations like multi-round negotiations, the

effect of network models might play out differently. Network models can potentially create excessive tensions in the negotiation that hinder effectiveness and undermine the outcome. These are exciting research directions to explore.

Temporal dynamics. Another self-regulation subfield concerns temporal dynamics in motivation and decision-making. One critical topic in this area is progress. Varying progress toward a goal can produce diverse effects on people's motivation to pursue or abandon a goal (Carver, 2003; Huang et al., 2012; Schmidt & Dolis, 2009). The literature on cybernetic models and control theories has a long tradition in understanding the complexity of how progress—as a critical input to a feedback loop—predicts goal affect and motivation (Carver & Scheier, 1982b; G. A. Miller, Galanter, & Pribram, 1960; Powers, Clark, & McFarland, 1960). Whereas past research emphasizes that the effect of progress depends on a person's personality and goal framing (e.g., gain vs. loss goal, to-go vs. to-date goals; Huang et al., 2017; Koo & Fishbach, 2008; Schmidt & DeShon, 2007), the current findings enrich the literature by showing that people's beliefs about the relations among the goals also matter for people's reaction to progress. Sequential models in particular have the ability to increase people's sensitivity to progress (Study 4). Moreover, sequential models also interact with personality to predict people's goal experience (Study 5). Despite these promising initial results, these studies only scratched the surface of the effects of goal models on temporal dynamics. It is possible that goal models may not just influence people's experience but also their choices in temporal decision making.

People's decisions now about the future can have critical life implications. For example, what makes people save for the future? What drives people to continue education for a better job? Research suggests that typically (not always) choosing the higher-value long-term goal over the lower-value short-term goal indicates success in self-regulation (Fujita, 2011; Trope &

Fishbach, 2000). Yet often people give up prematurely on beneficial long-term goals (e.g., saving goals, exercise goals). This is likely because they fail to see the goal progress they are making (e.g., Chang, Johnson, & Lord, 2009; Koo & Fishbach, 2010), and it happens especially during the middle (vs. the beginning and end) of the course of goal pursuit (Touré-Tillery & Fishbach, 2011, 2012). The current research suggests that sequential models may increase people's sensitivity to time. Therefore, it is possible that sequential models may amplify the sense of progress, reminding people that every step along the way to a long-term goal means an incremental success (Huang et al., 2017). If this is the case, sequential models may be particularly useful in the middle of a goal pursuit where goal progress feels stagnant (Touré-Tillery & Fishbach, 2011). By increasing the sense of progress, sequential models may break the stagnation and motivate people to move forward on the course of a long-term goal pursuit, adding new implications for temporal decision-making.

Achievement motivation. Last, a major subfield of self-regulation studies the mechanics of what drive people to success (Duckworth, Eichstaedt, et al., 2015; Elliot & Thrash, 2001). The measure of success depends on the context—it can be defined as job performance in the workplace and students' grade at school (Kuncel, Hezlett, & Ones, 2004). It is well known that a critical ingredient of high achievement is the amount of effort a person is willing to exert (Duckworth, Eichstaedt, et al., 2015; Wu, Kung, Chen, & Kim, 2016). Achievement motivation drives success; however, people often experience difficulty staying motivated, feeling fatalistic or threatened by the goal-pursuit process, especially when they see the person as a fixed entity (Robins & Pals, 2002). Most studies of implicit person theory on achievement motivation focus on this main effect. The current research adds nuance to this observation. It suggests that not all entity theorists suffer from negative goal-pursuit experience. In fact, it may be especially those

who also have a hierarchical model of their goals that tend to experience lower goal satisfaction (Study 6) and motivation (Study 7).

Moreover, goal models seem to be an antidote for entity theorists' lower achievement motivation without changing their beliefs about malleability of person characteristics. Specifically, an unexpected pattern emerged that the use of a network model was associated with more positive goal-striving experience (Study 6). This is possibly because compared to hierarchical models, network models encourage a less rigid perspective on goal relations and free entity theorists' from having fatalistic assumptions and self-threat about goal-pursuit (e.g., less anticipatory anxiety; Plaks & Stecher, 2007). This is largely in line with research on self-complexity that the more diverse self-concepts a person has, the more resilient the person is especially in the face of criticism or failure (Linville, 1987; Rafaeli-Mor & Steinberg, 2002). Further, given that ample research has shown persistent negative effects of entity (vs. incremental) theories (Burnette et al., 2013; c.f. Sisk, Burgoyne, Sun, Butler, & Macnamara, 2018), this finding is particularly important. It adds to the literature that in some situations (e.g., when using a network model), entity theorists could enjoy goal-pursuit to the same extent, or more, than incremental theorists.

Yet it is also noteworthy that network models might have a downside for incremental theorists. Incremental theorists see goal pursuit as a possible opportunity for learning and growth. Having a clear expectation of what successful goal pursuit leads to can be indicative of the progress in learning. By relating goals with associations, network models strip away information about possible stages or levels of learning that makes learning progress salient. The diffused sense of learning may explain why network models reduced incremental theorists'

positivity in goal-striving (Study 6). Future research should put these speculations to test and verify the underlying mechanisms of the phenomenon.

Practical implications

Insights into effective self-regulation generated by this line of research are not only theoretical but also actionable. As the studies together make clear, no one goal model is universally optimal. It will be practical to consider diagnostic questions one might ask to determine what model might help a person most effectively pursue a specific goal. Goal model assessment and goal model indices serve precisely this purpose. Understanding the beliefs about the relations of people's goals may provide both the researcher and the people themselves insights into how these models might guide or limit their approaches to specific self-regulatory challenges.

Critically, like other lay theories, people's goal models are changeable. The goal model manipulation task developed in this work is the first step to an effective goal model intervention. This goal model manipulation method can be applied to any goal domains (e.g., academic, work, and health). As different goal models are helpful in distinct contexts, the goal model manipulation can help people devise a suitable goal model in response to their specific motivational orientation (e.g., locomotion) and multiple-goal challenges (e.g., negotiation) for optimal self-regulation effectiveness.

Limitations and Future Directions

The current research by no means can provide a full picture into understanding goal models. There are several limitations and open questions to be addressed in future research.

Conceptualizing goal models. In this initial stage of building the goal model framework, it was essential to consider whether people's lay theories of goal structure belonged to distinct

models. Theoretically, the three lay goal models examined here reflect the diversity of scientific theories in the goal structure literature. Empirically, there is supportive evidence that most people consider the proposed goal models as distinct constructs (discriminant validity; Study 1) and that their models relate to specific structural properties in the goal map as expected (convergent validity; Study 1). Thus, while the current approach of considering goal models as distinct constructs appears warranted, it is interesting to consider how these goal models may also overlap in meaningful ways (i.e., multiplicative models). For example, it is possible that some people may represent their goals on a hierarchy and a sequence simultaneously. One popular folk time management strategy is to organize goals by *both* urgency and importance (e.g., doing urgent and important things first). Future research should consider these complexities and explore whether the combinations of goal models have unique implications.

The current framework posits that goal models are lay theories, and thus like other lay theories, goal models can be conceptualized at both the chronic and state levels (Chiu et al., 1997). However, more evidence is needed to support this claim in the study of goal models. Thus far, my studies have shown that goal models can both be assessed and manipulated, indicating that goal models can change across states. Yet, there is no direct evidence to address the proportion of the between-subjects and within-subjects variance: how stable a person's goal model naturally can be and what situations should spontaneously induce a specific goal model. Future work using a longitudinal design is needed to answer these queries.

Method and measurement. One limitation at the methodological level is that the current studies rely heavily on the concept-mapping method to assess and manipulate goal models. There are advantages of this particular method (e.g., suitable for the study of lay concepts, easy to represent structural properties) and the consistency in the use of method across studies. However,

the use of the same method across studies can also pose a common-method bias threat to the findings (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Fortunately, my research has already developed some alternative goal model methods, including self-report goal model scale (Appendix G), third-party coding (Studies 1 and 2), and goal model indices (Study 1).

Goal model indices in particular have much potential to uncover new goal structure phenomena. Beyond the three indices used in Study 1, the social network literature has documented a wide range of indices to represent social structure (e.g., diameter, transitivity; Hanneman & Riddle, 2005) that can be directly applied to the study of goal structure. For simplicity in my initial application of goal model indices (Study 1), I only considered undirected ties, i.e., mutual relations. But it is meaningful to for future work to consider other variations in ties, such as directed ties, i.e., relations that travel in one direction, and the strength of ties, i.e., the strength of the relation between nodes (Borgatti et al., 2013; Hanneman & Riddle, 2005). These more nuanced properties can build indices that allow more complex understanding of goal structures (e.g., reciprocity, maximum flow; see Hanneman & Riddle, 2005). In addition, besides goal model indices that characterize structural properties as a whole (e.g., centralization), new indices can be developed to represent properties of the location a goal holds—goal-centric indices (Borgatti et al., 2013). For example, a node can vary in the number of shortest paths from all nodes to all others that pass through it, a concept called betweenness centrality. The higher betweenness centrality a person has in a group, the more likely the person can broker different relationships and control the flow of information (White & Borgatti, 1994). The same may apply to goals within a goal structure. A goal with high betweenness centrality may have high instrumentality independent of its content. My ongoing work is developing these goal model and goal-centric indices as well as testing their implications.

Notably, future research should consider using diverse methods in the research and unpack the suitability of the use of each method—whether a specific method is better used in some contexts and not others. For instance, goal model indices can be limited for between-subjects comparisons of people's natural goal models because people spontaneously generate a different number of goals (e.g., Study 1: $M = 7.54$, $SD = 3.46$). The varying number of goals across structures causes goal model (and goal-centric) indices to fluctuate, undermining the statistical power to detect a significant difference across goal structures and the reliability of the difference (see Forbes, Wright, Markon, & Krueger, 2017; Fried & Cramer, 2017). One straightforward solution is to standardize the number of goals, and better yet the content of goals as well, across individuals. There are both pros and cons in doing so.

In some case, there are theoretical benefits to standardizing the number and content of nodes across individuals. Take the study of mental disorders as symptom networks for example. A mental disorder is a predefined set of symptoms. Based on DSM-IV, major depression has 9 key symptoms, and it is meaningful to examine the structural relations among these 9 specific symptoms in order to advance the theory of the particular disorder (Borsboom & Cramer, 2013). In the goal literature, there are collections of goals that are theoretically meaningful to be examined together (e.g., Chulef, Read, & Walsh, 2001; Grouzet et al., 2005; Rokeach, 1973). One of my ongoing studies looks at people's beliefs about the relations among 7 (shortened from 10) value goals that are universal in principle (e.g., achievement, power, security; Schwartz & Bilsky, 1987). Because of this top-down approach, I borrow the technique called "paired-judgment" (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000) to assess people's goal structure. In this task, I present participants with pairs of values in random order and ask them to rate on the degree of the (positive and negative) relations between the two values. Each person's

ratings together form a matrix and can be transformed into goal model indices. The paired-judgment method is flexible and easy to implement with a standardized set of goals, but it has limitations. This method removes the visualization process (unlike the standard goal model assessment) which could provide critical information for people to self-categorize goal models. Moreover, the use of standardized goals per se may reduce external validity compared to when people can freely report their goals. It may also reduce content validity as the given list of goals might not include all the goals that are important to an individual. None of the methods is perfect, and thus researchers should be mindful of the tradeoffs and choose the method(s) that are most suitable for their research question.

Exploration of antecedents. To demonstrate the significance of goal models, the current series of studies were designed to target their diverse consequences but not their antecedents. Nevertheless, examining the origins of goal models is also critical as they can inform what types of factors are most likely to shape people's models (e.g., developmental trajectories, self-regulatory variables, goal domains, life stage etc.).

First, goal models, like other lay theories, can be developed based on people's past experience and social learning (Haslam, 2017). Developmental research argues that specific lay theories are unlikely to be something people are born with and they emerge to provide explanations of a person's observations about the world. Take as an example lay theories of race and ethnicity—beliefs that racial/ethnic characteristics are fixed versus malleable. Young children do not possess strong lay theories of race until older and children living in places with high (vs. low) racial/ethnic segregation learned to adopt fixed beliefs about race sooner (e.g., Birnbaum, Deeb, Segall, Ben-Eliyahu, & Diesendruck, 2010; Deeb, Segall, Birnbaum, Ben-Eliyahu, & Diesendruck, 2011). The same may apply to goal models, where individuals may be

more likely to endorse a specific goal model based on their prior goal management experience. In other words, people may acquire differential focus on importance, associations, or time based on different types of goal experiences.

What kinds of goal experiences produce divergent goal models is still a question to explore. But some observations support the possibility that goal models can be something that is socially learned. Through the process of sharing the visions behind observable tasks, organizational leaders may influence subordinates in the way they believe their goals should be arranged and prioritized (e.g., Podsakoff, MacKenzie, Moorman, & Fetter, 1990). Warren Buffet, for instance, shared that he would rank goals from the most to the least important ones (Schroeder, 2008), resembling a hierarchical model. Goal organizing principles can also be more explicitly taught. Greg McKeown, CEO of a strategy firm for tech companies and author of the self-help book called "essentialism" taught employees to focus on doing things that are essential, another example of teaching an importance principle to organize goals (McKeown, 2014). David Allen, a management consultant famous for his productivity method known as "getting things done", argued that time is essential in consideration of multiple goals. In his book, he teaches that recognizing how long a task takes and deciding when to do it are the fundamental organizing rules for productivity (Allen, 2015). All these examples together suggest that it is possible for people to learn goal organizing principles in social contexts that they may apply to their own goals.

Theoretically, goal models may also stem from individuals' own motivational orientations and needs, but these are not supported by the current data. In Study 5, I hypothesized that a locomotion mode might predict the use of a sequential model. This hypothesis was not supported. It could be due to a weak manipulation of locomotion mode. However, I included the

measure of people's chronic regulatory mode in all studies, and there was no consistent pattern that either a chronic locomotion or assessment mode was associated with a tendency to use any of the goal models. Other exploratory work I have done to examine the relations between individual differences and goal models has also suggested that I am not likely to find simple relations between personality differences and goal models. For instance, unfulfilled needs are powerful in guiding the way people perceive the world (Pittman & Zeigler, 2007) and may temporarily alter people's goal models. Hypothetically, a high need for cognition (Cacioppo, Petty, Feinstein, Blair, & Jarvis, 1996) may stimulate individuals to think deeply about subtle interconnections among ideas, which may likely induce a network model. A high need for structure or order (Friesen, Kay, Eibach, & Galinsky, 2014; Neuberg & Newsom, 1993) may encourage individuals to look for a clear way to put goals into meaningful categories, and a hierarchical model that segregates goals by ranking might provide a way to do so. Last, a high need for closure (Webster & Kruglanski, 1994) may lead individuals to fix their attention on a clear end-goal, and a sequential model (and in some way a hierarchical model as well) may be more likely to be used and satisfy this need. In some of the studies, these needs were measured. Exploratory analyses showed, however, that they did not consistently predict people's use of goal models. Follow-up studies are needed to examine whether there are conditions in which stronger deprivation or activation of the needs would produce the effect.

Exploration of potential mechanisms and moderators. Building on past research, the current work argued for why goal models would affect specific self-regulatory outcomes, but the underlying mechanisms are not directly tested. To provide empirical evidence, future research should include measures of mediators of the goal model effects. This may include measuring self-threat and rigidity in the study of hierarchical models, conflict awareness in the study of

network models, and time sensitivity in the study of sequential models. Alternatively, researchers may operationalize these mechanisms in the form of goal model indices. For instance, conflict awareness can be broadly operationalized as "goal conflict ambiance" in the goal map (see Table 4) or more narrowly operationalized as the number of negative relations reported between the target goals.

The effects of goal models can also be influenced by moderating factors. The findings have already demonstrated how goal models interact with goal progress (Study 4), regulatory mode (Study 5), and implicit person theory (Studies 6-7) in influencing self-regulatory outcomes. There could be other important factors that future work should continue to explore. For instance, we do not know in what situations the effects of goal models would be amplified versus diminished. Time pressure and cognitive load may play a vital role. When in a rush or cognitively distracted, people may be less likely to pay attention to their goal models, producing weaker goal model effects. Another question that is interesting to ask is what determines the likelihood of people modifying their goal model. Individuals differ in their metamotivational awareness to choose an optimal motivational state that maximizes performance in a task (Scholer & Miele, 2016). This awareness may also predict the likelihood of individuals flexibly devising different goal models to suit the self-regulatory challenge at hand (e.g., switching from a network model to a sequential model when in stress about goal conflict).

Generalizability. Last, it should also be acknowledged that there are constraints to the generalizability of the current findings. Despite the attempt to diversify samples, most samples were recruited from North America, with many of the participants as undergraduate students. Although the use of goal models did not statistically differ by most demographic variables (e.g., gender, race, major; Study 1), this limitation draws caution to the extent to which the results

apply to other samples, such as older less-educated adults. For instance, in most studies with young undergraduate samples, hierarchical models were reported to be the least common model; however, in Study 2 with an older working sample, hierarchical models were the most common. This is in line with research on adult development suggesting that aging is related to forming more converging goals, perceiving less goal conflict, and having higher self-concept clarity (Diehl & Hay, 2011; Riediger, Freund, & Baltes, 2005). Future work will benefit from unpacking how aging affects goal models in relation to adaptiveness. Further, all study samples were from English-speaking populations, and we do not know if language or (national/ethnic) culture plays a role in influencing the goal model effects. In short, demographic differences in the use of goal models and goal model effects should be investigated further in future research with larger and more diverse samples.

Conclusion

To conclude, the development of the goal model framework marks a new journey for the literature on goals and self-regulation to understand multiple-goal dynamics using a lay theory perspective. This research provides initial evidence that the framework captures the diversity in participants' goal models, develops multiple strategies to measure and manipulate people's goal models, and demonstrates that these goal models have nontrivial effects on several different self-regulatory outcomes. While this line of work continues to grow, there are many questions yet to be addressed. Through a deeper understanding of the nature and implications of goal models, we will be able to develop well-informed self-regulation strategies to help people to juggle multiple goals with greater success.

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Appendix A

Goal Model Assessment

Your Goals

Please read the instructions on each page carefully and turn over to the next page ONLY WHEN you have completed the task on the page. Please do not change your responses on earlier pages unless you are being instructed to.

If you have any questions when you are filling out the survey, please feel free to ask the experimenter.

Your Life Goals

[USE BLACK PEN]

In this task, we want to understand how people understand their goals in life.

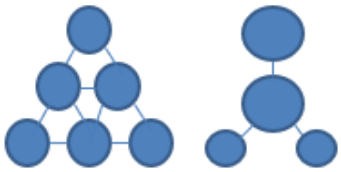
In the space below, please think about your goals in life, and create a diagram or concept map to organize and present your goals visually. Please label all elements of your map/diagram/figure. **Use only the black pen.**

There are no right or wrong, better or worse presentations. You can organize your goals in whatever ways you want that fit how you usually think about them.

[Turn to the next page only when you have finished the task on the current page.]

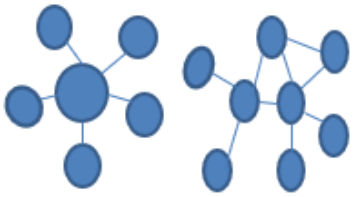
Below are three example types of different goal representations that people might use to think about their goals:

Hierarchical Models



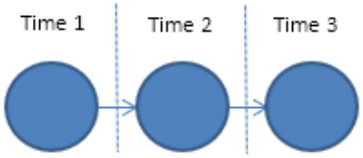
They have a clear ordering structure, which means the higher-order goals are superior to and encompass the lower-order ones. Lower-order goals can be the means to the higher-order ones.

Network Models



They focus on how goals are related to or derived from each other. Usually the more important goals have more connections. And goals that are closely related together form clusters.

Sequential Model



This type of models emphasizes how goals are organized along the timeline. The attainment of one goal depends on the attainment of the prior goal.

How much do you think each of the examples is similar to your own view of goals?

	Not at all similar						Extremely similar
1. Hierarchical	1	2	3	4	5	6	7
2. Network	1	2	3	4	5	6	7
3. Sequential	1	2	3	4	5	6	7

Please rank the models according to how closely they fit the way you think about or represent your goals:
(1: the closest fit ---- 3: the least close fit)

Hierarchical _____

Network _____

Sequential _____

[Turn to the next page only when you have finished the task on the current page.]

[USE BLUE PEN]

From now on, please **do NOT** change the drawing of your goals by erasing goals or adding new goals.

Please go back to your visual presentation of goals…

If you have already drawn lines in between your goals to indicate there are some sort of relations, **use the blue pen** to indicate above the line how they are related by:

- using a **"+"** sign when the pursuit of a goal **facilitates/helps** the pursuit of the other
- using a **"-"** sign when the pursuit of a goal **hinders/excludes** the pursuit of the other

If you did not draw any lines between goals, you may turn to the next page.

[Turn to the next page only when you have finished the task on the current page.]

[USE RED PEN]

Please go back to your visual presentation of goals…

1. There may be links between goals that you did not indicate in your original drawing but that you do think are present. If this is the case, use the **red pen** to draw lines between goals to indicate the relationships.

2. **Use the red pen** to indicate above the line how they are related by:

- using a **"+"** sign when the pursuit of a goal **facilitates/helps** the pursuit of the other
- using a **"-"** sign when the pursuit of a goal **hinders/excludes** the pursuit of the other

[After you finish the task on this page, you may return the booklet to the researcher.]

Copy and list all the goals you have from your visual presentation below:

After listing all the goals, please use the scale next to each goal and rate how individually important each goal is to you at this point in your life

Goals

	Not at all										Extremely Important
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11
_____	1	2	3	4	5	6	7	8	9	10	11

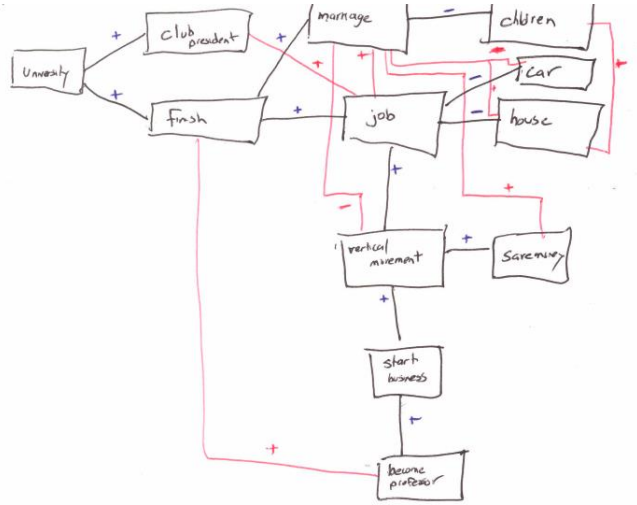
Appendix B

Instructions for Transforming an Undirected Goal Map into an Adjacency Matrix

Steps

1. On the first column in Excel, starting at cell A2, enter the name of each goal in a cell.
    a. Include subgoals
    b. Use exact wording
    c. Replace space between words with an underscore
2. Sort goal names by alphabetical order.
3. Copy and paste special, transposing all goal names into the first row starting at cell B1.
4. Enter numbers in the matrix to represent goal relations
    a. -1 = negative relationship (indicated by "-" sign)
    b. 0 = no relationship
    c. 1 = relationship but no value (indicated by no or mixed sign)
    d. 2 = positive relationship (indicated by "+" sign)

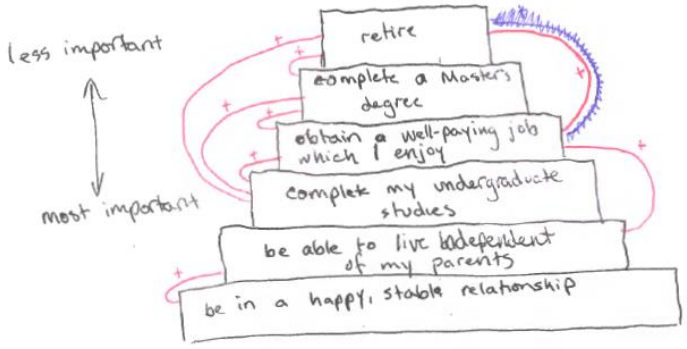
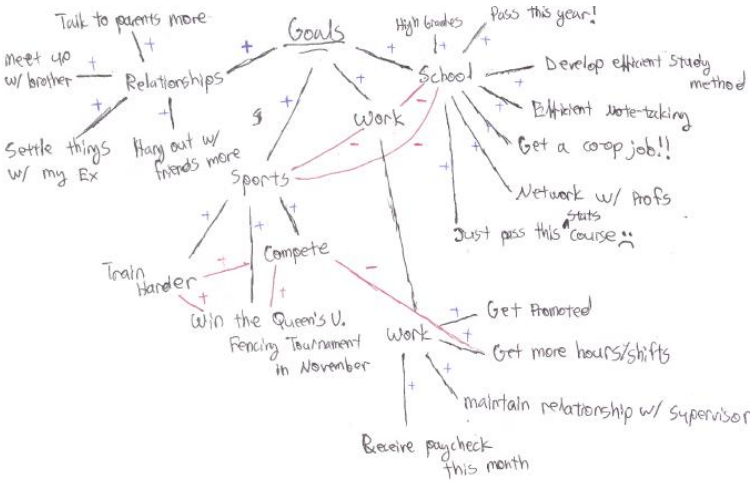
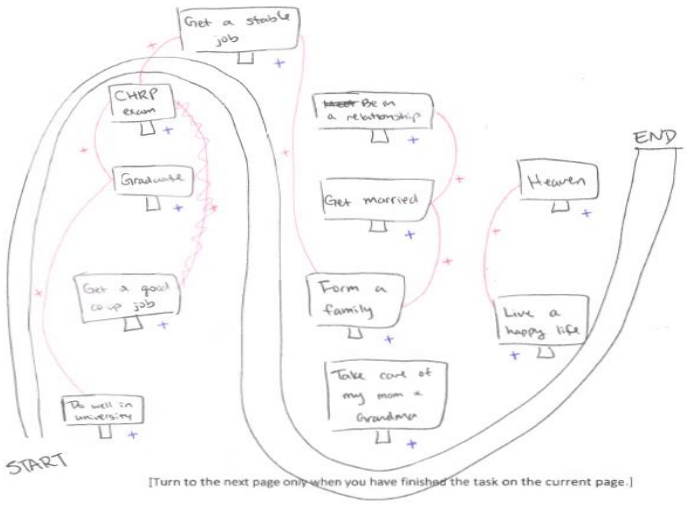
A sample goal map and its matrix



	A	B	C	D	E	F	G	H	I	J	K	L	M
1		become_professor	car	children	club_pres	finish	house	job	marriage	save_mor	start_busi	university	vertical_m
2	become_professor		0	0	0	2	0	0	0	0	2	0	0
3	car	0		0	0	0	2	-1	-1	0	0	0	0
4	children	0	0		0	0	2	0	-1	0	0	0	0
5	club_president	0	0	0		0	0	2	0	0	0	2	0
6	finish	2	0	0	0		0	2	2	0	0	2	0
7	house	0	2	2	0	0		-1	2	0	0	0	0
8	job	0	-1	0	2	2	-1		2	0	0	0	2
9	marriage	0	-1	-1	0	2	2	2		2	0	0	-1
10	save_money	0	0	0	0	0	0	0	2		0	0	2
11	start_business	2	0	0	0	0	0	0	0	0		0	2
12	university	0	0	0	2	2	0	0	0	0	0		0
13	vertical_movement	0	0	0	0	0	0	2	-1	2	2	0	

Appendix C

Sample Goal Maps and the Self-Categorized Goal Model (Study 1)

Hierarchical	
Network	
Sequential	

Appendix D

An Online Version of the Goal Model Assessment (Study 1)

IMPORTANT: Instructions

In the first part, we would like to understand your goals. Because you will be asked to visualize them, please make sure you have a piece of White paper (around A4 or letter size) and a pen before you proceed.

You will be asked to upload the image of your visualization later in the survey.

○ I have a piece of White paper and a pen at hand; I am ready to start the survey

>>

Your Life Goals

Goals are things that people want to achieve. In this task, we want to understand how you organize your goals.

Please think about your goals in life. For example, job promotion, money, well-being, spending time with family, having children etc.

Then spend at least 3 minutes, on your piece of paper, create a diagram or concept map to organize and present your goals visually. Please label all elements of your map/diagram/figure.

There are no right or wrong, better or worse presentations. You can organize your goals in whatever ways you want that fit how you usually think about them and is characteristic of you.

The next button will appear after 3 minutes. Click the next button only when you have completed your diagram.

Appendix E

Goal Model Manipulation – The Network Model Condition

In this task, we want to understand how students organize what they do at school to achieve their goal of academic success. In the space below, please think about your goal of academic success, and produce a diagram that visually represents what you usually do or you can do to achieve it.

Read the information and follow the structure of the figure to create your diagram.

Organize Your Goals as a Network

Provide a clear clustering structure, which means goals are related to or derived from each other. Goals have different degrees of connections, and goals that are more closely related are tied and together form clusters. For example, to achieve good health, people could eat healthy food and rest well every day (associated goals).

There are no right or wrong presentations. Try your best to be comprehensive and create as many goals and links associated with academic success as you want. Please label all elements of your diagram.

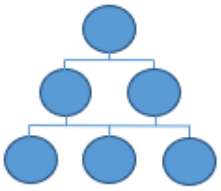
Your representation of achieving academic success:

Goal Model Manipulation – The Hierarchical Model Condition

In this task, we want to understand how students organize what they do at school to achieve their goal of university success. In the space below, please think about your goal of achieving success in university (e.g., academic, health, social etc.), and produce a diagram that visually represents what you usually do or you can do to achieve it.

Read the information and follow the structure of the figure to create your diagram.

Organize Your Goals on a Hierarchy



Provide a clear ordering structure, which means the higher-order goals are superior to and encompass the lower-order ones. Lower-order goals ae the means to the higher-order ones. For example, to achieve good health (as a higher-order goal), people could eat healthy food and rest well every day (as lower-order goals).

There are no right or wrong presentations. Try your best to be comprehensive and create as many subgoals under academic success as you want. Please label all elements of your diagram.

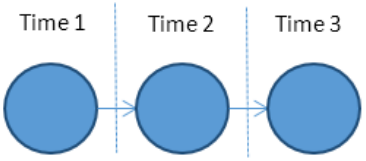
Your representation of achieving university success:

The Sequential Model Condition

In this task, we want to understand how students organize what they do at school to achieve their goal of university success. In the space below, please think about your goal of achieving success in university (e.g., academic, health, social etc.), and produce a diagram that visually represents what you usually do or you can do to achieve it.

Read the information and follow the structure of the figure to create your diagram.

Organize Your Goals in a Sequence



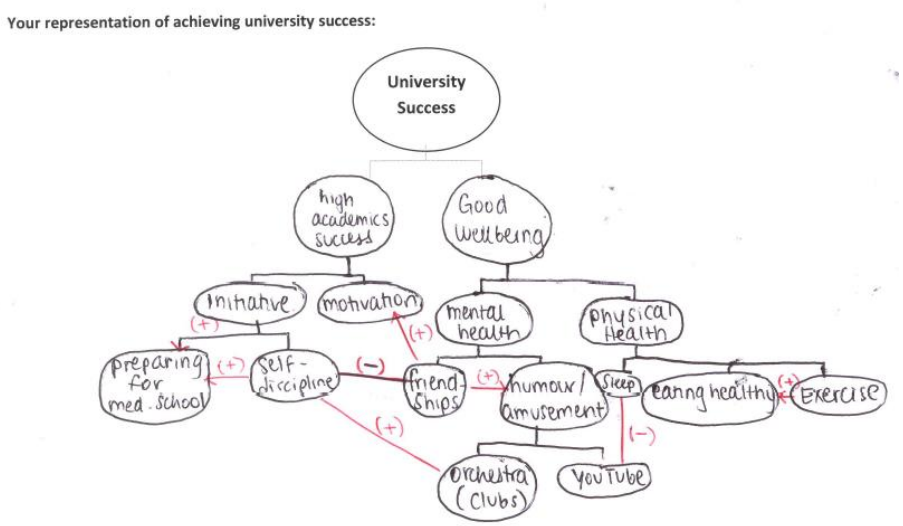
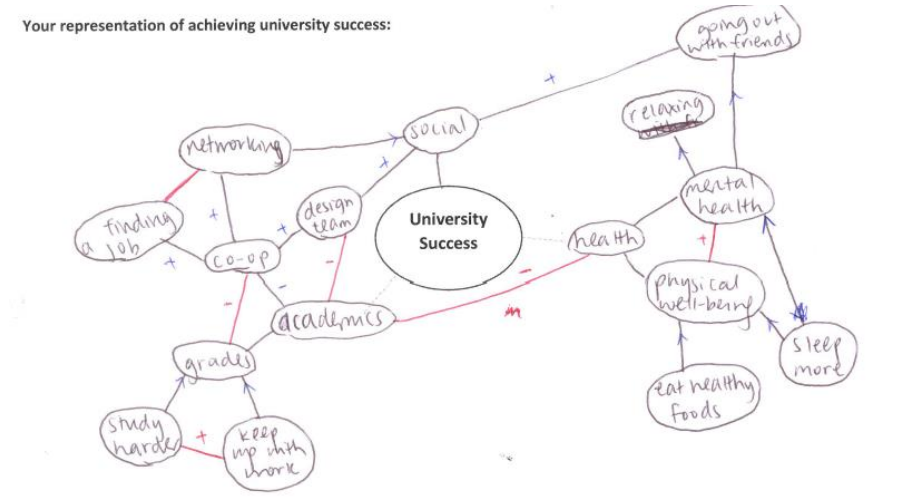
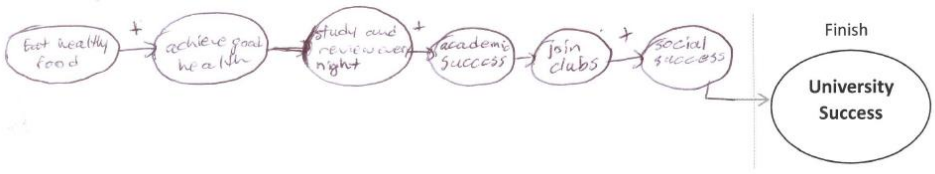
Provide a clear sequential structure, which means goals are organized along the timeline or in stages. The attainment of one goal depends on the attainment of the prior goal. For example, to achieve good health (the end-goal), people take different prior steps - eat healthy food and/or rest well every day.

There are no right or wrong presentations. Try your best to be comprehensive and create as many steps that lead to your success in university as you want. Please label all elements of your diagram.

Your representation of achieving university success:

Appendix F

A Sample Goal Map from Each Goal Model Condition (Study 3)

Hierarchical	
Network	
Sequential	

Appendix G

Goal Model Scale

1. My goals were categorized from the most important to least clearly.
2. There was a clear hierarchy of goals. Some goals were just meant to be more important than the others.
3. I classified my goals by order of importance.
4. I organized my goals by significance from the most important to the least.
5. I organized my goals based on their level of interconnectedness.
6. I paid a lot of attention to the ways that goals were related to each other.
7. Many of my goals were closely related to others, and therefore completing a goal could greatly influence the progress towards its connected goals.
8. The more important my goal was, the more it would be interconnected with and influence other goals.
9. I placed my goals on a timeline based on the chronological order to achieve them.
10. My goals were arranged in a step-by-step process.
11. I organized my goals in chronological orders.
12. My drawing of the goals had a clear sequence of steps.

Note. Used as manipulation check in Study 3. The hierarchical model sub-scale consists of Item 1-4; the network model sub-scale consists of Item 5-8; the sequential model sub-scale consistent of Item 9-12.

Appendix H

Story Rewriting Task (Integrative Creativity)

Creative Story Rewriting

In this task, we want to study people's imagination.

You will read a summary of a fairy tale randomly selected by the computer. After reading, spend a few minutes on thinking about how *you* would develop a new version of it. You may use your wildest imagination to rewrite the story, and the story should be developed from the original fairy tale.

Try your best to be creative, original, and coherent! Please do not worry too much about grammar as long as you think the ideas are clear.

>>

The Story of Snow White

Once upon a time, there was a queen who named her only daughter Snow White because of her beautiful skin. The queen died, and Snow White's father married a new queen, who was evil and vain. Every morning she would stand in front of the mirror and say, "Mirror, mirror on the wall, who is the fairest one of all?" The mirror always answered, "you are," until one day it said that Snow White was the fairest one of all.

The evil queen ordered one of her servants to take Snow White into the forest to have her killed. The servant, feeling sorry for Snow White, let her go and brought back a boar's heart to show the queen he had done the deed. Snow White, alone and hungry in the forest, came across a little cottage with seven dwarves. They said she could stay with them if she cleaned and cooked.

They all lived happily until one day when the mirror told the evil queen that Snow White was still alive. The evil queen disguised herself as an old lady, went to the cottage, and gave Snow White a red apple that was poisoned.

When Snow White took a bite of the apple, she fell down unconscious. The dwarves were very sad and built a glass coffin for her. One day a prince came by and saw how beautiful Snow White was, and bent down to give her a kiss. Snow White woke up, and they were married.

Your version:

Once upon a time....

Appendix I

Brick Use Task (Divergent Creativity)

The following is a timed task. You are given 2 minutes in the task. Please read the below information carefully before you start.

You will be randomly presented with an object. Please try your best to list as many creative uses of that object as possible. Note that the uses of the object you give are not limited to any kinds or to any uses you had seen or heard about before.

When you are ready, please click to start. Once you have clicked the next button, you will know what is the object and the timer will start counting down.

>>

0153

Use of a Brick

Think of a brick. What are the different ways in which you could use a brick?
Please write down **all the uses that come to your mind**. Please begin now.

[The ask will end automatically after 2 minutes.]

1	
2	
3	
4	
5	
6	
7	
8	

Appendix J

Exploratory Individual Difference Measures

Measure	Reference	Study 1	Study 2	Study 3	Study 4	Study 5	Study 6	Study 7
Actively open-minded thinking	Stanovich & West, 1997		x					
Career interest	Laurin, Fitzsimons, & Kay, 2011					x		x
Cultural tightness	Gelfand et al., 2011	x			x		x	
Family satisfaction	Staines & Pleck, 1983		x					
Implicit person theory	Levy et al., 1998	x		x	x	x	x	x
Job engagement	Schaufeli, Bakker, & Salanova, 2006		x					
Job involvement	Quinn & Staines, 1979		x					
Job satisfaction	Cammann, Fichman, Jenkins, & Klesh, 1983		x					
Life satisfaction	Diener et al., 1985	x	x	x	x	x	x	x
Need for closure	Roets & Van Hiel, 2011	x	x	x	x	x	x	x
Need for cognition	Cacioppo, Petty, & Feng Kao, 1984	x	x	x	x	x	x	x
Need for structure	Neuberg & Newsom, 1993	x	x	x	x	x	x	x
Positive and negative affect schedule	Watson, Clark, & Tellegen, 1988	x			x		x	
Regulatory focus	Higgins et al., 2001	x			x		x	
Regulatory mode	Kruglanski, Thompson, Higgins, Pierro, & Spiegel, 2000	x	x	x	x	x	x	x
Self-esteem	Rosenberg, 1965	x	x	x	x	x	x	x
Ten-item personality inventory	Gosling, Rentfrow, Swann, & Swann Jr., 2003	x	x	x	x	x	x	x
Trait self-control	Tangney, Baumeister, & Boone, 2004	x		x	x	x	x	x
Universal values	Schwartz, 1994	x			x		x	