CHAPTER 4

Construal Processes

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Humans have evolved a unique ability to mentally travel outside the here and now. We can contemplate the past, the future, counterfactual situations, other places, and other people's perspectives. However, these mental travels pose a central challenge: As the distance to the target of contemplation increases, the potential for variability within and surrounding that target also increases. For example, if I am preparing for the day, I can step outside to feel the weather—the temperature, the humidity, whether it is raining, and so forth—and use that information to decide what to wear that day. However, if I am thinking about preparing for a trip next month, I cannot simply step outside and know what the weather will be. It would be impossible to know all the details of the future weather in a distant place, and there are a variety of possibilities of what it could be, so it would be difficult to plan at the level of specific outfits. However, people are still easily able to imagine and plan for future vacations by considering certain features, such as the cost of the vacation, which are unaffected by details that are uncertain and liable to vary (e.g., the precise weather forecast). Or consider taking another person's perspective: If I see that someone has stubbed their[1] toe, I can infer that they feel pain, and I can imagine that pain. But there will be uncertainty around the exact degree, localization, and nature of the pain that they feel compared to my own pain if I stub my toe. However, despite this uncertainty and the potential for their experience to vary from my own, humans are still easily able to consider, understand, and learn from the experiences of others.

How is it that humans are able to contemplate, learn from, and tailor their behavior toward distant events and objects even though that distance entails increasing the variability of possible details surrounding them? In this chapter, we advance the following theoretical framework: Humans overcome the psychological challenge of thinking about events that occur beyond the here and now by constructing abstract mental representations that remain stable as specific details of the event vary. This proposal builds on construal-level theory (CLT), which posits a basic relationship between abstraction and the ability to consider objects or events that are psychologically distant (i.e., removed from the here and now). Research in this tradition has shown that as psychological distance to a target increases, people rely on higher-level, more

abstract construals, whereas when psychological distance decreases, people rely on lower-level, more concrete construals (for reviews, see Liberman & Trope, 2008, 2014; Trope & Liberman, 2003, 2010).

In this chapter we elaborate and expand on several key principles that are foundational for CLT. The *first principle* is that increasing psychological distance to a mental target increases the variability in potential details surrounding that target. The *second principle* is that abstraction has evolved to deal with the variability. It does so by construing mental objects in terms of their commonalities while subordinating their variations. The *third principle* is that encountering or considering variability induces the mental process of abstraction as a way to manage all possibilities. Together, these three principles form the basis for CLT. In the first part of the chapter, we elaborate these key principles and review illustrative research. In the second part of the chapter we expand on how these principles are tied to additional research in memory, self-control, and social cognition.

Theoretical Principles

Principle 1: Psychological Distance Increases Potential Variability

Psychological distance refers to the extent that any target of thought is removed from the egocentric here and now on dimensions of time, space, social distance, or hypotheticality. Cognition involves constantly traveling along these dimensions, such as imagining your weekend plans, thinking about where you parked your car, taking your colleague's perspective, or thinking about a counterfactual outcome of an election.

The challenge of distances is that they are "epistemic barriers," in which increasing distance is necessarily accompanied by an increase in uncertainty (Gilead, Trope, & Liberman, 2019). As a target becomes removed from direct experience, we lose access to its concrete perceptual details. As a result, psychological distance carries with it some degree of uncertainty about these specifics. Moreover, as psychological distance increases, we lose access to even more details, which means that the variety of possibilities for these concrete details increases. As a result, psychological distance increases anticipation for variability of possible outcomes. For example, while I cannot know exactly what the interior design of the home down the block looks like, the range of possibilities is likely much narrower than the range of possibilities for what the interior design looks like for a home in a foreign and unfamiliar country.

In terms of goals and self-regulation this creates a challenge—pursuing distant outcomes entails regulating one's behavior in a way that is effective even when one faces a variety of possible future states of the world. For example, if I am commuting to work right now, I can be relatively certain about the traffic and how to deal with it. If I am considering my commute in the future, there is a wider range of options for what the traffic will be like and how I should deal with it. This example illustrates that when considering any outcome (in this case, getting to work), the psychological distance from it increases the potential for variability in the factors that could plausibly impact reaching it.

The same challenge of uncertainty and potential variability occurs in the social domain when considering another person's experience. I can be relatively certain about what I ate for breakfast this morning. But if I am trying to guess what a friend had for breakfast, there will be a wider variety of possibilities to consider—and thus more uncertainty. Therefore, in the social domain, distance operates as a cue to the degree of potential discrepancy between one's own circumstance and that of a target (Kalkstein, Hubbard, & Trope, 2018b).

A concluding point is that seemingly distinct distances—temporal, spatial, social, and hypotheticality—are interrelated and together form a common currency of psychological distance (Maglio, Trope, & Liberman, 2013). At a basic level, the experience of psychological distance operates in a similar way and has a similar impact on mental operation when it occurs along any of these four dimensions. The current framework emphasizes that the interrelation among distances is due to a shared relationship with variability; that is, it is a positive association in which an increase in any psychological distance means an increase in potential variability.

Principle 2: Abstraction Evolved to Manage Potential Variability

When encountering an object (a person, an event, situation, etc., real or imagined), *abstraction* is a cognitive process of making a distinction between aspects that are central for a given purpose and aspects that are incidental for it and therefore peripheral (Shapira, Liberman, Trope, & Rim, 2012). Objects that share the same central aspects but differ in their peripheral aspects are deemed equivalent to each other (with respect to the given purpose). Peripheral aspects are thus allowed to vary without changing how the object relates to the purpose. In contrast, variability in terms of the central aspects would change how the object relates to the purpose (Gilead et al., 2019).

For a given construal, the important aspects are the ones that define how a person responds to the mental object. For example, if you are trying to save money, you will likely choose a grocery store based on its prices. Variations in terms of price (e.g., price variations between a store at time point 1 vs. time point 2, or between store *A* and store *B*) will change how you respond. In contrast, peripheral aspects are the ones that have relatively less impact on how a person processes or responds to the mental object. For example, the exact location of the grocery store may be peripheral; you may walk slightly farther in light of the goal to save money.

The process of abstraction creates invariance through mental construal. High-level construals (i.e., abstract construals) place a single object in a class with other objects (e.g., construing specific grocery store *A* as "an affordable store"), or group several mental objects based on their commonalities (e.g., construing grocery stores *A, B,* and *C* as "affordable stores"). As can be seen in this example, abstraction identifies commonalities across variable mental objects; identification of these commonalities is based on their relevance to one's goal. In other words, stores *A, B,* and *C* may be quite variable (e.g., in terms of location, hours, and customer service). But abstraction omits the low-level details that vary in ways that are irrelevant for one's goal and unites them based on their goal-relevant similarities. This makes higher-level construals stable and invariant despite any degree of variability within lower-level (less relevant) aspects. For example, changing the hours of the most affordable grocery store in my neighborhood will not affect my construal of it as my preferred store in light of my higher-level budgeting goals. In summary, abstraction distinguishes between which variability matters *for a given purpose* (i.e., changes to or variability among high-level aspects), and which variability does not matter for that purpose (i.e., changes to or variability among low-level aspects).

When abstraction occurs, the mind moves from a lower-level construal of a mental target (an object, event, action, situation, etc.) to a higher-level construal of that target. An example is taking the mental representation of the activity "exercise" as an input and construing it in terms of the more general concept of "improving health." Higher-level construals are more context independent. Improving health can manifest in various ways: choosing a salad in a restaurant, scheduling a checkup, or choosing to exercise. This means that high-level construals travel well across psychological distance, where contextual details are more likely to vary. As distance increases, and the uncertainty about how contextual details may vary increases, higher-level construals become increasingly important. For example, if I am considering my vacation in a year, and I don't have a location in mind yet, I won't know what specific exercises will be possible or what specific kinds of food will be available. But I can still maintain the high-level goal of being healthy during my vacation. In contrast, shifting downward from a more abstract construal to a more concrete construal would involve taking the input of "exercise" and construing it in terms of the more specific means of "running on a treadmill." Lower-level construals include more contextual features into their representation (e.g., the treadmill is at a gym). Returning to the example of the vacation, if I am making a plan to exercise during my vacation in a month but I don't know where I am going, I may not be able to make specific plans about the details of my exercise, so it makes sense to construe the goal in terms of "exercise" instead of something more specific. However, as the vacation approaches, and I know more about what options I have for exercise, moving to a lower-level con-

strual will be functional for helping me plan for the specific activities (e.g., pack a bathing suit for swimming).

Note that abstraction is always a subjective and relative process, and it shifts according to one's goals. No external object is inherently high-level or low-level but is instead only high or low relative to other mental objects for a given purpose (Gilead et al., 2019). Say, for example, that you are more concerned with health goals than with budgeting: Then the store's inventory of certain health foods may take precedence over its prices. In other words, variation in terms of health food options might matter a great deal, while variations in price might matter relatively less. However, the opposite would be true for people who are more concerned about budgeting than with health. As this example illustrates, abstractness is not a feature of objects in the external world, but rather something that the mind imposes on external objects.

One of the key consequences of the process of abstraction is that it guides how a person responds to a situation in a range of ways. In other words, though it is a cognitive process, it guides not just how people think but also how they feel and act. The level at which a person is construing a target determines how the person responds to that target. For example, a higher-level construal that represents an object in terms of one's most important values, such as health, will lead one to choose a vegetable over a cookie. However, a construal that represents the object at a lower level in terms of its taste will choose a cookie over the vegetable. Note that in this example, the construal in terms of taste is low-level relative to the overall goal of improving health.

The current framework emphasizes that as construals become more abstract, they are capable of dealing with more variable contexts, and of identifying more variable means to the same end. In the following sections, we review three lines of research that demonstrate the importance of abstraction for identifying variability that is relevant for a given purpose, while subordinating irrelevant variability: (1) visual working memory, (2) time perception, and (3) categorization.

Visual Working Memory

Indirect evidence for the function of abstraction as a means to classify variability comes from work on how abstraction impacts visual working memory (VWM; Hadar, Luria, & Liberman, 2020). This study revealed that a lower level of construal impaired the ability to filter distractors in VWM. In the current framework, distractors correspond to low-level (i.e., task-irrelevant) features that may vary without impacting the important aspects of the task. When people had a less abstract mindset, they were less able to separate the irrelevant distractors from the targets.

Additional research has shown that inducing abstract processing via a power manipulation improved VWM (Hadar et al., 2020; for the relationship between power and abstraction, see Smith & Trope, 2006). The study used a typical task that involves testing the ability to detect changes to target items. The experiment displayed visual sources with less information—that entailed a higher signal-to-noise ratio (one changing target within a field of four total targets), compared to more information—that entailed a lower signal-to-noise ratio (one changing target within a field of eight total targets). The study revealed that inducing a sense of power increased ability to use VWM to detect change despite a lower signal-to-noise ratio. In other words, abstraction was putatively related to a greater ability to detect the meaningful variability—that is, whether a target had changed or remained the same, even in the face of a wider range of overall variability.

Time Perception

Research on time perception provides important indirect evidence for the relationship between variability and abstraction. Past work has shown that increasing the number of changes that happen in a situation increases the speed at which time is experienced (e.g., Block, 1989, 1990). Hansen and Trope (2013) examined the effect of construal level on time perception. Their research was built on the idea that adopting an abstract mindset reduces the number of variations that are perceived in a situation. Across three studies, they found that people in an abstract mindset perceived time as passing more slowly than did people in a concrete mindset. In two additional studies, they found that changes to low-level details speeded time perception for those in a low-level mindset, whereas changes

to global features speeded time perception for those in the high-level mindset. This research provides important evidence for the idea that abstraction places greater weight on variation in high-level features, whereas concrete thinking places greater weight on variations in low-level features.

Categorization

Another field of research that explores the relationship between variability and abstraction is categorization. In a seminal paper on the psychology of categories, Rosch, Mervis, Gray, Johnson, and Boyes-Braem (1976, p. 382) assert, "The world consists of a virtually infinite number of discriminably different stimuli. One of the most basic functions of all organisms is the cutting up of the environment into classifications by which nonidentical stimuli can be treated as equivalent." These authors go on to argue that the abstraction of general categories that cover variable exemplars is a fundamental mental operation that allows people to organize the external world into cognitively and behaviorally useful units of representations. Through treating variable instances as exemplars of a general category, people are spared the mental work of generating unique predictions and action plans for each subtly different object or event they may encounter (see Murphy, 2010). The task of encountering each object or situation anew, without recognizing it as a case of a broader class, would make adaptive functioning nearly impossible given the seemingly infinite ways in which any two targets may differ from one another.

In general, the construction of categories is a cognitively efficient adaptation that humans have developed to simplify the massive complexity and variety of the external world. Categories serve as general knowledge on which people may draw on to understand both previously encountered and novel events or objects (Murphy & Medin, 1985). For example, suppose a young child has recently acquired the abstract category of "dog" and has learned that dogs are friendly creatures who slobber. The knowledge of this category and its typical characteristics would allow the child to infer much about a wide variety of new creatures as long as they are labeled as dogs. As a result, that child would have a much stronger sense of how to interact with any new dog than if they had not acquired the abstract concept of "dog."

More generally, at their core, categories define and label variability. Lower-level categories include less variability among their members, whereas higher-level categories include more variability among their members. For example, there is less variability between various objects in the category "carrot" than in the category "vegetable." And there is more variability in the category "food" than there is in the category "vegetable." In this way, categories are general mental representations that partition the immense variability encountered in the external world into manageable and useful cognitive units.

Principle 3: Variability Prompts Abstraction

The third principle is that integrating across encountered or anticipated variability prompts abstraction. This principle follows from the first two principles, but it makes unique predictions. The first two principles dealt with the purpose of abstraction for processing variability in the world. In this final section, we review the idea that because abstraction is adaptive for managing variability, seeing or anticipating variability may begin the mental processes associated with abstraction. This principle further posits that when anticipating variability, the level of abstraction recruited will reflect the degree of predictability of the anticipated variability. More predictable forms of variability include a narrower range of possible outcomes, whereas less predictable forms of variability include a wider range of possible outcomes, and this wider range in turn requires a higher level of abstraction to manage it.

Structural Alignment

Support for the idea that integrating across variable inputs leads to abstraction comes from structural alignment theory (SAT; Gentner, 1983; Markman & Gentner, 1993). According to SAT, the process of comparing two or more distinct stimuli initiates a process of extracting an abstract and schematic representation of the underlaying structure of each. Structural alignment then works to identify commonalities

across distinct stimuli that remain stable despite superficial or lower-level differences. For example, a structural alignment of a satellite and the moon might highlight the structural commonality that each orbits the earth. Through this process of structural alignment, the act of comparing distinct stimuli leads to the development of relational categories and, more generally, abstract schematic representations (e.g., Boroditsky, 2007; Christie & Gentner, 2010; Gentner & Namy, 1999, 2006; Gick & Holyoak, 1983; Kurtz, Boukrina, & Gentner, 2013; Markman & Gentner, 1993). Additional work indicates that increasing the variability between two objects in a comparison further promotes abstraction (Vendetti, Wu, & Holyoak, 2014).

Category Induction

Another example of variability prompting abstraction comes from research on distributed practice and category induction. A vast array of research has examined the role of massed versus distributed learning on long-term memory. While massed learning corresponds to learning something in one temporal context (e.g., studying for 3 hours in a row on a Monday), distributed (spaced) learning refers to learning the same thing, but spread out into variable temporal contexts (e.g., studying 1 hour per day on Monday, Wednesday, and Friday). In distributed learning, successful studying necessitates abstraction over these temporally variable contexts. This in turn helps to direct attention to the primary dimension, which is the content of study.

Recent research has tested whether distributed learning increases abstraction. Specifically, two studies tested the effect of distributed learning on inductive reasoning (i.e., generalization from observed cases to entire abstract categories; Vlach, Sandhofer, & Kornell, 2008). The researchers tested how well individuals could learn that a range of exemplars included members of different categories. Learning occurred with either massed (back-to-back) repetitions or spaced repetitions. They found, as predicted, that spaced repetitions facilitated learning of abstract categories compared to massed repetitions (see also Vlach, Ankowski, & Sandhofer, 2012).

Summary of Theoretical Principles: Variability Explains the Relationship between Abstraction and Psychological Distance

In this chapter, we build on CLT, which posits an essential relationship between psychological distance and abstraction. We do so by postulating three core principles that explain CLT in terms of a more basic relationship between abstraction and variability. The first principle states that distance is related to variability: As distance to a mental target increases, variability of possible specific details increases. The second principle states that abstraction is designed to manage this variability. The third principle states that considering variability prompts abstraction. Put together, these three principles lead to the conclusion of CLT, namely, that as psychological distance to a target increases, potential variability around details of that target increases, which in turn prompts the need to identify and extract sources of stability via abstraction. In other words, abstraction broadens the range of possibilities we can consider, which in turn broadens our scope to include more distant targets.

Empirical Evidence

In the first part of this chapter, we reviewed the three principles that form the theoretical basis of CLT. In the second part of the chapter we first provide further review of empirical evidence that relates these principles to existing research on CLT, then examine how these principles manifest in terms of how people store and apply information, how they make decisions, and how these processes are expressed in social contexts.

A diverse body of existing research provides evidence for the relationship between psychological distance and abstraction, which covers areas such as counterfactual thinking, memory, social cognition, communication, and morality (for a meta-analysis, see Soderberg, Callahan, Kochersberger, Amit, & Ledgerwood, 2015). For example, research has shown that people prefer to identify actions in terms of their ends rather than their means when they are more temporally distant (Liberman & Trope, 1998), spatially distant (Fujita, Henderson, Eng, Trope, &

Liberman, 2006), less likely (Wakslak, Trope, Liberman, & Alony, 2006), and socially distant (Liviatan, Trope, & Liberman, 2008). Construing an action in terms of its ends is functional for projecting it across greater distances wherein the means for completing that action become more uncertain. Consider the action of "locking the door." When I am currently engaging in the action, I can represent it in terms of how I will do it—for example, by "placing a metal key in a lock." However, when the action is psychologically distant, I may consider a wider range of ways that the action may be accomplished—for example, using a key card or a pin pad for a digital alarm system. Therefore, representing the action more abstractly, in terms of its end (i.e., "securing the house") provides a representation of the action that can remain stable, even as the contextual details around the action may vary.

As another example, temporal distance increases the relative weight people place on more abstract, aggregate information (e.g., average customer rating) compared to more concrete, individualized information (e.g., one specific customer review) when evaluating and making decisions about products (Ledgerwood, Wakslak, & Wang, 2010). In this example, when people imagine using a product in the more distant future, they tend to do so in a more decontextualized manner that allows for a variety of possibilities. This makes it useful to focus on more abstract information during evaluation (e.g., consensus rating), since it provides information that is more broadly applicable than does the specific experience of one reviewer.

An important question in learning and memory is the extent to which people generalize after they learn something. In this process, abstraction comes in as the ability to identify that event *A* is similar to event *B* even if their lower-level details diverge. Recent research examined how psychological distance impacts generalization (Ram, Struyf, Vervliet, Menahem, & Liberman, 2019). In these studies, participants underwent a learning phase that showed stimuli predicting outcomes. Whereas some participants saw stimuli that predicted a given outcome with low probability, others saw stimuli that predicted the outcome with high probability. Here, low probability corresponded to greater psychological distance to the outcome (i.e., it is more hypothetical) than high probability to the outcome (i.e., it is less hypothetical). In terms of the present framework, the higher-probability condition corresponded to more certainty about the outcome and the lower-probability condition corresponded to more uncertainty. After the learning phase, generalization was tested by presenting identical stimuli, as well as a range of similar (but not identical) stimuli, and people rated their expectations for the outcome. During this test of generalization, people in the low-probability condition were more likely to expect the same outcome from similar, but not identical, stimuli.

This research provides evidence for the idea that initial exposure to psychological distance to an object (the outcome) led people to generalize more widely from that object. Ram and colleagues (2019) point out that there is variability inherent in distancing, and this calls for using broader generalization to maintain the applicability of one's prediction. This means knowing that stimulus *X* will lead to outcome *Y,* and generalizing to infer that stimulus *X′* may also lead to outcome *Y.* This is adaptive because as we extend beyond the here and now, we need to be able to understand that different things may predict the same outcomes, even if they are not identical to the things that predicted these outcomes in the past.

In addition to the effect that psychological distance has on abstraction, CLT posits a bidirectional relationship in which abstraction prompts the consideration of more distant objects (Trope & Liberman, 2010). We propose that variability is involved in this bidirectional relationship. Because abstract construals focus on stable features of mental objects and subordinate variability, they can apply to more distant situations, in which the details are variable, uncertain, or unknown. As an example, if I generate an abstract representation of my phone as a communication device, it fits a wide range of instantiations that extend across various psychological distances.

So far, we have sought to elaborate the three principles that form the basis of CLT and review research that illustrates this relationship. In the sections that follow we examine how the principles manifest in empirical work in terms of (1) memory, (2) decision making, and (3) social cognition.

Memory

A key area in which the relationship between abstraction and variability applies is in the domain of memory. Memory involves mental time travel, so it is no surprise that abstraction plays a role. Functionalist accounts of memory posit that memory exists to serve prospection (e.g., Schacter, Addis, & Buckner, 2007; Suddendorf, 2006). These theorists draw on evidence from neuroscience that memory systems highly overlap with systems responsible for simulation and propose that memories exist as the raw inputs for predictions about the future. These accounts emphasize that people construct simulations of anticipated future events by recombining concrete details of past experiences.

We posit that the memory-for-prospection process has a central problem in the form of uncertainty about details, to which we lose access when a target moves outside our direct experience. One source of uncertainty is in terms of how veridical our memories are, especially as they extend further into the past. A parallel source of uncertainty is in terms of what to expect in the future, especially as we try to simulate events that are further in the future. We therefore conclude that abstraction (i.e., moving to a higher level of construal that omits concrete details but maintains general meaning) is an essential part of the process of using our memories for prospection and prediction (see Liberman, Trope, & Rim, 2011). In this section, we cover evidence for this conclusion with research on (1) memory-based analogical comparison and (2) the effect of massed versus distributed practice on memory.

Memory-Based Comparison

Evidence for the role of abstraction in the process of using memories for prospection comes from research on memory-based comparison. One set of studies varied whether people made comparisons between two images presented simultaneously, or two images presented separately on two sequential trials (Kalkstein, Hubbard, & Trope, 2018a). While the simultaneous condition entailed comparing two sources in the same temporal context, the sequential condition entailed bridging representations across two separate (albeit proximal) temporal contexts. The experiments demonstrated that sequential comparison led people to construe the stimuli at a more abstract level than did simultaneous comparison. When two visual scenes were presented sequentially, people identified correspondences between objects in each scene based on their relational roles (e.g., they matched an umbrella in one scene with a newspaper in another because both occupied the role of protecting a girl from the rain). In contrast, when the scenes were presented simultaneously, people identified correspondences between objects in each based on their surface-level appearance (e.g., they matched an umbrella in one scene with a similar umbrella in another, even though they occupied different roles in the scene). In more general terms, when the source of comparison is removed from immediate experience, the comparison shifts to a higher level of abstraction.

From the current perspective, we argue that this shift toward more abstract processing when recalling the past is functional for prospection. Previous accounts of prospection suggest that people construct simulations of future scenarios by recombining specific details of past experience (Schacter et al., 2007). In contrast, this research suggests that abstraction facilitates simulation by constructing mental representations that omit concrete details rather than recombine them. Such decontextualized representations can then be used to prospect about future contexts whose details are unknown. In this way, abstraction may serve a critical role in linking memory to prospection.

The Distributed Learning Effect

The distributed learning effect demonstrates a link between contextual variability and long-term memory. Here, we elucidate this link by positing a role for abstraction in managing uncertainty and supporting long-term memory. The *distributed learning effect* refers to the phenomenon that memory retention for items studied across a set of spaced study phases is better than memory retention for items during one study phase, even if the total amount of study time is equivalent (Ebbinghaus, 1885; for a review, see Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006). Distributed practice effects

are important because they have been found in not only basic domains but also applied domains (e.g., foreign language learning: Bahrick & Phelps, 1987; surgical training: van Dongen, Mitra, Schijven, & Broeders, 2011; memorizing anatomical information: Dobson, Perez, & Linderholm, 2017).

Spaced repetitions correspond to variable temporal contexts, whereas massed study phases correspond to a single, stable context with limited variability. Studying across variable contexts leads to increases in the variability of low-level details around the targets that people are trying to learn. For example, if you are learning the meaning of new words in a foreign language, you are learning in a context that includes myriad peripheral details, such as the room you're in, the amount of daylight, your interoceptive state, and so forth. While increasing spaces between episodes of learning leads to decreasing similarity of those episodes (i.e., more variability in peripheral details), whatever remains that *is* similar across the episodes will be identified as stable and enduring. We posit that this is an instance of abstract processing, which is engaged to manage variability of low-level, context-bound details (see also Toppino & Gerbier, 2014). This abstract processing, in turn, may support better long-term memory for the targets at the test phase (i.e., by constructing representations of the targets that are robust to future contextual changes, including the contextual changes that occur in these studies between the learning phase and the test phase).

Decision Making

In addition to memory, abstraction can manage variability in the domains of decision making and self-control. The way people behave in response to a situation may be determined by how abstractly or concretely they construe the situation. When choosing how to act, an individual must manage a range of variable inputs and concerns. Abstraction facilitates making decisions that are in line with global concerns, which include more psychologically distal outcomes over more local concerns, which include only more proximal outcomes. In the following section, we review the relationship between abstraction and decision making in three domains: (1) self-control, (2) decisions based on large versus small samples of information, and (3) exploration versus exploitation.

Self-Control

Self-control challenges are often defined by a conflict between an immediate temptation and a more global goal (e.g., Fujita, Trope, & Liberman, 2010; Kalkstein, Fujita, & Trope, 2018). One way to conceptualize self-control problems is the challenge of acting in line with global goals, despite the variability of interests and concerns that may influence any given decision about how to act. For example, a dieter may have the global goal of being healthy, but the specific smell when walking by the bakery may prompt an isolated desire to indulge in sweets, even though doing so would undermine their overall health goal. In this case, self-control entails adhering to one's health goals that are stable and enduring across various contexts. Failure means indulging in the momentary and contextual desire of consuming sweets.

Research within the CLT framework has shown that higher-level construals promote self-control by promoting structuring and prioritization of one's higher-level goals. Fujita and colleagues have manipulated level of construal and have shown that inducing a more abstract mindset leads to greater self-control in a range of domains, including reducing temporal delay discounting and changing food attitudes to align with dieting goals (Fujita & Carnevale, 2012; Fujita & Han, 2009; Fujita, Trope, Liberman, & Levin-Sagi, 2006). Furthermore, when people encounter a self-control dilemma, they choose to adopt a high-level construal (Nguyen, Carnevale, Scholer, Miele, & Fujita, 2019). One explanation for the way abstraction can promote self-control is that it creates a unifying policy that integrates across the range of variable concerns. This integration, and the resulting abstract policy, coordinates interests, so that an individual can act in line with their global goal.

Sampling Large versus Small Amounts of Information

When gathering information for a decision, it is optimal to rely on larger random samples of information because they are more representa-

tive and thus give rise to estimates that are more likely to generalize to a larger population or a different sample. The breadth of sampling has been found to impact the quality of decisions in financial and personal domains. For example, frequently checking investment outcomes splits information samples into smaller, less representative chunks. Relying solely on the most recent small chunk, without integrating it into a broader pattern, leads to underinvestment in relatively risky but high-paying alternatives (e.g., stocks) and overpreference for safe alternatives (e.g., bonds) (Benartzi & Thaler, 2007; Thaler, 1999). As another example, when people are learning about reward choice sets from small samples of their own direct experience compared to summary descriptions, they underweight the likelihood of rare events (Hertwig, Barron, Weber, & Erev, 2004).

Halamish and Liberman (2017) demonstrated in five experiments that psychological distance leads people to prefer larger samples of information before making a decision. In these studies, the decision was between two options that had different probabilities of a financial payout. The authors explain the effect in terms of desirability and feasibility: Gathering a larger sample of information may be more desirable (to make an optimal choice) than it is feasible (at the cost of time and cognitive resources). According to CLT, psychological distance promotes desirability concerns ("What do I want?") over feasibility concerns ("How I can get it?").

In the current account, obtaining more (vs. less) information may correspond to an anticipation of more (vs. less) variability. With greater psychological distance, people may anticipate a higher degree of variability in the outcome of choice. As a result, people may be motivated to obtain more information to extract a more generalizable estimate to protect against such uncertainty. This research reveals a relationship between psychological distance and choosing to sample more information; it also sets the stage for additional research on how larger or more variable samples themselves may promote higher levels of abstraction.

Exploration versus Exploitation

Many reward-based decisions can be framed in terms of staying in a local context, where the payoffs are certain (e.g., going to a nearby, familiar restaurant) versus venturing outside of the local context, where the payoffs are uncertain but include potential for higher reward than the current context affords (e.g., searching throughout the current and surrounding neighborhoods for a new restaurant). Traditionally, this is known as a trade-off between exploitation and exploration.

To exploit one's original local context is to take advantage of a known entity with a known value; it is a safe and certain choice (e.g., a restaurant that one knows is good enough). While relatively effortless to choose, the exploitation choice does involve a potential opportunity cost. To explore novel contexts is to gamble—to gain potentially higher rewards (e.g., a higher-quality restaurant) or risk potential losses (e.g., finding only lower-quality restaurants). There are many situations in which the expected value of exploration is greater than the expected value of exploitation. Yet despite this higher expected value, exploration likely involves the cost of time and resources, so exploration is not the default choice over exploitation.

What factors contribute to exploration over exploitation? Exploitation is based on choosing to stay in your local area, which entails less exposure to variability. Exploitation occurs when an individual chooses to stay put or chooses to stop exploring after an encounter with a negative short-term outcome, even when the possibility of a positive long-term outcome exists. In contrast, exploration is based on choosing to move beyond one's local area, which entails more exposure to variability. In theory, individuals who explore should have an abstract representation of the potential overall value to be gained, and this abstract representation can remain stable, even as they encounter variable experiences along the way to their ultimate goal.

Yudkin, Pick, Hur, Liberman, and Trope (2019) examined this question in a set of studies that used the Two Hills Game. The task involves uncovering tiles on a matrix that each have varying values. The participants start in a place on the matrix that is near one "hill" of value that corresponds to a local maximum. There is also another hill, which is farther away from the starting point, and corresponds

to a global maximum. In order to arrive at the global maximum, participants must "explore," which includes traversing a valley of tiles that are lower in value than the local maximum, before gradually ascending to the global maximum. Exploitation was indexed by the likelihood of staying near the local maximum, whereas exploration was indexed by measuring the likelihood of leaving the area around the local maximum, as well as the overall points earned in the game. Across several studies, they found that greater psychological distance promoted more exploration. In addition, they found a correlation between level of construal, measured as a mindset before the task, and the degree of exploration, in which higher levels of construal were positively associated with amount of exploration.

One way to explain this relationship is that distance increases people's level of construal, which in turn allows them to mentally subordinate the variability that is irrelevant to their goal, while identifying and centering on variability that is relevant to their goal. Hence, construing the task at an abstract level encourages people to endure short-term experiences of low-value tiles in the "valley" by keeping them focused on the ultimate goal of eventual ascent to the global maximum that is meaningfully more rewarding.

Social Cognition

The ability to extract abstract commonalities across variable events and circumstances gives rise to humans' expansive social capabilities (Kalkstein et al., 2018b). At the most basic level, each individual necessarily has their own unique experience with the world. Furthermore, it is impossible to ever truly and fully know another person's inner experience. Yet despite such variability and lack of access to others' personal experiences, humans have a remarkable ability to learn from, share ideas with, and coordinate with one another. Drawing on the current framework, we argue that such sociality is made possible by abstract thought that renders idiosyncratic differences secondary to more general between-person commonalities. In the following section, we explore the relationship between abstraction and social cognition in four domains: (1) causal attribution, (2) social learning, (3) communication, and (4) social diversity and creativity.

Social Causal Attribution

When engaging in social interactions or anticipating future ones, people are often trying to explain their own behavior and others' behavior, and make predictions based on those explanations. Classic theory and research on social judgment points to the role of abstraction in managing the high degree of variability in others' behaviors and uncertainty about potential causes of those behaviors (Fiske, 1993; Heider, 1944; Jones, 1972; Kelley, 1973). This uncertainty about causes corresponds to a wider range of possible options that could explain the behavior. For example, let's say you observe a woman who trips, and you are trying to explain her behavior. One possible explanation is a specific explanation based on a contextual detail: "The floor was slippery"; another explanation is a general one based on the person's disposition: "She is clumsy." The goal of causal social inferences is to make predictions about behavior that generalize to multiple contexts. In order to make a prediction, the causal inference must not only be adequate to describe the current behavior but also general enough to apply in new contexts.

From a CLT perspective, trait-level inferences are functional for making predictions, as they identify abstract qualities that are represented as enduring across variable contexts (e.g., you can imagine that a clumsy person will continue to make missteps even without knowing contextual specifics such as exactly what the misstep will be or how it will occur). Moreover, CLT predicts that with psychological distance, people shift from more specific, contextualized explanations (e.g., "She tripped because the floor was slippery") to more general, dispositional explanations (e.g., "She tripped because she is clumsy"). According to CLT, the classic *fundamental attribution error,* which is the tendency to make dispositional rather than situational attributions (Jones & Davis, 1965; Ross, 1977), would increase with increasing distance due to increased variability and uncertainty of the contextual details that may have given rise to the behavior.

One set of studies examined whether increasing psychological distance to a target scenario—by considering it in the future rather than the present—would prompt abstract processing and thus increase the weight of global traits in predicting and explaining behavior across situations that vary in time, location, or social context (Nussbaum, Trope, & Liberman, 2003). This research showed that temporal distance increased the level of trait-based attributions rather than situation-based attributions. In another study, people sought more information about global traits for the distant future than for the near future, and they also rated explanations of their own behavior as more global (applying to more situations) when the explanations were provided for distant rather than near outcomes. All these studies point to an overall preference for more global, consistent, trait-based explanations when the situations are distal compared to proximal (see also Henderson, Fujita, Trope, & Liberman, 2006; Rim, Uleman, & Trope, 2009).

The Kelley Covariation Model

As we noted earlier, the current framework is not the first to propose of a link between variability and social attribution. The Kelley covariation model seeks to explain how people make causal attributions based on multiple observations over time. It states that "an effect is attributed to the one of its possible causes with which, over time, it covaries" (Kelley, 1973, p. 108). The current framework builds on the covariation model by positing a role of abstraction in the process of identifying covariations. When a cause covaries with an effect over time, there are also things that inevitably do not covary with those two variables. If I see Robin being polite at work, at home, and at a party, Robin is covarying with being polite, while the locations are changing**.** I must not only track the covarying of Robin and "polite" but also subordinate the variability that is not relevant to my trait inference, which is the changing locations. Relatedly, if I hear 10 people say that a comedian is funny, that comedian covaries with being funny even as the people who evaluate her vary. In this case, the process of abstraction subordinates the dimension of who is evaluating the comedian and extracts a stable representation that the comedian is linked to the trait of being funny. Finally, this model may apply to a situation as well. If I see 10 job candidates be polite in their job interview, then "job interview" and "polite" are covarying despite variability in the candidates. In this framework, we emphasize, there is a hierarchy in which the covarying factors are superordinate and other random variables are subordinate. Abstraction is the cognitive process that creates this hierarchy.

Social Reinforcement Learning

Evidence that people rely on trait information in order to generalize across contexts comes from a study on reinforcement learning and social decision making (Hackel, Doll, & Amodio, 2015) that investigated how people respond to reward information versus information that implied a trait in an economic game setting. The study showed that while people encode information about the reward value of other players in the game (i.e., the magnitude of money shared by a player across trials), they also encode trait-level information (i.e., generosity: the proportion of allotted money shared by a player across trials). Moreover, this study revealed that the trait-level information generalized more to new contexts more than did reward-level information. Specifically, participants preferred to interact in subsequent contexts with more generous players. Thus, the abstract trait concept guided people's preferences for interaction partners across variable contexts.

Social Learning

Social learning, the ability to vicariously learn from the experiences of others, is arguably the single greatest contributor to the richness and expansiveness of people's mental horizons (see Bandura, 1977; Boyd, Richerson, & Henrich, 2011). Through social learning, people gain exposure to an exponentially wider variety of experiences, events, and information than they could ever encounter on their own. Moreover, increasing the diversity of one's interaction partners creates more varied opportunities for learning, as it exposes that individual to an even wider array of ideas and experiences.

However, social learning also poses a challenge, in that it requires people to transfer information from one context (i.e., someone else's

experience) to another that is potentially very different (i.e., one's own experience). Furthermore, as one's interaction partners become more distant and dissimilar, the possibility for their experiences to have occurred in vastly different contexts increases. Thus, at its core, social learning entails solving the problem of extracting general lessons that are applicable across variable circumstances.

Abstract thought is therefore foundational to social learning and to broadening the range of others from whom one can learn. One series of studies demonstrated that thinking abstractly increases the scope of others that people are willing to consider as sources for social learning. For example, people consider a broader range of others when they contemplate emulating traits rather than behaviors (traits are more abstract, as they encapsulate a variety of behaviors) (Kalkstein, Kleiman, Wakslak, Liberman, & Trope, 2016). This expansion in social scope afforded by abstraction is especially relevant in today's world of global interconnectedness. More than ever before, people are interacting with others from different and diverse contexts than their own. The ability to learn abstract lessons that generalize across a variety of contexts enables people to take advantage of the wealth of learning opportunities available through interacting with distant and diverse others (Kalkstein et al., 2018b).

As in other domains, the link between variability and abstraction in social learning is bidirectional. The challenge of transferring lessons from other people to the self leads people to engage in abstract thought that forms decontextualized representations of the lesson that are stable across variable contexts. Supporting this assertion, research has shown that people represent learned information at a more abstract level when they acquire it through social learning than when they acquire it through their own direct experience (Kalkstein et al., 2016). In addition, this research has shown that the more distant a model for social learning is, the more abstractly people construe the information learned from them (see also Hansen, Alves, & Trope, 2016). This occurs because distance operates as a cue to potential variability in circumstance. Since more distant models may occupy more discrepant circumstances, learners tend to represent their action and acquired information at a higher level to ensure its successful transfer to their own circumstance.

Moreover, research has also shown that when people apply information learned from more distant others, they do so by acting on higher-level representations of the information. For example, one set of studies showed that people were more likely to emulate a model by pursuing the same goal (but adopting different means) when the model was distant, but they were more likely to emulate the model by imitating specific movements when the model was near (Genschow, Hansen, Wanke, & Trope, 2019). This research shows that abstraction during social learning also impacts the application of learned information by providing a schema for emulation that permits flexibility in execution, which may be necessary if one's immediate environment is different than that of the model.

Communication

On the other end of the interaction, teachers and communicators are tasked with the challenge of sending out information in a way that is applicable to the context of their recipients. This challenge is exacerbated when communicators are attempting to reach audiences that are distant or diverse. As with social learning, a distance implies the potential that the audience inhabits a context very different from one's own. In this case, the communicator must account for a variety of possible contexts to ensure that the message is applicable to a distant receiver. To do so, communicators use more abstract language when communicating with more distant others (Joshi, Wakslak, Raj, & Trope, 2016). Similarly, when communicating with large and diverse audiences, communicators face the challenge of sending out a message that is applicable to the variable contexts and perspectives of all the people in the audience. Research has shown that communicators use more abstract language, discuss more abstract qualities of themselves (e.g., traits instead of behaviors), and use more high-level persuasive appeals (e.g., emphasize desirability of a product over its feasibility) when communicating to larger and more diverse crowds (Joshi & Wakslak, 2014). Overall, using abstract language to communicate with distant and diverse crowds

is functional, as it sends messages that are more broadly applicable across the variable experiences of audience members. Finally, from our perspective, referential communication to an audience is likely to result in higher-level construal of the referent. Whether this will produce a shift toward the audience's evaluation of the referent (Echterhoff, Higgins, & Levine, 2009; Higgins, 2016) will depend on whether there is greater evaluative similarity to the audience at a high level of construal of the referent or greater similarity at a low level of construal.

Broader Implications

In this section, we briefly explore some broader implications of these principles. First, social diversity may affect processes of group decision making and creativity. Furthermore, abstraction may prompt preferences for social diversity and facilitate equitable application of justice principles. Finally, we discuss the implications for how people deal with variability of the climate—from typical seasonal changes to the consequences of global warming

Social Diversity and Inclusiveness

A central argument we have made throughout this chapter is that integrating across variable events or objects promotes abstraction. In the social domain, this suggests that exposure to diverse perspectives and cultures should facilitate abstract thought. While there is much debate around the effectiveness of group decision making, our perspective suggests that diverse groups may lead to more abstract decision making. However, we would only suspect such an outcome in cases in which the group actively integrates across diverse perspectives (Maznevski, 1994).

Indirect support for this comes from the finding that living abroad is related to increased creativity in problem solving and associations (Maddux & Galinksy, 2009). Given the link between abstraction and creativity (e.g., Polman & Emich, 2011), this finding is consistent with the hypothesis that exposure to diverse cultures promotes abstraction. Under our account, such a result would be expected, since living abroad entails living in a context that varies from one's own context. To the extent that individuals compare the two, we would expect them to develop more abstract understandings of each. Furthermore, this finding has implications for immigration in general, including migration of refugees. Such patterns increase the diversity of perspectives, cultural knowledge, customs, and so forth; abstraction may be recruited to extract high-level commonalities among groups in order manage this diversity.

Finally, abstract thinking may promote acceptance and preference for social diversity and inclusiveness. For example, research has shown that among conservatives, thinking abstractly is related to an increase in tolerance for non-normative groups (e.g., people who diverge from the majority in terms of sexual orientation or religion; Luguri, Napiere, & Dovidio, 2012). Abstract thinking is also related to endorsement of affirmative action, a precursor to social diversity (Fleischmann & Burgmer, 2019). In addition, psychological distance is related to a preference to apply justice principles universally rather than applying them based on individuating features of a target (Mentovich, Yudkin, Tyler, & Trope, 2016). Abstraction may be associated with preferences for certain forms of social diversity because it is able to extract variability that is important for the situation at hand (e.g., has this person been treated unfairly?) and subordinate variability that is irrelevant for that situation (e.g., a person's demographic characteristics).

Climate Change

These principles may have implications for how abstraction helps people manage environmental variability, both locally and globally. Moving from a consistent environment (e.g., a stable, temperate climate) to an environment that varies according to a pattern (e.g., seasonality) may require an increase in abstraction to facilitate planning and coordination to manage that variability. For example, within a local climate that includes both summer and winter months, a preagricultural community would need to plan for the shift in available food sources in the winter (see Van Lange, Rinderu, & Bushman, 2017). This kind of planning may be facilitated by abstraction: A range of food sources may be unified under the category of whether it can be preserved for winter, while other features of the

food (e.g., its taste) may be subordinated. This process of abstraction and prioritization would then guide people toward acquiring preservable foods before winter rather than foods that are tasty but may rot (see also Kalkstein et al., 2018b).

Beyond seasonality, abstraction may be critical for unpredictable climate variability, namely, for finding ways to respond to the myriad variable consequences of the climate change crisis. Responding to climate change requires thinking beyond one's immediate local context and considering a wide variety of scenarios. For example, there is a great deal of uncertainty in predicting the severity and location of hurricanes 20 years from now. While we cannot yet predict exactly how climate change will impact future weather events, consensus has emerged that we are experiencing more variable and extreme weather events currently than in the past and that we can expect even more variable and extreme weather in the future. In order to plan and prepare for such events, we must identify policies and solutions that will be applicable across a range of possible natural disasters. These might include abstract procedures planned and enacted by governmental agencies to deliver aid to affected areas. They might be preventative measures, such as better initiatives to reduce carbon emissions, thus targeting the causes of climate change and perhaps alleviating the need to respond to myriad future calamities. In general, abstract thinking will be imperative for generating adaptive responses to the uncertain future we face because of climate change.

Conclusion

CLT proposes that abstraction is designed to manage targets at increasing levels of psychological distance. In this chapter, we have sought to elucidate the role of variability in this process, including variability of possibilities and the uncertainty therein. As psychological distance increases, variability increases, which in turn prompts the need for abstraction to manage that variability. We are proposing variability as a unifying factor that relates various psychological distances and highlighting abstraction as a unique cognitive adaptation that manages variability. In addition to connecting research results across various domains, including memory, self-control, and social cognition, this proposal seeks to provide a theoretical basis for novel hypotheses in future research.

NOTE

1. In the chapter, we have given careful thought to pronoun use. In situations like this one in which pronoun use was needed and the gender identity of the person being referenced is unknown, we used "they/them/their" to indicate a gender-neutral pronoun.

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