# On the Vices of Nominalization and the Virtues of Contextualizing

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The chapters in this volume document the importance of context across diverse literatures, including genetics, neuroscience, perception, action, cognition, emotion, social interaction, and culture.[1] Specifically, three dominant themes emerge from this interdisciplinary collection.

**Theme 1. Extensive evidence exists for context effects.** Regardless of one's theoretical orientation, there can be no doubt that context effects are ubiquitous. When a phenomenon is studied carefully, it typically does not behave the same way across contexts. Regardless of whether the phenomenon is genetic, neural, cognitive, behavioral, social, or cultural, it is likely to exhibit extensive sensitivity to context, as the diverse chapters of this volume illustrate.

**Theme 2. Taking context into account is more effective than ignoring it.** When a mechanism is specified independently of context, it may capture some variance of the phenomena it explains. Nevertheless, taking context into account invariably explains significantly more variance. When a mechanism contributes to a phenomenon, context shapes the expression of its contribution.

**Theme 3. Mechanisms as dynamic context-sensitive processes.** As Barrett, Mesquita, and E. Smith (Ch. 1) document, lay individuals and scientists alike gravitate toward decontextualized ways of thinking that simplify and objectify mechanisms. From this perspective, modular mechanisms exist that operate exactly the same way across contexts, using additional processes to adapt a mechanism's behavior to each context in which it operates (e.g., Fodor, 1983). A classic example is Chomsky's (1965) decontextualized rules of syntax that remain constant across contexts, while performance rules map them to specific utterances. Fodor's (1975) decontextualized representations of concepts operate similarly. Barrett et al. provide many additional examples of decontextualized mechanisms in science.

Some mechanisms may indeed operate across contexts in a relatively invariant manner. For example, DNA remains constant across different contexts while RNA expresses it dynamically (Harper, Ch. 2), and occasionally, a classically-

conditioned stimulus-response relation does not change across contexts (e.g., Bouton, Ch. 12). Nevertheless, the form of many mechanisms depends inherently on context. Following Barrett et al.'s Context Principle, such mechanisms emerge from context, with context contributing to the expression of the mechanism on each occasion (also see Bechtel, 2007; Bechtel & Richardson, 1993). Rather than being constant in each context, the mechanism itself changes, reflecting contextual contributions to its emergent form. Many authors in the current volume construe their mechanisms of interest this way, namely, as dynamic context-sensitive processes, not as objectified context-free mechanisms.

Ultimately, distinguishing between these two possibilities must be addressed for any mechanism. Given the strong epigenetic character of virtually everything at systems level neuroscience and higher in complex organisms, it seems likely that many of the relevant mechanisms will turn out to be inherently context-sensitive. Furthermore, the exquisite sensitivity of cognitive processes to repetition priming, statistical structure, and expertise, together with the widespread belief that context-sensitive patterns in memory underlie such phenomena, suggest that modular context-free mechanisms in the brain may be relatively unusual.

## The Vices (and Virtues) of Nominalization

If the evidence for context effects is so overwhelming, why do people continue to exhibit *Platonic Blindness*, namely, the failure to see the importance of context (Dunham & Banaji, Ch. 10)? One possibility is that Platonic Blindness reflects a more general and basic phenomenon associated with coercing processes into noun concepts. For example, coercing cognitive processing into the noun "cognition" causes us to view cognition as a more discrete, isolable, and context-free system than it really is.[2] Perhaps nominalizing cognitive processing in this manner, along with other intelligent processes, invites the false belief that cognition, affect, perception, and action constitute modular systems in the brain that can be studied independently of each other. Conversely, the verb "cognizing" does not seem to invite such inferences, suggesting instead that cognition is a process that varies dynamically over time as a function of contextual influences.

## Origins of Process Simplification

This section speculates on the origins of nominalizing processes and the associated effects of simplifying and objectifying them. According to this proposal, an intuitive theory about nouns develops during childhood, which specifies that prototypical noun concepts exhibit the properties of countable physical objects. Once this intuitive theory is in place, it coerces nominalized processes into conceptualizations that are relatively modular and context-free.[3]

Before proceeding further, two important points must be made. First, it is often argued that nouns essentialize their referents, simplifying their representations by endowing them with inherent invisible properties that constitute their true nature (e.g., Gelman, 2003; Medin & Ortony, 1989; also see Barrett et al., Ch. 1). The account to follow extends this view, proposing that manipulable object categories motivate an intuitive theory of nouns, which, in turn, shapes thought by making things appear simpler than they really are.[4]

Second, this account focuses on Western cultures where count nouns and object categories are salient. In non-Western cultures, where verb categories and/or mass nouns are important, this account is less applicable. Indeed, much evidence suggests that verbs and contextual relations become increasingly important in these other cultures, relative to nouns and object categories (e.g., Nisbett, 2002). Notably, however, the account to follow predicts such cultural modulation: To the extent that nouns and manipulable object categories are not central in a culture, the intuitive theory that prototypical nouns exhibit the properties of physical objects should have less impact on thought.

**Ease of learning manipulable object categories.** Banaji and Dunham (Ch. 10) suggest that people's proclivity for decontextualizing processes originates in knowledge about manipulable object categories. Much research suggests that these categories are indeed privileged in human cognition.

Consider evidence from developmental psycholinguistics. In general, manipulable object categories associated with nouns are acquired earlier than process categories associated with verbs for actions and events. A common explanation is that the members of manipulable object categories are individuated more easily in perception than the members of process categories (e.g., Gentner & Boroditsky, 2001; Piccin & Waxman, 2007).

To see this, consider the ease of individuating an object like a *chair* relative to the ease of discriminating a process like *convince*. Objects

typically have clear physical and perceptual boundaries such that they pop-out in the visual field; objects remain relatively constant over time and across contexts (in shape, components, behavior, etc.); objects are readily manipulated and acted upon; objects enter into relatively simple contact causality. Conversely, processes are relatively amorphous in perception, often not being clearly bounded physically or perceptually; processes typically change significantly over time and vary significantly with context; acting upon processes is often more complex than manipulating objects; processes typically enter into complex, often intentional (psychological), causal relations. For these reasons, manipulable object categories like *chair* are easier to individuate in perception than process categories like *convince*.

Because manipulable object categories are easier to individuate than process categories, object categories are easier for children to learn. Identifying their instances in complex perceptual fields is easier, as is establishing their shared properties. Additionally, storing category information in memory is easier, as is retrieving and using it. Because of these advantages, manipulable object categories tend to be acquired earlier in development than process categories.

Not only do manipulable object categories have physical properties that make them easy to individuate, they benefit from biological pre-dispositions that anticipate these properties. At an early age, infants expect objects to have clear boundaries, to remain relatively constant across time and context, to be easily manipulable, and to exhibit contact causality. Some theorists propose that these pre-dispositions reflect innate determinants (e.g., Baillargeon, 2008; Spelke, 2000), whereas others propose that they reflect weaker biological determinants coupled with epigenesis (e.g., Elman et al., 1996). Regardless, the evidence for such predispositions is overwhelming. Most importantly for our purposes here, these predispositions establish strong expectations about the salient properties that make manipulable object categories easy to individuate.

Cross-cultural research further illustrates the salient nature of manipulable object categories (e.g., Malt, 1995). Across diverse cultures, including ones not exposed to Western science, highly similar categories for plants and animals develop at the generic (basic) level of taxonomies. Furthermore, these categories are generally consistent with scientific categories grounded originally in morphological structure and later in genetics. According to Malt (1995), this strong consistency across cultures reflects the perceptual salience of these categories, both physically and perceptually. Physically, the members of a genus-level category share a common morphological structure, namely, a common configuration of parts. Butterflies, for example, exhibit one shared morphology, whereas crickets and bees exhibit others. Perceptually, a powerful shape processing system has evolved in the ventral stream of the brain that extracts shared morphological structure and establishes categories around it (e.g., Biederman, 1987; Milner & Goodale, 1996; Rosch et al., 1976; Ungerleider & Haxby, 1994). Because these morphological structures are well-bounded, relatively constant across time and contexts, and readily manipulable, they yield highly similar categories across cultures, regardless of cultural beliefs and practices. As we saw for category learning in development, object categories are associated with properties that make them salient and easy to learn.

**Nouns and an intuitive theory about their associated concepts.** Most languages (perhaps not all) distinguish grammatically between nouns, verbs, other grammatical classes. One common way of viewing these distinctions in linguistics is that nouns represent individuals, whereas verbs and modifiers predicate processes and properties of these individuals (for recent reviews and theories, see Bisang, in press; Croft, 2007).

Notably, linguistic theories often associate the general semantic properties of nouns with the salient properties of manipulable object categories (e.g., Frawley, 1992; Langacker, 1987). Nouns are prototypically associated with referents that are well-bounded and relatively constant across time and contexts. Clearly nouns can refer to many other kinds of referents as well, such as mass nouns that are not well-bounded (e.g., "sand") and processes that change across time and contexts (e.g., "a jump" varies over time, and also across entities that jump, such as children, horses, and crickets). Nevertheless, prototypical noun concepts are generally characterized as manipulable objects. Frawley (1992), for example, characterizes nouns as exhibiting informational, temporal, and cognitive stability at the levels of discourse, ontology, and concepts.

How might manipulable object categories come to define the prototypical noun concept? From a

developmental perspective, many nouns are learned early for manipulable object categories, as we just saw (e.g., Gentner & Boroditsky, 2001; Piccin & Waxman, 2007). As a result, these early categories come to dominate children's intuitive theories about what a noun is.[5] Prototypically, a noun comes to mean categories whose members have clear boundaries, remain relatively constant across time and contexts, are manipulable, and exhibit simple contact causality. Even though children ultimately learn that nouns can refer to many other kinds of things, including events and mental states, these latter categories remain relatively atypical and peripheral to the prototypical conception. When people first think of noun categories, manipulable object categories come to mind.

Much evidence supports this claim. The first exemplars learned for a category tend to be typical (Mervis & Pani, 1980), with these typical exemplars continuing to dominate the category's representation into adulthood (Rosch & Mervis, 1975). Generalizing this pattern to noun concepts, the early association of manipulable object categories with nouns results in these categories becoming prototypical conceptions of nouns more generally.

The shape bias in early conceptual development further supports this proposal (e.g., Pereira & L. Smith, 2009). During early noun learning, children believe that shape is the central property for defining the category associated with a noun for a manipulable object category. When learning the noun's meaning, children assume that the object's shape is common across objects associated with the word. The shape bias illustrates that an expectancy about shape comes to bias children's beliefs about manipulable object categories in general. Analogously, the proposal here is that manipulable object categories come to bias people's expectations about noun meanings more generally.

Finally, the overemphasis on manipulable object categories in the adult categorization literature further supports their central role in the conceptualization of nouns. In this literature, a common complaint is that too much research focuses on manipulable object categories because they are relatively simple, well-defined, and context-independent (e.g., Medin, Lynch, & Solomon, 2000). Much less research addresses more amorphous noun categories for events and abstract entities. Thus, manipulable object concepts appear unusually prototypical of nouns, not just to lay individuals, but to scientists.

All this evidence supports the proposal that manipulable object categories become central to people's intuitive theory of nouns. As a result, when someone uses a noun or nominalizes a process, the properties of manipulable object categories become active implicitly and automatically, structuring cognition.

**Coercing processes into object concepts via nouns.** Once this intuitive theory about nouns exists, to what mischief might it be put to use? Coercing processes into object-like concepts seems like a particularly relevant example.

Coercion is a basic linguistic phenomenon whereby a lexical concept is restructured conceptually by a syntactic structure that contains it. Consider the intransitive English verb, "sneeze." An agent can sneeze (Melanie sneezes), but the act of sneezing does not take an object in the way that a transitive verb like "push" does ("Melanie pushes the pillow" vs. "*Melanie sneezes the pillow"). Structurally speaking, "push" takes a syntactic and semantic object, but "sneeze" does not.

Consider, however, the sentence, "Lisa sneezed the foam off her beer." Interestingly, this sentence seems perfectly grammatical. According to construction grammar (Goldberg 1995), this grammatical use results from embedding "sneeze" in the *caused motion construction*, a syntactic and semantic pattern that English speakers use to describe agent-caused motion. Most importantly, when an intransitive verb like "sneeze" is inserted in the verb argument of the caused motion construction, the transitive properties of the verb argument are coerced onto the verb. Even though the verb is normally intransitive, it develops transitive properties.

Coercion is a general phenomenon that goes beyond verbs, for example, operating on nouns as well (Michaelis, 2004, 2005; also see Lupyan, 2008). Consider the sentence, "After hogging the only pillow on the bed, Emily moved over and gave her younger sister some pillow." As illustrated by the first usage of "pillow" in this sentence, "pillow" is normally a count noun, referring to a kind of well-bounded object that can be counted, such as chairs or birds. As illustrated by the second usage, however, "pillow" can be coerced into a mass noun, namely, a physical object with amorphous boundaries, such as air or sand. The evidence for coercion is that "pillow" now enters into the type of noun phrase associated with mass nouns ("*some* pillow" comparable to "*some* air"), rather than entering into the type of noun phrase associated with count nouns ("*the* pillow" comparable to "*the* chair").

Once the concept of *pillow* has been coerced into the conceptualization of a mass noun, reasoning about it changes, such that an agent can share some of it.

More generally, coercion can be viewed as a form of perspective taking, an ability that appears unique to humans (e.g., Tomasello & Whitten, 1999). Because of this ability, humans can radically change how they experience something of interest. A specific situation, for example, can be viewed from different spatial perspectives (e.g., a theatrical play from before vs. behind the stage). Similarly a situation can be viewed from different conceptual perspectives (e.g., a house from the perspective of a home buyer vs. a thief), or from different emotional perspectives (e.g., the outcome of a basketball game from the perspectives of winning vs. losing). Coercion appears to reflect similar changes in perspective, as when viewing *sneezing* in intransitive vs. transitive manners. Thus, the nominalization of processes may reflect a more general perspective-taking ability that has evolved in humans.

## Consequences of Nominalizing Processes

**Conceptual simplification.** Taken together, the preceding sections suggest that nominalizing a process should coerce its conceptualization toward a manipulable object category. Nominalizing cognitive processing as "cognition," for example, should increase the conception of cognition as a modular, stable, and simple entity. Once the intuitive theory associated with nouns is applied to the process, its conceptualization is simplified and objectified. Rather than being viewed as something that exhibits diffuse boundaries, varies across time and context, is complex to control, and enters into complex causal relationships, the process is viewed as something that exists discretely, remains relatively constant across time and context, is easy to manipulate, and enters into simple causal relationships. Platonic Blindness follows, viewing the process as a context-free mechanism, analogous to a simple manipulable object.

**Vices and virtues of Platonic blindness in everyday cognition.** Nominalizing a process may license a variety of (mistaken) assumptions about it: (1) a simple well-defined representation suffices to capture the process's content (analogous to object well-boundedness), (2) the process is relatively stable across time and contexts (analogous to object constancy), (3) the process is easy to manipulate and influence (analogous to manipulating an object), (4) the process enters into relatively simple causal relationships (analogous to contact causality).

Although nominalizing a process distorts it, advantages may result as well, warranting the simplification. Indeed, nominalizing may have virtues as well as vices! Nominalized processes, for example, may be relatively easy to learn, store, and retrieve; they may be relatively easy to communicate; they may be well-suited to various types of reasoning, including class inclusion, induction, and causal analysis. Because nominalized representations are relatively simple, compact, and stable, they are efficient cognitive units.

Consider thinking about oneself. Nominalizing behavior as traits may simplify the process of establishing one's self concept and conveying it to others, especially when doing so is important, as in Western cultures (Kitayama & Imada, Ch. 9). Rather than having to list a series of trait-situation interactions, people simply summarize their identities as traits, even if doing so oversimplifies their actual personality and behavior (Mischel & Shoda, Ch. 8). Simplified trait descriptions similarly make it easier for others to remember an individual's identity, and to communicate and reason about it.

In general, nominalizing processes may streamline cognition in a variety of ways that include learning, representation, storage, communication, and inference. Indeed, these compact streamlined units of representation may be essential—or at least highly useful—for many basic cognitive functions that humans perform regularly. In many processing contexts, more complex and cumbersome representations might make efficient processing difficult, if not impossible, especially when survival and other issues of fitness are at stake. Notably, however, these benefits come at the cost of over-simplifying the associated processes.

**Vices and virtues of Platonic blindness in science.** The contributions to this volume suggest that, in science, nouns are often associated with process simplification (e.g., Barrett et al., Ch. 1). Nouns typically capture these simplifications, as we saw for the concepts of *emotion*, *trait*, *self concept*, *prejudice*, and *stimulus-response behavior*. No level of analysis is immune to process simplification, from *gene* and *neuron*, to *perception* and *cognition*, to *self* and *culture*. Again, when these same concepts are verbified (e.g., *emoting*, *perceiving*, *cognizing*), they acquire a more dynamic, context-sensitive feel, perhaps because an intuitive theory associated with verbs makes these properties salient.

Science is well known for valuing elegance, parsimony, and power in theoretical and empirical

research. When possible, scientists like to avoid messy complexity, imprecision, and weak effects. In general, scientists prefer tractable domains that are amenable to formal analysis, in particular, domains that allow linear, compositional, and closed-form analysis. As domains become increasingly dynamical, non-linear, and multiply determined by many weak causes interacting in complex ways, scientists become increasingly reluctant to wallow into them. Thus, it should not be surprising if rigorous examination of scientific practice found that nominalizing processes promotes increased elegance in theory and empirical assessment. Idealization in science is pervasive, and clearly highly productive in many cases.

Nominalizing processes may further reflect an emphasis on understanding the internal structure of mechanisms, analogous to understanding the internal structure of objects. Often scientific interest focuses on identifying the components of a mechanism and establishing the relations between them. Of less interest is understanding the mechanism's external relations to other mechanisms in relevant contexts. As a result, the number of external relations is minimized, with those addressed supporting an elegant analysis of the mechanism's internal structure. The overall effect is a simplification of the mechanism as being relatively context free. If the full set of external relations were considered, the complexity of the mechanism's internal structure might increase as well, making it appear as more of a context-sensitive process than as a context-free object.

In reaction to the oversimplification of scientific problems, scientists often call for less emphasis on idealized elegance and more emphasis on natural complexity. In categorization research, for example, category learning is often studied in extremely simplified contexts, such that only a few well-controlled variables affect learning, thereby enabling powerful mathematical models to explain it. Other categorization researchers, however, argue that this over-simplified approach distorts the true nature of the process (e.g., Murphy, 2002, 2005). In a similar spirit here, the contributors to this volume argue that complexity is not a nuisance factor but central for understanding everything, from genes to the self. Lewontin (2000) makes a similar argument for research in genetics.

Interestingly, even context-appreciative scientists often find it necessary to simplify processes at lower levels of analysis. Mischel and Shoda (Ch. 8), for example, focus on the importance of context at the level of person-situation interactions. At the lower levels of their CAPS model, however, the units for cognition, affect, and behavior are presented in relatively context-free ways. If pressed, Mischel and Shoda would almost certainly agree that these units are context-sensitive as well. Nevertheless, thinking about context-sensitivity at these lower levels over-complicates the analysis of context effects at the level of person-situation interactions. Simplification (idealization) is useful—and probably necessary—in most scientific contexts, with the caveat that dynamic context-sensitive processes may actually constitute processes all the way down.

## The Virtues of Contextualizing

As we have just seen, both the lay public and scientists exhibit strong pre-dispositions to view the world through the lens of simple objectified noun concepts. Contrary to this view, extensive evidence exists that the world does not work this way. Instead the fundamental building blocks of everything, from genetics to culture, appear to be dynamic context-sensitive processes.

### Context Effects are Universal

**Examples from the current volume.** In genetics, it has become overwhelmingly clear that context plays central roles via epigenesis, with an organism's body and environment contributing to gene regulation (Harper, Ch. 2). In the brain, a neural circuit is modulated by other circuits that contain it, rather than operating independently (Sporns, Ch. 3; also Barrett et al., Ch. 1). In social endocrinology, the body's current hormonal context modulates the perception of social stimuli (van Anders, Ch. 4).

In general, the body and the environment serve as contexts for cognition, with environmental and bodily states not only modulating cognitive processes but being essential for them (Richardson et al. Ch. 15; also Sporns, Ch. 3; E. Smith & Collins, Ch. 7). The body and environment similarly modulate learning (Bouton, Chap. 12). In perception, processing objects and events is modulated by background knowledge and theories (Schwarz, Ch. 6), and also by various other contextual factors, including the current motivational state and the potential for action (Barrett et al., Ch.1; Richardson et al., Ch. 15).

In personality, a person's social behavior does not result from situation-independent traits but instead

from situational patterns of meaning-making, affect, and action (Mischel & Shoda, Ch. 8). Similarly, a person's self concept reflects the cultural context (Kitayama & Imada, Ch. 9; also E. Smith & Collins, Ch. 7), and emotion is not just a discrete response to a stimulus, but reflects the larger social situation, in turn, regulating it (Mesquita, Ch. 5).

In social cognition, various aspects of processing people, including categorization, attribution, and attitude, are modulated by the race of the perceiver and the perceived (Dunham & Banaji, Ch. 10). Similarly, a person's prejudice toward a particular group is not rigid but is instead adapted to different individuals and groups, reflecting evolutionary pressure to interact effectively with the people present (Sinclair & Lun, Ch. 11).

In the larger social context, the perception of a person's behavior is interpreted relative to the background norms of social groups (Prentice & Trail, Ch. 13; also E. Smith & Collins, Ch. 7). More generally, a person's behavior is interpreted relative to the history of behaviors, situations, and cultural practices that accumulate in social settings, what Adams et al. (Ch. 14) call "social sediment." Extensive amounts of previous behavior serve as the context for interpreting current behavior. Unless past behavior is taken into account, explaining current behavior is difficult.

**Calling all context effects.** Several authors here note the significance of bringing research on context together in one volume. Doing so demonstrates the ubiquity of context effects and their importance, suggesting that dynamic context-sensitive processes constitute central mechanisms in natural organisms.

It is worth noting that the evidence for such processes goes significantly beyond these chapters. Consider some prominent examples that document how situations contextualize diverse processes.[6] In language comprehension, texts can be incomprehensible when the relevant situation is not known (e.g., Bransford & Johnson, 1973). During conversations, situations are central to establishing common ground between speakers (e.g., H. Clark, 1992), and also in non-human communication (e.g., W. Smith, 1977). Widespread evidence indicates that people use situation models to represent the meanings of texts (e.g., Zwaan & Radvansky, 1998). Across levels of analysis, language comprehension is a heavily situated process (Barsalou, 1999; Sanford & Garrod, 1981). In problem solving and reasoning, it is often difficult to draw valid conclusions without the support of concrete situations (e.g., Cheng & Holyoak, 1985; Gick & Holyoak, 1980; Johnson-Laird, 1983). In developmental psychology, the Vygotskian tradition stresses the importance of situations in acquiring cognitive and social skills (e.g., Vygotsky, 1991). In linguistics, the importance of situations motivated the theory of construction grammar, where grammatical structures evolve from familiar situations (e.g., Goldberg, 1995). In philosophy, the importance of situations motivated the theory of situation semantics, where logical inference is optimized when performed in the context of specific situations (e.g., Barwise & Perry, 1983). In artificial intelligence, situating action in physical environments enhances robotic intelligence (e.g., Brooks, 1991; Kirsh, 1991).

General arguments about the central role of situations in cognition can be found in A. Clark (1997), Dunbar (1991), Glenberg (1997), Greeno (1998), Spivey (2007), Barsalou (2003), and Barsalou, Breazeal, and L. Smith (2007). Robbins and Aydede's (2008) *Handbook of Situated Cognition* documents situation effects extensively across diverse domains and provides theoretical accounts. Even at the level of galaxies, context effects exist, with a galaxy's internal operation depending on neighboring galaxies (Cho, 2009). Much other work not cited here further documents diverse context effects.

**Context-sensitivity even in nouns.** Based on the earlier analysis of nouns, one might assume that nouns for manipulable object categories are relatively context-free, referring to entities that are well-bounded, stable across time and contexts, easily manipulated, and causally simple. Nevertheless, much evidence shows that nouns for manipulable object categories are highly context-sensitive as well, just like everything else.

As we have already seen, the adult categorization literature focuses on the study of nouns for manipulable object categories. In this literature, context effects are extensive, exhibiting two general themes (Yeh & Barsalou, 2006). First, strong associations exist between manipulable objects and the situations in which they occur. On processing *chairs,* for example, relevant settings and events come immediately to mind, such as *office* and *sitting* (Wu & Barsalou, in press). Second, the conceptual content activated for a noun varies with the situation in which it is processed. Thus, the content activated for *basketballs* depends on whether basketballs are processed in a gym (they bounce) or

on a lake (they float) (Barsalou, 1982). As Yeh and Barsalou document, overwhelming evidence exists that the nouns for manipulable object concepts exhibit these two forms of context-sensitivity. Even though the intuitive theory for nouns suggests that their content is context-free, it is not.

If the conceptual content for nouns is not context-free, then it seems certain that the conceptual content for word classes associated with processes is not context-free either. Much evidence supports this conclusion as well. Many authors have noted the strong dependence of verbs on context (e.g., Gentner & Borodisky, 2001; Langacker, 1987). For example, the verb "run" depends on the entity or process that is running (e.g., toddler, sprinter, grandparent, dog, sparrow, spider, engine, meeting). As the entity or process changes, the conceptual content for "run" changes as well. Many authors have similarly noted the strong dependence of abstract concepts on context (e.g., Barsalou & Wiemer-Hastings, 2005; Wiemer-Hastings & Graesser, 1998; Wiemer-Hastings, Krug, & Xu, 2001). The meaning of "truth," for example, depends on whether it is processed in a principle's office, a courtroom, a church, or a course on logic.

## Contexts Optimize and Simplify Processing

Why do context effects exhibit such ubiquity? As we saw earlier, nouns are associated with optimizing and simplifying processes. Interestingly, so are contexts! Taking context into account both optimizes and simplifies the implementation of a process. Each benefit is addressed in turn.

**Optimizing processing.** Applying a single constant form of a mechanism typically does not produce optimal performance across different contexts. To see this, imagine that a single constant concept for *chairs* existed, such as a definition or rigid prototype. Essentially, such a concept would have to be the lowest common denominator across *chairs*, capturing information true of most instances at a relatively abstract level (e.g., seat, back, legs, used for sitting). Problematically, this constant form would falsely describe some instances, such as bean bag chairs. Most significantly, even when this constant form is correct, it fails to provide much relevant information essential for successful goal-directed action. On a jet, for example, this constant form fails to provide the following relevant information: Chairs on jets have a unique shape and structure adapted for air travel; chairs on jets are reclinable, but at the risk of cramping the person behind you; chairs on jets contain controls for audio and video systems; chairs on jets have seat belts that should remain fastened. Furthermore, optimal knowledge about chairs on jets is context-sensitive to time, persons, and a host of other factors. Seat belts, for example, need not be fastened once a comfortable cruising altitude is reached, although it is recommended that they remain fastened. When holding a child in one's lap, the seat belt should not be placed around the child but only around the adult. Clearly, a single stable representation of *chairs* does not support everything one needs to know about chairs on jets. Instead, context-sensitive representations retrieved at the correct points in time optimize successful interactions with these objects. The contributions to this volume document many analogous ways in which context optimizes processing.

**Context-specific knowledge simplifies processing.** Extensive evidence indicates that processing becomes easier with practice (e.g., Chase & Ericsson, 1981). When an organism has experience with a particular situation, the subsequent learning produces expertise that simplifies later processing and performance. Conversely, when an organism does not have such experience, more effortful processing is necessary to produce a novel response, often associated with trial and error. As practice on the task increases, accompanied by feedback, effortful responding becomes relatively unnecessary, with performance becoming increasingly automatic.

According to many theories, expertise results from storing situation-specific chunks or exemplars in long-term memory that represent how to perform a task in a specific situation (e.g., Anderson, 1983; Logan, 1988; Chase & Simon, 1973; Medin & Schaffer, 1978; Newell, 1990; Nosofsky, Palmeri, & McKinley, 1994; Palmeri, Wong, & Gauthier, 2004). Rather than having to use executive processes to figure out an appropriate response, a situation-specific pattern in memory becomes active that specifies what to do. Simple pattern matching replaces reasoning to produce expert performance, with effort decreasing and automaticity increasing.

Thus, optimal processing is often associated with simple processing. Most importantly, both optimal processing and simple processing reflect context-specificity. Optimal processing results from taking context into account. Simple processing results from retrieving situation-specific patterns stored in memory from previous experience. Most processing, most of the time, probably proceeds as

optimally as it does because relevant context-specific patterns reside in memory. When such patterns are absent, processing tends to become more difficult and less optimal.

## Nouns in Context

As we saw earlier, nominalizing processes has virtues, producing compact cognitive units that are easy to represent and process. These compact units have further virtues as described next, playing important roles in contextual processing. Although this section focuses on nouns, the principles presented apply to all word classes, including verbs, adjective, and adverbs. The focus on nouns reflects our general emphasis on understanding the process of nominalization and its relations to contextualization.

**Roles of nouns in context-sensitive systems.** A noun serves the important goal of integrating diverse situational information for its associated concept. Consider nouns for physical object categories. Even though the relevant knowledge for *cars* varies widely across situations, it may be useful to integrate all this knowledge using a single index, namely, the noun "car." Integrating all this knowledge serves multiple purposes. A common index can cue many different instances of the same category, such as various cars one has experienced. A common index can cue the diverse situations in which cars occur, such as on the highway, in the gas station, at the mechanic, in the parking lot, in an accident, in transporting purchases, and so forth. A common index can motivate searches for common information across instances and situations, should such information become important (e.g., for certain types of relatively abstract induction that attempt to generalize across situations). A mechanism that strengthens shared information and weakens unique information across situations may underlie the emergence of common decontextualized information for nouns (e.g., Watkins & Kerkar, 1985).

Nouns may serve similar functions in other domains besides physical objects. Trait and emotion nouns, for example, may serve to integrate similar types of behavior across individuals and situations, again for the purposes of later being able to retrieve it, abstract over it, generate broad inductions, etc. Similarly, decontextualizing a mechanism in science may serve as an index that integrates diverse context-specific knowledge about the mechanisms and later supports broad inductions about it (e.g., the constructs of fluency, prejudice, gait).

Modern theories of grammar suggest that nouns perform another important role. In sentences, nouns typically represent individuals, whereas verbs (with their associated constructions) typically elaborate on these individuals (e.g., Bisang, in press; Croft, 2007; Langacker, 1987). In "The car crawled along the narrow unpaved road," the nouns "car" and "road" serve as individuals elaborated by the remainder of the sentence. Essentially this elaboration can be viewed as contextualizing the individuals, especially the subject noun ("car"). The car of interest is driving (not being fueled) along a road that is unpaved and narrow (not a freeway). Because nouns are always being contextualized in this manner by sentences, decontextualizing the nouns (at least to some extent) may facilitate this process. If a noun's meaning can be represented as a compact decontextualized cognitive unit, then contextualizing it in a new way is easier. If a noun were always retrieved with detailed context, the retrieved context could interfere with elaborating it the new context. Thus decontextualization serves contextualization across situations.[7]

Such decontextualization may similarly serve contextualization in other domains, such as traits, emotions, and scientific mechanisms. Again, decontextualizing a construct may make it easier to process in new contexts.

In summary, decontextualized nouns play central roles in context-sensitive systems. Problems arise, however, when we reify decontextualized noun concepts as stable independent entities and forget that they belong to contextual systems in which they constantly develop emergent forms.

**Context-sensitive processing of noun concepts.** Under normal circumstances, noun concepts typically appear in contexts, not in isolation. In language processing, noun concepts for manipulable objects often occur in familiar situations (e.g., a *car* on the highway, a *car* in the gas station, a *car* in a parking deck). Many theories propose that the conjunction of an object noun and a familiar situation activates entrenched knowledge about that object in the situation. A car on a highway, for example, activates knowledge about the car's engine running and a driver controlling it, whereas a car in a gas station activates knowledge about the engine being off with the driver outside pumping fuel. Even though one might be tempted to believe that a decontextualized representation of *car* exists, the moment that the *car* concept is placed in context, a relevant situated representation is retrieved and an emergent form of *car* is constructed. Much evidence supports this claim (for reviews, see Barsalou et al.,

1993; Barsalou, 2003, 2008; Yeh & Barsalou, 2006).

Mechanisms in other domains operate similarly. Although the cognitive system may be capable of constructing decontextualized representations of traits and emotions, once these representations are processed in familiar contexts, they become contextualized and emergent forms appear (Mischel & Shoda, Ch. 8; Mesquita, Ch. 5). Similarly, scientists may be able to articulate decontextualized mechanisms in nature, but placing them in context illustrates their context-sensitivity (e.g., genes, Harper, Ch. 2; neural circuits, Sporns, Ch. 3; fluency, Schwarz, Ch. 6; stimulus-response relations, Bouton, Ch. 12; gait, Richardson et al., Ch. 15).

In summary, it is possible to conceptualize nouns in decontextualized ways, and these decontextualizations play important roles. We err, however, when we mistakenly believe that these decontextualized mechanisms refer to meaningful entities in isolation and forget that they operate intrinsically in contexts and depend on contexts for their realization. The mechanism indexed by a noun integrates a large system of situated patterns, with this system usually producing an emergent form well-suited to the current situation.

## Learning to Context

Is it possible to alter human cognition so that it is less inclined to coerce processes into objectified noun concepts when doing so is counter-productive? Is it possible to more readily appreciate the contextual nature of things? The final section explores these issues.

### Developing Awareness of Contextual Impact

Dunham and Banaji (Ch. 10) suggest that developing awareness of contextual influences can decrease people's tendency to simplify dynamic context-sensitive processes. As a domain is studied increasingly, it may often become clear that its central mechanisms are not as simple and context-free as believed initially. As it becomes clear that these mechanisms are context-sensitive, people may come to view them as complex dynamic processes rather than as simple rigid mechanisms.

To the extent that the media, educational institutions, political systems, and occupational environments adopt these contextualized accounts, they may be transmitted broadly to lay individuals. In turn, the cognition and behavior practiced widely in the culture may change. Such change may also be transmitted individual to individual, via the relationships into which individuals enter.

It is not clear how best to make this happen. What seems most likely is that these ideas will take hold to the extent that they increase quality of life. Concrete benefits of contextualized thinking will get people's attention, change their cognition, and redirect their behavior (cf. Cohen, 2001).

### Cultural Enhancement of Contextualizing

Some cultures appear to exhibit this principle. Kitayama and Imada (Ch. 9) review evidence that an inter-dependent orientation to self can result from individuals living in close proximity across many generations (e.g., in Asian cultures). More specific factors that result from living this way—high levels of pathogens, farming, low social mobility, and no frontiers—cause people to become inter-dependent. Most importantly, inter-dependency creates an appreciation of context. Individuals perceive themselves as an intrinsic part of a larger culture, realize that who they are reflects their culture, and see that their behavior contributes to it. Because thinking this way is important to optimal living in close proximity across generations, it makes cognition relational and context-sensitive (also see Nisbett, 2002).

Under these conditions, thinking contextually produces rewards in everyday life and increases fitness. Again this may be what it takes to foster contextual thinking. Only when the conditions of living reach a point where contextual thinking is advantageous will people adopt it. Otherwise, more independent forms of thought, as in Western cultures, may offer different advantages well-suited for other living conditions (e.g., living on a rapidly changing frontier with relatively few people). Even under these latter conditions, one could argue that seeing oneself as part of nature, or as part of a local ecosystem, would produce concrete rewards (Atran & Medin, 2008). Nevertheless, the data suggest that independent orientations to self are adaptive under some conditions (Kitayama & Imada, Ch. 9).

Western cultures may be rapidly approaching the point where contextual thinking is increasingly essential. As population density continues to grow, along with pressure on social, political, and environmental systems, inter-dependency may become increasingly fit. Cultures may increasingly enforce inter-dependent thinking, and people's cognitive systems may become increasingly sensitive to context (cf. Cohen, 2001).

### Formal Practices for Contextualizing

Because Eastern cultures have exhibited an appreciation for interdependency and the importance

of context over millennia, it is perhaps not surprising that sophisticated methods for developing these modes of thought have evolved in these cultures. Not only are these practices relevant to the lay public, they are relevant for scientific thought.

Buddhism offers a well-known example of such practices, containing various techniques across many traditions for transforming objectified cognition into contextual cognition. Although Buddhist meditation is often known for focusing attention to create calmness, these attention-based practices are primarily a tool for achieving deeper conceptual changes in cognition (e.g., Dalai Lama XIV & Berzin, 1997; Thrangu Rinpoche, 2004).[8] Once it becomes possible to focus attention with minimal distraction, attention is focused on all mental activity, from perception to thought. As mental activity is observed, attempts to understand its nature follow. A conceptual apparatus typical of many Buddhist approaches supports this introspective examination, focusing on the objectivization vs. contextualization of conscious experience. On the one hand, constructs such as *essence*, *object,* and *concept* refer to undesirable mental states that are experienced subjectively as being true, real, and of an independent objectified nature. On the other hand, constructs such as *emptiness* (*voidness*), *dependent origination*, and *impermanence* refer to the dynamic context-sensitive process of experience. From this latter perspective, all conscious experience is *empty* (*void*), namely, it is not inherently real, as it may seem to be, but is simply mental activity constructed by the mind. Even when a mental state corresponds to a perceived entity, the mental state is not the real entity, but a mental state constructed to represent it (e.g., the experience of color constructed from physical wavelength). In general, the qualia of experience are mental constructions not to be confused with perceived counterparts that may contribute to them. Furthermore, all experience results from *dependent origination*, namely, no experience exists as an independent object, but instead emerges from a wide variety of contextual factors acting together, including the current situation, other knowledge, the brain, the environment, culture, and so forth. Finally, all experience is *impermanent,* namely, it is never a permanent object but ever changing.[9]

Of particular interest is the self. Although the self appears to exist as an independent objectified entity, this is an illusion, according to Buddhism. Instead, there is no real self, with thoughts of oneself being empty (mental constructions), dependent on numerous contextual factors, and impermanent.

During conceptual analysis of experience in Buddhist practice, various logical approaches are adopted to deconstruct the essentialist objectified nature of experience. A particular experience, such as a thought, a perception, or one's self concept, is examined with formal questions designed, first, to undermine its appearance as a real object and, and second, to reveal its true nature as a temporary inter-dependent highly-contextualized construction of the mind. Rather than simply focusing attention to produce calmness, attention focuses on experience while this conceptual apparatus operates. Even when a mental state corresponds to a perceived entity, the mental state is viewed as distinctly different from the entity, being a dynamic inter-dependent construction that in itself is not real.

This approach to meditation—Mahamudra— is considered relatively difficult and advanced. Nevertheless, it is widely viewed as powerful and effective when performed correctly at the appropriate time in a meditation practice. It is a reliable technique for contextualizing cognition profoundly.

Mindfulness based stress reduction (MBSR), practiced increasingly in Western cultures, can be viewed as a Westernized form of Buddhist meditation, drawing techniques from many traditions, including Mahamudra (Kabat-Zinn, 1988, 1994, 2005). In MBSR, attention is distributed across experience—from the body, to thought, to the environment—as the mind produces experience from one moment to the next. Experience flows uninterrupted, unless some aspect of experience is grasped, thereby causing the practitioner to leave the moment and become engrossed in thought. As the ability to follow successive experiential states without distraction develops, these states come increasingly to be viewed as transient thoughts, rather than as events that appear real. The less real thoughts seem, the less self interest and affect they produce, thereby reducing stress and negative affect. Although standard MBSR does not explicitly engage a Buddhist conceptual apparatus (e.g., *emptiness*, *dependent origination*, *impermanence*), some of the benefits nevertheless result, perhaps because the presence of such an apparatus is implicit. By viewing experience as a continual flow of temporary mental states that pass quickly, rather than as real objects that exist indefinitely with continuing implications, experience acquires a sense of impermanence and dependence on the mind, rather

than as objectified reality in the world. Increasing research documents the benefits of this simple practice in psychotherapy, medical treatment, and education (e.g., Baer, 2003).

MBSR is becoming increasingly widespread in Western cultures, not only to treat physical and mental health problems, but also to improve the quality of life and relationships. Following Kitayama and Imada (Ch. 9), the nature of Western culture may be changing such that contextualized practices like MBSR are increasingly fit. As it becomes clear that we are all one global community, and that each individual's actions have implications for others, practices like MBSR may produce contextual awareness that optimizes living under these conditions.

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## Footnotes

[1] Throughout this chapter, "context" will refer to the background in which something of focal interest occurs in the attentional foreground. As the chapters in this volume illustrate, such backgrounds are highly diverse, including genetic material, neural circuits, hormonal contexts, physical settings, social interactions, cultures, and so forth.

[2] Quotes will be used to indicate linguistic forms, and italics will be used to indicate categories and their associated concepts. Thus, "cognition" is a linguistic form (a word in this case), whereas *cognition* indicates the associated category and concept.

[3] Nominalization typically refers to the use of a verb or an adjective as a noun, with or without morphological transformation, so that the word can act as the head of a noun phrase. In this chapter, however, "nominalization" will be generalized to include creating a noun as the name for a process.

[4] For the sake of simplicity, "manipulable object categories" from this sentence on will refer to *countable* physical objects (e.g., *chairs*, *birds*). Whenever categories for mass objects are relevant (e.g., *air*, *sand*), this will be indicted explicitly.

[5] An intuitive theory is a coherent system of background beliefs that helps lay individuals explain a focal entity of interest, often specifying properties and relations relevant to understanding and predicting the entity (e.g., Murphy & Medin, 1985; Murphy, 2002).

[6] "Situation" is used in this section and elsewhere as the subset of contexts that typically contain agents and objects performing meaningful goal-directed events in a setting (e.g., Barsalou, 2003, 2005, 2008; Barsalou, Niedenthal, Barbey, & Ruppert, 2003).

[7] This account does *not* assume that there is a single stable decontextualized representation that exists for a noun. Instead, it is highly likely that these decontextualized representations vary dynamically across occasions as a function of numerous factors, including the frequency and recency of information associated with the noun's referents. As a result, numerous decontextualized forms of a noun occur over time.

[8] Many religions, not just Buddhism, attempt to increase awareness of the extensive inter-dependence that exists among people and with the world. In particular, practices for fostering compassion across religions often appear to have the effect reducing isolation and connecting individuals with their social and environmental contexts.

[9] Buddhist approaches vary considerably in their assumptions about the physical world (e.g., Dunne, 2005). Some approaches are dualistic, adopting a strict distinction between mind and physical matter. Others amount to philosophical idealism, assuming that only mind exists. Still others are non-dualistic, viewing the physical world as an energy field, not unlike modern physics. In all cases, it is agreed that sensory experience *at least appears* to involve an external, physical world, and that from a *conventional* perspective, an extra-mental world cannot be denied. Regardless of the stance taken, the focus is typically on the mental experience of reality—whatever form it takes—and on seeing that this experience is inherently empty, inter-dependent, and impermanent.