Objectivism versus Constructivism: Do We Need a New Philosophical Paradigm?

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Many scholars in the instructional systems field have addressed the paradigm shift in the field of learning psychology and its implications for instructional systems technology (IST). This article analyzes the philosophical assumptions underlying IST and its behavioral and cognitive foundations, each of which is primarily objectivistic, which means that knowing and learning are processes for representing and mirroring reality. The philosophical assumptions of objectivism are then contrasted with constructivism, which holds that knowing is a process of actively interpreting and constructing individual knowledge representations. The implications of constructivism for IST provide a context for asking the reader to consider to what extent our field should consider this philosophical paradigm shift.

☐ Learning theory has undergone a major revolution during the past few decades. Beginning in the late 1950s with psychologists such as Chomsky, Simon, and Miller, learning psychology underwent a scientific revolution or paradigm shift (Kuhn, 1962) in which theories and models of learning from the cognitive sciences are now more commonly used to explain learning processes than the behavioral explanations they supplanted, especially those that require higher-order thinking (Gardner, 1985).

For most of the first half of this century, behavioral laws provided the most prominent conceptions of learning. Learning, according to behaviorism, is a change in the behavioral dispositions of an organism. Learning behaviors, according to behaviorists, can be shaped by selective reinforcement. Since learning is equated with behavioral outcomes, behavioral laws excluded the role of mental operations. Behaviorists such as Skinner were unwilling to acknowledge the existence of the mind* or the act of knowing because these are not observable. Since the existence of the mind could not be proven from the observation of behavior, and since behaviorists were con-

*The term "mind" is used often in this paper to refer to the covert, mental operations that give rise to consciousness and cognition. The term is not meant to posit a separate Cartesian entity, but rather the ability to think.

cerned primarily with discovering laws of human behavior, the mind was an unnecessary construct in the learning process. Behaviorists "believe that the construct of mind does more harm than good; that it makes more sense to talk about neurological structures or about overt behaviors than about ideas, concepts or rules" (Gardner, 1985, p. 39); and that discussing these entities is misleading and incoherent. The exclusion of the mind from the learning process by behavioral laws was a primary theoretical cause of the paradigm shift in learning psychology.

Learning, according to cognitive psychology, is concerned not so much with behavioral responses, but rather with what learners know and how they acquire it. The cognitive revolution first enlisted the neo-behaviorists, who posited a role for the mind but relegated it to "black-box" status because they could not comprehend or understand it. The revolution concluded by not only acknowledging the mind, but also studying its functions and processes. Cognitive activity is embodied in mental states that enable humans to construct mental representations and manipulate them through the use of symbols (Fodor, 1981). The mind is the agent of learning, and so it is both appropriate and necessary to study it from a mentalistic perspective, according to cognitive theorists. Unlike the behaviorists, who were only concerned with what learners do, cognitive psychologists are interested in what learners know and how they come to acquire it.

INFLUENCES OF THE COGNITIVE REVOLUTION ON IST

Instructional systems technology evolved with a behaviorist foundation, so its theory base was naturally influenced by many of the behaviorists' assumptions. Fundamental IST processes, such as task analysis, behavioral objectives, criterion-referenced evaluation, and mathemagenic strategies, all reflect a behavioristic tradition. For instance, the first true technology of instruction—programmed instruction—was essentially an application of operant conditioning wherein the learner's behavior was shaped by reinforcement of desired learning behaviors. Behavioristic assumptions therefore delimited the types of questions generated by research and theory development in the IST field.

In the past decade, IST has consciously rejected many (though certainly not all) of its behavioristic assumptions and accommodated a new set of psychological assumptions about learning from the cognitive sciences. Winn (1975), a leader in this transition, invoked an "open systems model of the learner," a more organismic view of the learner as one who interacts with the environment and acquires knowledge, skills, and competence from it. But the roots of behaviorism extend deeply into IST practice. Acceptance of the mentalistic perspective from the cognitive sciences has been inconsistent. Therefore, Winn (1989) is still promoting the use of cognitive instructional strategies, less reductionistic forms of analysis, and a more holistic approach to conceiving learner interactions to a field that still focuses on learning behaviors.

The urging of cognitive models and processes of instructional design has echoed through our journals and conferences for over a decade (Champagne, Klopfer, & Gunstone, 1982; DiVesta & Rieber, 1987; Jonassen, 1985a; Wildman & Burton, 1981). Why have these calls had so little effect on IST theory and practice? Does cognitive psychology not provide a more valid model of learning than behaviorism? This article argues that perhaps cognitive psychology has not provided enough of a paradigm shift; that behavioral and many cognitive instructional design processes are based on a restrictive set of philosophical assumptions that do not adequately conceptualize the mental states of the learner; and that perhaps a new philosophical paradigm shift is needed in IST.

Limitations of the Cognitive Theory of Learning

The Role of the Mind in Learning

Perhaps IST has not accommodated or even adequately conceptualized the mind in its theories of learning because the psychological revolution did not include a commensurate philosophical revolution in the field to adequately accommodate the mind. Cognitive

theory conceives of mental processes but does not make the philosophical assumptions necessary to extricate itself from the constraints of Cartesian dualism. Descartes believed that the mind stands apart and operates independently of the body, which is a different sort of entity (Gardner, 1985). He posited great powers to the mind, but was unable to say what the mind really does. Is the mind the sole source or agent of learning, or is learning the result of neurochemical reactions that occur in the body? Does the mind therefore exist within the body? Descartes believed both.

Many cognitive scientists believe that the mind is a material entity that controls the actions of the knower. Others believe that the mind and the consciousness it enables are not material but spiritual, and hence not bound by physical entities. Cognitive theorists are also caught in the theoretical trap of dualism; the agents of learning are therefore not clear to them because they, like Descartes, are unable to apply consistent epistemic criteria to study the existence of the mind.

Most current cognitive psychologists start with the assumption that the role of mental activities is to represent the real world. Information processing theorists, for instance, use cognitive task analysis to represent the mental operations that must be performed in order to accomplish the task, assuming that a most appropriate sequence of mental activities exists. These activities are externally manipulated by the teacher or the instruction. Cognitive learning models isolate mental operations in order to discover the most efficient mapping of external reality onto learners. Even Piaget, whose epistemological theory is alleged to be one of the most constructivistic, assumed that mental constructions were representations of the real world to which the learner had to "accommodate" (Bruner, 1986). The inconsistency of his position was that, like Descartes and many cognitive theorists, Piaget posited epistemic characteristics to the mind but did not employ epistemic criteria for describing or evaluating the role of mental activities in learning. The mind, according to Piaget and most cognitive psychologists, can only be thought of as a reference tool to the real world.

What contemporary cognitive theorists are asking is, is the mind merely a tool for reproducing the real world, or does the mind produce its own, unique conception of events or objects which is based on individual conceptions of reality? This new group of cognitive theorists is driving the revolution that is the subject of this article (Bruner, 1986, 1990; Churchland, 1984; Goodman, 1984). The new cognitive revolution escapes the trap of dualism and conceives the proper study of man through a more interpretive approach to cognition concerned with "meaning-making" (Bruner, 1990).

Is There an Objective Reality?

Another limitation of current cognitive theories is the philosophical position about the mind (defined in the next section as *objectivism*) that regards thinking as effective only if it adequately describes some "objective reality." Bruner (1986, p. 95) asks, "Is a science of thinking not a science until it meets the criteria of objectifiability?" Is the mind merely a reflexive agent for re-presenting a societally accepted reality? Our western cultural belief system accepts the existence of a real world. For instance, the journal that you are reading now is real. It is simple to describe its physical attributes: black ink on white paper. However, what each reader believes this article to be, and, more importantly, what each reader believes it to mean, may not be so easily referenced to any objective reality, at least none that appears obvious. If our learning theory assumes that we construct meaning for objects and events by interpreting our perceptions of them in terms of our past experiences, beliefs, and biases, then each of us mentally represents our own personal reality. Each reality is somewhat different, because each person's experiences and resulting apperceptions are different. These differences in interpretation are proof, ipso facto, of the individual, constructed nature of reality.

Consequent Effects on IST

So, to restate the hypothesis of this article, a potential explanation for the lack of a para-

digm shift in IST is that both behavioral and cognitive conceptions of instruction seek to analyze, decompose, and simplify tasks in order to make instruction—and by inference, learning—easier and more efficient. The process of reducing the complexity of learning tasks, whether cognitively or behaviorally based, may well be misrepresenting the thinking or mental processing required by the task. Such decomposition also misrepresents the nature of the content, which is often fraught with irregularity and complexity (Spiro, Coulson, Feltovich, & Anderson, 1988). In attempting to simplify the learning in order to improve instructional efficiency and effectiveness, IST may be short-circuiting relevant mental processing. Designers' attempts to simplify learning risk supplanting the complexity that is inherent in the learning process or the task to be learned.

The implicit goal of many instructional strategies espoused by instructional designers appears to be to supplant thinking rather than engage or enhance it (Salomon, 1979). The explicit goal of IST is more efficient "knowledge transmission." Designers use their objective tools (e.g., task analysis) to determine an objective reality, which they then try to map onto learners through embedding instructional strategies that control learning behavior. But knowledge transmission tacitly assumes that (1) we all agree on what reality is, and (2) we all use essentially the same process for understanding it. A number of cognitive researchers, whose positions are described later in this article, question these assumptions and present alternative conceptions of learning that are based on different philosophical assumptions. Their assumptions are based upon constructivism. In the next section, these constructivistic assumptions are contrasted with the assumptions of current behavioral, cognitive, and IST beliefs, which are based on objectivism.

COMPARING PHILOSOPHICAL PARADIGMS

In this section, alternative conceptions of how we perceive objects and conceive reality are compared. These theories of thinking and learning are *objectivism* and *constructivism*. A purpose of this article is to describe the philosophical assumptions of these theories. This article argues that behavioral psychology, most of cognitive psychology, and IST are firmly rooted in objectivism. The implications of a philosophical paradigm shift to constructivism for IST are considered later. Ultimately, the reader must judge the meaningfulness of each theory in generating his or her own view of reality, learning, and instruction.

This article proceeds by describing the differences in these alternative positions for a theory of understanding and learning. In order to contrast their assumptions, the two theories are generally described as polar extremes on a continuum from externally mediated reality (objectivism) to internally mediated reality (constructivism). Most theorists, however, take positions that fall somewhere in the middle of the continuum.

In order to explain any philosophy, its metaphysics and epistemology must be described. These are the foundations of any philosophy. Metaphysics (more specifically, a branch known as ontology) describes the nature of reality, that is, the assumptions that we hold about the physical world. Epistemology is the study of the nature of knowledge and thought. How we come to know and what we know are integrally related and essential to any philosophy of understanding. Objectivism and constructivism are contrasted on the basis of metaphysical and epistemological criteria.

Table 1 lists assumptions that both objectivism and constructivism make about reality, the mind, thought, meaning, and symbols. These convey the metaphysical and the epistemological assumptions of the poles of the continuum described above.

Objectivism

Objectivism has its roots in *realism* and *essentialism* (Lakoff, 1987). Realism, needless to say, believes in the existence of the real world, external to humans and independent of human experience. This belief relies on the existence of reliable knowledge about the world, knowledge that we, as humans, strive to gain. What is epistemically important to this posi-

TABLE 1 ☐ Assumptions Inherent in Objectivism and Constructivism

	Objectivism	*Constructivism*
Reality (real world)	External to the knower	Determined by the knower Dependent upon human mental activity
	Structure determined by entities, properties, and relations	Product of mind Symbolic procedures construct reality
	Structure can be modeled	Structure relies on experiences/interpretations
Mind	Processor of symbols	Builder of symbols
	Mirror of nature	Perceiver/interpreter of nature
	Abstract machine for manipulating symbols	Conceptual system for constructing reality
Thought	Disembodied: independent of human experience	Embodied: grows out of bodily experience
	Governed by external reality	Grounded in perception/construction
	Reflects external reality	Grows out of physical and social experience
	Manipulates abstract symbols	Imaginative: enables abstract thought
	Represents (mirrors) reality	More than representation (mirrors) of reality
	Atomistic: decomposable into "building blocks"	Gestalt properties
	Algorithmic	Relies on ecological structure of conceptual system
	Classification	Building cognitive models
	What machines do	More than machines are capable of
Meaning	Corresponds to entities and categories in the world	Does not rely on correspondence to world
	Independent of the understanding of any organism	Dependent upon understanding
	External to the understander	Determined by understander
Symbols	Represent reality	Tools for constructing reality
	Internal representations of external reality ("building blocks")	Representations of internal reality

tion is that it assumes that we all gain the same understanding. Essentialism holds that, among the properties that make up this stable knowledge, what makes an entity a particular thing is the existence of essential properties. Lakoff claims that objectivism is a special case of essentialism.

The important metaphysical position that objectivism makes (see Table 1) is that the world is real, that it is structured, and that its structure can be modeled for the learner. The epistemology of objectivism holds that the purpose of the mind is to "mirror" that reality and its structure. It does so by thought processes that manipulate abstract symbols (primarily language) that represent that reality. Those thought processes are analyzable and decomposable. The meaning that is produced by the thought processes is external to the understander; it is determined by the structure of the real world. Learning consists of grasping the referents of words, that is, the kinds of entities or concepts that the words denote in reality (Rand, 1966). Objectivism assumes that learning is the process of mapping those entities or concepts onto learners.

Objectivism—the more common scientific conception of reality—holds that there is an objective reality that we as learners assimilate. The role of education is to help students learn about the real world. Students are not encouraged to make their own interpretations of what they perceive; it is the role of the teacher or the instruction to interpret events for them. Learners are told about the world and are expected to replicate its content and structure in their thinking.

Constructivism

Constructivism claims that reality is more in the mind of the knower, that the knower constructs a reality, or at least interprets it, based upon his or her apperceptions. The emphasis in objectivism is on the *object* of our knowing, whereas constructivism is concerned with how we *construct* knowledge. How one constructs knowledge is a function of the prior experiences, mental structures, and beliefs that one uses to interpret objects and events. Constructivism does not preclude the existence of an external reality; it merely claims that each of us constructs our own reality through interpreting perceptual experiences of the external world.

This view of constructivism is not an example of *solipsism*, which claims that the mind can only know its own interpretations, that reality is completely individualistic. We are clearly able to comprehend a variety of interpretations and use those in arriving at our own interpretation. For instance, some of us interpret the wars in Vietnam, Granada, and Iraq as the obligation of a democratic state to defend the rights of nations oppressed by the evils of communism or dictatorships; others believe these wars represent the avaricious protection of the rights of multinational corporations to perpetuate a decadent lifestyle. How correct is either view?

The assumptions of constructivism are fundamentally different from those of objectivism. Radical constructivists (Goodman, 1984; von Glasersfeld, 1984; Watzlawick, 1984) believe that there is no real world, no objective reality that is independent of human mental activity. In Goodman's view, our personal world is created by the mind, so no one world is any more real than any other. There is no single reality or any objective entity that can be described in any objective way; rather, the real world is a product of the mind that constructs that world. A less radical form of constructivism holds that the mind is instrumental and essential in interpreting events, objects, and perspectives on the real world, and that those interpretations comprise a knowledge base that is personal and individualistic. The mind filters input from the world in making those interpretations.

Bruner (1986) claims that constructivism began with Kant, who, in his *Critique of Pure Reason*, argued for *a priori* knowledge that precedes all reasoning. It is what we know, and we map it onto *a posteriori* knowledge, which is what we perceive from our interactions with the environment. But what we know as individuals is what the mind produces. Kant believed in the external, physical world (noumena), but it is known only through our sensations (phenomena)—how the world appears to us.

Constructivism, founded on Kantian beliefs, claims that reality is constructed by the knower based upon mental activity. Humans are perceivers and interpreters who construct their own reality through engaging in those mental activities: "Cogito, ergo sum" (I think, therefore I am—Descartes). Therefore, the existence of the individual is predicated on his or her own constructions.

According to constructivists, thinking is grounded in perception of physical and social experiences, which can only be comprehended by the mind. What the mind produces are mental models that explain to the knower what he or she has perceived. Rather than being driven by external structures, these mental models are *a priori*, according to Kant.

The important epistemological assumption of constructivism is that meaning is a function of how the individual creates meaning from his or her experiences. We all conceive of the external reality somewhat differently, based on our unique set of experiences with the world and our beliefs about them.

APPLICATIONS OF CONSTRUCTIVISM

Many educators and cognitive psychologists are working to develop more constructivistic environments and instructional prescriptions (Duffy & Jonassen, in press). Perhaps the most important of these prescriptions is the provision of instruction in relevant contexts (Jonassen, 1991a). *Situated cognition* (Brown, Collins, & Duguid, 1988; Resnick, 1987) argues that learning occurs most effectively in context, and that context becomes an important part of the knowledge base associated with that learning. So, rather than decontextualizing learning in isolated school environments, we should create real-world environments that employ the context in which the learning is relevant. A related approach is to require learners to serve a *cognitive apprenticeship* (Collins, 1990; Collins, Brown, & Newman, 1987). Just as a craftsman would not teach an apprentice using prepared scripts, instructional environments and teachers should focus on realistic approaches to solving real-world problems rather than utilize predetermined instructional sequences. The instructor is a coach and analyzer of the strategies used to solve these problems.

Another important strategy is the presentation of multiple perspectives to learners. *Cognitive flexibility theory* is a conceptual model for instruction that facilitates advanced acquisition of knowledge in ill-structured knowledge domains. Flexibility theory (Spiro et al., 1988) avoids oversimplifying instruction by stressing conceptual interrelatedness, providing multiple representations or perspectives on the content because there is no single schema (no objective reality), and emphasizing case-based instruction that provides multiple perspectives or themes inherent in the cases.

The approaches represented by these authors are clearly cognitive and also make constructivistic assumptions, yet there is an objectivistic grounding to them. Constructivism is not the panacea for all of the instructional problems in education and training, no more than other theories and technologies are. Yet all are designed to make learning a more realistic and meaningful process.

IMPLICATIONS OF CONSTRUCTIVISM FOR IST: DO WE NEED ANOTHER REVOLUTION?

IST is not ignorant of cognitive learning theory. Many of its innovations, such as elaboration theory and information processing analysis, are based on cognitive theories. Yet IST begins, as do these cognitive theories, with an objectivistic world view, secure in the belief that the purpose of instruction is that of transfer agent, transferring objective information to learners. Perhaps the greatest epistemological concern about this assumption is that what is transferred to the student is learned by the student without interpretation or reconstruction. Constructivism claims that learners can only interpret information in the context of their own experiences, and that what they interpret will, to some extent, be individualistic. As designers, we may intend to map a particular reality onto learners, but ultimately they interpret our messages in the context of their own experiences and knowledge, and construct meaning relative to their own needs, backgrounds, and interests. Rather than attempting to map the structure of an external reality onto learners, constructivists recommend that we help them to construct their own meaningful and conceptually functional representations of the external world.

If IST were to accommodate some of these constructivistic assumptions, these are some of the changes in practice that could result:

Instructional goals and objectives would be negotiated, not imposed. Instructional designers cannot impose a prescribed reality on learners because each learner will interpret that reality somewhat differently. Therefore, the outcomes of learning will vary somewhat, and objectives, if they are useful at all, would be a negotiating tool for guiding learners during the learning process and for self-evaluation of learning outcomes. This prescription is especially problematic for training design, which typically is based on the solution of specific, perceived problems. Most training is, almost by definition, convergent and objectivistic, because it supports explicit performance goals.

Task and content analysis would focus less on identifying and prescribing a single, best sequence for learning. Task analysis would concentrate more on considering appropriate interpretations and providing the intellectual tools that are necessary for helping learners to construct knowledge. These tools, and the environments containing them, should not only accommodate but also promote multiple interpretations of reality.

The goal of IST would be less concerned with prescribing mathemagenic instructional strategies necessary to lead learners to specific learning behaviors. Rather than presenting instructional treatments, designers would provide generative, mental construction "tool kits" embedded in relevant learning environments that facilitate knowledge construction by learners. This generative-mathemagenic distinction (Jonassen, 1985b) refers more to control of mental processing than to levels of processing. Constructivists believe that learning is internally controlled and mediated by the learner. Objectivists believe that learning is externally mediated by the instructional strategies that predetermine the required mental activities that give rise to acquiring the elements of an external reality.

Evaluation of learning would become less criterion-referenced. If you believe, as radical constructivists do, that no objective reality is uniformly interpretable by all learners, then assessing the acquisition of such a reality is not possible. A less radical view suggests that learners will interpret perspectives differently, so evaluation processes should accommodate a wider variety of response options. Evaluation of learning, according to constructivists, should become more goal-free (Jonassen, 1991b; Scriven, 1983). Evaluation would become less of a reinforcement or control tool and more of a self-analysis tool.

CONCLUSION

Much of cognitive psychology and most of IST currently are grounded in objectivism. Objectivists believe that the goal of instruction is to map an external reality onto learners. Perhaps the most common conception of instruction based upon objectivist thinking is the "transmission of knowledge," a knowledge that is prescribed by subject-matter analysis. Objectivists accomplish this task analysis, whether it is behavioral or cognitive task analysis, by determining what reality should be learned and how it should be acquired.

Constructivists warn that the "knowledge" that is transmitted may not be the knowledge that is constructed by the learner. They maintain that, rather than prescribe learning outcomes, instruction should focus on providing tools and environments for helping learners interpret the multiple perspectives of the world in creating their own world view. In answer to Bruner's question about whether a science of thinking must be objectifiable, constructivists contend that it is unnecessary, while objectivists believe that learning and thinking can and must be objectified in order to be transmitted and assessed.

If we as a field choose to adopt a more constructivistic view of instruction, then we assume the need for a philosophical revolution of some dimension in our field to support the psychological revolution that has been underway for over a decade. Constructivists claim that we need a *philosophy of understanding* to support our *psychology of understanding*. This philosophy of understanding is "constructivism," claims Goodman (1984), and it comprises a philosophy of science, a philosophy of art, as well as a philosophy of cognition.

Objectivism and constructivism represent alternative conceptions of learning and thinking, much like the artist-scientist, two-worlds dialectic (Snow, 1960). The IST world is largely scientific and objectivistic. Goodman (1984) claims that constructivism is an increasingly popular philosophy that may be applied to cognitive science and, by inference, to IST.

The intention and conclusion of this article is *not* that we reject all of our objectivistic assumptions in favor of the constructivistic assumptions. Objectivists would argue against that recommendation from the pragmatic perspective that any nonobjectivist or nonrealist position is inoperable, that constructivism is antecedent to academic chaos. IST should not

necessarily adopt a radical constructivistic view that thought is completely individualistic, that all of us cannot interpret the world in a similar manner. Such a position is solipsistic and *would* surely lead to intellectual chaos and the inability to communicate. Besides, the socially negotiated meaning that underlies "common knowledge" is part of the constructivist belief.

Yet constructivism holds important lessons for how to interpret the results of learning and for how to design environments to support learning. Those environments must engage learners in negotiating meaning and in socially constructing reality. Educators have always been the agents of control, so that societal reinforcement (social learning theory remains firmly rooted in behaviorism) is predicated on assimilating enough of its objective reality. If we, as educators or designers, relinquish that control, then learners must assume it. The objectivistic research on learner control suggests that learners are often unable or unwilling to assume greater personal responsibility for learning, so learning should be externally mediated by instructional interventions. Constructivists argue that the type of control that is invested in learners in such studies precludes "meaning making."

Since learning obviously entails constructivistic and objectivistic activities, the most realistic model of learning lies somewhere on the continuum between these positions. Instructional design is a prescriptive theory based upon descriptive theories of learning (Reigeluth, 1983). Instructional design and the learning theories that support it are largely objectivistic. The implications of many descriptive learning theories are obvious for a prescriptive theory of instruction and its related practice. However, constructivistic theories of learning remain largely descriptive. The implications of constructivism probably are not established well enough to support a prescriptive theory of instruction, yet some of the implications are becoming more obvious (Duffy & Jonassen, in press).

It is reasonable for IST to consider the implications of constructivism for instructional systems. Foremost, researchers and designers should question our long-standing but delusive presumption that we can always control what individuals learn. At best, teachers and designers constrain learning, but in order to maximize individual learning, we may have to yield some control and instead prepare learners to regulate their own learning by providing supportive rather than intervening learning environments.

A final caveat: when integrating constructivism into the instructional design process, the nature of the learning and the context in which it will occur should be considered before committing to one theory or the other. For instance, the outcomes of air traffic controller training probably should not be individualistic or primarily constructed, yet designers must recognize that controllers' perceptions of their roles and functions will differ somewhat. The intent of this article is not to suggest that designers adopt constructivism as they have so many other potential panaceas, but that they reflect upon and articulate their conceptions of knowing and learning and adapt their methodology accordingly. When asked to commit to either the objectivistic or constructivistic camp, the designer will be best served by replying that it depends upon the context. □

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