Language as a Tool for Thought: The Vocabulary of Games Facilitates Strategic Decision Making

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Abstract

People in competitive decision-making situations often make poor choices because they inadequately understand the decision they are to make, particularly because they fail to consider contingencies such as how their opponent will react to their choice (Tor & Bazerman, 2004). Accordingly it would be useful to have a generally applicable vocabulary to guide people towards effective interpretations of decision situations. The vocabulary of games provides one such toolkit. We presented 508 participants with words from the vocabulary of games, or some lesser form of support, on a tic-tac-toe decision scenario. Participants then generated a course of action for a second competitive decision-making scenario. Participants presented with words from the vocabulary of games were more likely to transfer and generate sound explanations of contingencies than participants receiving the same key information in other terms or lesser support. Vocabularies not only invoke particular framings of decision situations, but can guide reasoning through those and subsequent decisions as well.

Introduction

There are two basic steps to making a decision: understanding what is to be decided, then making the actual decision (Brandenberger & Nalebuff, 1996; Newell & Simon, 1972). Most decision research makes assumptions about how people understand the decision situation, and then analyzes how they subsequently make the decision. Considerably less decision research has examined the systematic influences that lead people to their initial understandings of decision-making situations (see, e.g., Bazerman, Curhan & Moore, 2000, for an argument on the need for more such research). We agree with March (1994: 211-212), who claimed that "understanding decision making involved understanding the ways in which language carries, elaborates, and creates meaning." The broad proposal guiding our research is that the vocabulary people use to articulate a decision frames and guides their reasoning of that decision.

The words used to describe a decision should influence how people understand the decision and accordingly what choices and actions seem most reasonable to make. Political actors appear to assume this to be true, as indicated by the resources they expend to "frame the debate" and thereby influence key decision makers to favor their desired policies. More than 60 years ago, the sociologist Mills (1939) argued that problems are perceived relative to a vocabulary. For example, what counts as murder seems straightforward, but should differ substantially across vegans, anti-abortion activists, lawyers, soldiers and the (hopefully extinct) ritual practitioner of human sacrifice (Clark, 1998).

One role of language is to invoke particular framings or interpretations. There are many decision-making studies that could be viewed as such, particularly among studies of framing effects (e.g., Larrick & Blount, 1997), although few attribute their effects to language *per se*. For example, Liberman, Samuels and Ross (2004) found that people choosing in a prisoner's dilemma situation were more likely to cooperate if the situation was labeled a "Community game" than if it was labeled a "Wall Street game." These labels invoked cultural norms, and hence people's understanding of the decision to be made. As studies of priming and memory accessibility amply demonstrate, that which can reliably invoke is important.

Language not only invokes but also guides reasoning. One way language does so is by providing and organizing "tools for thinking" (Vygotsky, 1934; see also the related proposal of culture as a toolkit, as in Swidler, 1986). The tool analogy runs as follows: just as work is easier if one has the right tool for the job, so too is it easier to reason through a decision if one uses appropriate words for describing it. Also, if a hammer is available, one is more likely to think of nailing something together—and analogously, knowledge of a particular vocabulary makes it more likely one will use that vocabulary to understand and make decisions about situations. By this view of language, vocabularies do not determine whether someone can or cannot think of something, but rather vocabularies make particular ideas and subsequent reasoning easier and more likely to occur. Further, just as an individual tool is less useful than a toolbox of related tools for coordinated activity, so too are sets of words—vocabularies—more useful than individual words (Loewenstein & Ocasio, 2005; Loewenstein & Gentner, 2005).

One final important aspect of conceptualizing vocabularies as toolkits is that just as the same tools can be useful in a wide variety of settings and for a wide variety of projects, vocabularies can also capture abstract ideas of wide applicability. This is often the case for professional and expert vocabularies (jargon). For example, *whether and how much to donate to public radio* and *how much effort to put into writing one's section of a co-authored first draft* are quite different decisions, but both can be construed more generally as decisions about *cooperating in social dilemmas*. Vocabularies are particularly useful for helping people transfer abstract ideas and frameworks typically used in one context for use in understanding and making decisions in a novel situation (Gentner & Loewenstein, 2002; Loewenstein & Gentner, 2005).

The Vocabulary of Games

One important toolbox for thinking about decision making is the vocabulary of games (von Neumann & Morgenstern, 1944; Luce & Raiffa, 1957). Clearly there is more to game theory than its vocabulary, but it is just as clear that learning the vocabulary is part and parcel of learning the larger approach to understanding strategic decision making. Minimax, the logic of backward induction and decision trees have become standard approaches to strategic decision making. Research in decision making highlights why these developments and subsequent training are so important: people often fail to think about what actions they and their opponents can take in a competitive decision making situation.

The best known problems used to highlight poor interpretations and reasoning through contingencies are the Acquiring a Company problem used by Max Bazerman and colleagues (e.g., Ball, Bazerman & Carroll, 1991; see also Foreman & Murnighan, 1996) and the Monty Hall problem (from the game show, "Let's Make a Deal", e.g., Burns & Wieth, 2004; Idson et al, 2004). In key ways, these problems are like the simple children's game, tic-tac-toe, in which two players attempt to get three marks in a row on a 3x3 grid. In all of them, it is a poor strategy to decide what to do without first considering what the other person will do in response to that choice. To adults—perhaps because most adults played tic-tac-toe as children—it is obvious that there are two players, what the rules of the game are, and what possible moves the players can make. To children learning the game, however, these things are not so obvious, and so there are actual winners and losers. And like these inexperienced children, adults without sophisticated understanding of decision making use faulty approaches to the unusual competitive decision making situations of the Acquiring a Company and Monty Hall problems. On their first attempts, most adults focus on poor subsets of the available information (usually they focus on their own choice and ignore what will follow it) and as a result give the wrong answer (Tor & Bazerman, 2004). These problems in understanding decision situations extend well beyond the Acquiring a Company and Monty Hall problems. Even for prisoner's dilemma games, a recent eye-tracking study suggested that some participants systematically focus on just four of the (only!) eight numbers available, and those four numbers guide their choices (Hristova & Grinberg, 2005). People are even poor at recognizing a useful framing of a decision when directly presented a choice between two (Blount & Larrick, 2000). The poor interpretation of initial situations is a general concern that skews decision making and problem solving (Newell & Simon, 1972; Kershaw & Ohlsson, 2004).

If people perform poorly on a wide variety of decision problems due to poor initial interpretations, then it would be useful to have a generally applicable vocabulary to guide people towards effective interpretations of decision situations. Such a vocabulary would demarcate categories and suggest lines of reasoning that facilitate making sound choices across situations. The vocabulary of games provides one such toolkit.

Experiment 1

Experiment 1 examines whether receiving a simple subset of terms of the vocabulary of games could facilitate decision making requiring participants to consider contingencies. First we presented people with a tic-tac-toe decision scenario, followed by a challenging decision scenario that, like the Monty Hall and Acquiring a Company problems, requires people to think through contingencies of what actions are possible for themselves and their counterparts. This was a novel decision scenario about two people playing an unusual party game (the scenario is presented in full in the Appendix). The vocabulary terms were presented accompanying a tic-tac-toe decision scenario, allowing the actual text of the key decision scenario to remain constant, and to require participants to transfer it to a new situation. Thus there were three conditions: the vocabulary condition, the "game-only" control condition (who were given the tic-tac-toe decision scenario without the accompanying vocabulary terms), and the "reversed" control condition (who completed the key decision scenario before the tic-tac-toe decision scenario in case that scenario in itself was helpful).

Methods

Participants A total of 215 undergraduate students at a large public university taking an introductory course in Management (although they were not business school students) participated for extra course credit.

Design Participants were randomly assigned to the vocabulary condition (n=88), the game-only control condition (n=86), or the reversed control condition (n=41).

Procedure and Materials All materials were presented on a computer. Most participants were first given a tic-tac-toe decision scenario. They were shown the current state of the board three moves into a game and asked to choose between two possible subsequent moves. In the vocabulary condition, the screen was titled "Tic-Tac-Toe Game," the choices were labeled "move A" and "move B," and the question was:

> "You are O, and now have essentially two choices, A or B (all other moves are equivalent to these, just imagine

rotating or flipping the board around). Which move should you make?"

In the control conditions, the screen was titled Tic-Tac-Toe, the choices were labeled A and B, and the question was the same except the word *move* was replaced by *decision*. There was a correct answer—one of the two moves led to a certain loss. After choosing one of the two moves or the option that stated both moves were equally good or bad, participants were shown the two choices again and told which was the correct answer. The vocabulary condition read:

"You were presented with the two moves above. The correct answer was Move B. As in many games, the challenge is to look ahead several moves to determine where the other player can place their pieces. If you go through this exercise, you will realize that, following Move A, X has two ways to win. O can only block one of these. Following Move B, the outcome would be a draw."

Participants in the control conditions were told simply: "You were presented with the two options above. The correct answer was B."

Participants then completed the party hat decision scenario—listed in the Appendix—about an unusual party game between "you" and "a guy" involving two white hats and one black hat. The key to solving the problem is to recognize that the guy's silence means he must not know what color hat he has. Because he can see you and there is only one black hat, if you had on a black hat he would know he was wearing a white hat. Thus you must be wearing a white hat. Finally, we note that the reversed control condition completed the party hat decision before the tic-tac-toe decision.

Scoring The key dependent measure was participants' explanations for their choices to the hat decision. Their forced choice responses were uninformative, as many participants chose the correct response for the wrong reason (specifically, many said they had a two-thirds chance of being right if they guessed "white hat"). As a result, we only counted a response as correct if participants provided a correct explanation for their correct choice. We counted as correct those explanations that stated the logic just listed about the meaning for the other party's silence. These responses were quite distinct, and two coders blind to condition showed perfect agreement.

Results and Discussion

As predicted, vocabulary condition participants were more likely to generate correct explanations than were control condition participants (15% versus 2%), χ^2 (1, N=215) = 13.95, p < .001. There was little difference in performance between the two control conditions (game control: 2% correct explanations; reversed control: 0% correct explanations). The low level of performance overall is consistent with the difficulty of these problems. Nonetheless, the reliable advantage for the vocabulary condition implies that participants were better able to consider the contingencies in the hat decision if they had encountered words from the vocabulary of games and reflected upon the contingencies in the tic-tac-toe problem.

Experiment 2

Experiment 2 built on Experiment 1 with two important enhancements. First, we added two conditions to disentangle presenting the vocabulary from encouraging people to think through contingencies. The extended vocabulary condition, like the vocabulary condition in Experiment 1, included terms from the vocabulary of games in the context of analyzing contingencies in the tic-tac-toe decision. One new condition was a minimal vocabulary condition that presented a few words from the vocabulary of games but not those about contingencies. Perhaps invoking the vocabulary would be sufficient, even without presenting words related to contingencies. The other new condition was a content control condition. This group received a discussion of the contingencies in the tic-tac-toe decision scenario, but using words specific to tic-tac-toe rather than general terms from the vocabulary of games. This is a strong test of whether or not just the idea of contingencies, but not the vocabulary of games itself, is key to interpreting contingencies and transferring that understanding to further decisions. The second change is that we used a new competitive decision scenario. This decision scenario was not a game but a business decision. This enables us to generalize to the broader decision-making domain, and beyond situations normally termed games.

Methods

Participants Participants were 293 undergraduates from the same sample as in Experiment 1.

Design Participants were randomly assigned into one of five conditions: the extensive vocabulary condition (n=55), a minimal vocabulary condition (n=68), a content control condition (n=54), a game-only control condition (n=51), and a reversed control condition (n=65).

Procedure and Materials The overall procedure and the tic-tac-toe materials were largely the same as in Experiment 1. The questions and explanations for the tic-tac-toe decision were new. In the two vocabulary conditions, the question was: "Player O is competing against opponent X. Player O plans a strategy to win, or at least tie, the game. Of the two possible moves, A and B, which should Player O make?" In the three control conditions, the question was: "O has two choices, A or B. What is O's best choice?" Table 1 lists how each condition explained the right answer.

Next, participants were shown the software decision scenario (shown in the Appendix). The decision was whether a software company should preemptively begin work on an about-to-be ordered game for desktop computers or for videogame consoles. Participants were asked to explain a decision to pursue one of the formats or to wait. Next, because these decision problems are challenging, all participants were given two hints, and could then generate a new answer. Specifically, they were asked "How could she not just have a good guess or estimate of which format is likely, but actually be CERTAIN about the format Nanosoft is assigning Creative Designs?" And, "If Game Driver knows which format Creative Designs was assigned by Nanosoft AND they have not yet started to hire, what implications does this have for the format that Nanosoft assigned to Creative Designs?" Finally, similar to Experiment 1, in the reversed control condition, the software decision scenario was presented first, then came the tic-tac-toe decision scenario.

Table 1: Descriptions of the correct answer to the Tic-Tac-Toe problem by condition.

Condition	Descriptions
Extensive Vocabulary	The winning move is B. You can see why if you consider how Player X would move in response to Player O choosing move A. Follow that plan through to see what move Player O would take after that. Looking moves ahead reveals that after move A, Player X will win. After move B, Player O can force a tie, and so move B is best.
Minimal Vocabulary	The right move for Player O was move B.
Content Control	The correct choice was B. You can see why if you consider what X would choose after O chose A, and then what O would choose after that, and so forth. After choice A, X will achieve 3 in a row. After B, O can prevent that outcome, and so choice B is best.
Game Control	The correct choice was B.
Reversed Control	The correct choice was B.

Scoring As in Experiment 1, we only counted a response as correct if participants provided a correct explanation for their correct choice. We counted as correct explanations that stated (1) the other company knows what kind of game the focal company was assigned to create, (2) even with this knowledge the other company had not started work themselves, and so (3) this must mean they were assigned a console game because if the focal company had been assigned the computer game the other company would know what they were supposed to produce. These responses were so different from the other responses that they were essentially self-evident, and two coders blind to condition agreed on all entries.

Results

The Software decision problem was difficult, as only 3%, evenly distributed across conditions, solved it prior to the hints. However, after the hints, there were clear differences by condition (Table 2). The extensive vocabulary condition (35% correct explanations) performed better than all the remaining groups (an average of 20%), χ^2 (1, N=293) = 5.61, $p < .05$. There was no sign that minimally hinting at the vocabulary of games or presenting the contingency logic in situation-specific terms outside the vocabulary of games were of any benefit. Rather the suggestion is that understanding a decision problem using the vocabulary of games—a coherent toolkit for thinking through sequences of contingent actions by two players—can be effectively transferred to think through a further decision scenario.

We found additional evidence that the vocabulary of games was effective in what people wrote in their explanations. The explanation advantage demonstrated by people in the extensive vocabulary condition was fully mediated by the use of words suggesting insight. Words denoting insight were automatically content coded according to LIWC dictionaries (Pennebaker & Francis, 1999; we found similar patterns coding for words used to discuss contingencies, such as *because*, *since*, *thus*, *alternatives*, *options*). We found that a greater proportion of the extensive vocabulary group's responses exhibited insight than did those from the remaining groups (84% versus 64%), reliable according to a logistic regression, B = 1.085, S.E. = 0.473, Wald χ^2 = 5.257, $p < .05$. Expressing insight, in turn, was associated with correct explanations (35% correct for those using insight words versus 4% for the remainder), B = 2.49, S.E. = 0.616, Wald χ^2 = 16.368, $p < .001$. Finally, although the extensive vocabulary group generated reliably more correct explanations (as noted above), B = 0.885, S.E. = 0.382, Wald χ^2 = 5.367, $p < .05$, this effect was no longer significant if insight was also entered into the model. In this combined model, expressing insight continues to show a reliable advantage for generating correct explanations, B = 2.417, S.E. = 0.618, Wald χ^2 = 15.285, $p < .001$, but the effect of being in the extensive vocabulary condition is no longer significant, B = 0.622, S.E. = 0.402, Wald χ^2 = 2.399, $p = .12$. A Sobel test confirmed the reduction was reliable, $Z = 1.99$, $p < .05$, implying mediation (Baron & Kenny, 1986).

There was an interesting relationship between participants' performance on the tic-tac-toe decision and the software decision. Receiving the extensive vocabulary was most valuable for those who had incorrectly answered the tic-tac-toe decision. One potential explanation is that those who were correct did not pay much attention to the main part of the manipulation, which occurred in the explanation of the correct answer. A second potential explanation is that those who were wrong were most in need of interpretive help, which was only capably supplied by the extensive vocabulary. For those who gave the correct response to the tic-tac-toe decision scenario, the extensive vocabulary group was no more likely to provide a correct explanation for the software decision scenario than were those in the other conditions (36% versus 27%), χ^2 (1, N=155) = 1.14, $p = .29$. However, for those who were given an incorrect response to the tic-tac-toe decision scenario, the extensive vocabulary group was more likely to provide a correct explanation for the software decision scenario than were those in the other conditions (32% versus 13%), χ^2 (1, N=138) = 4.57, $p < .05$.

Table 2: Proportion correct explanations by condition and correctly solving the Tic-Tac-Toe Decision Scenario.

	Correct Explanations for the Software Decision Scenario		
Condition	If Correct on Tic-Tac-Toe	If Wrong on Tic-Tac-Toe	Total
Extensive Vocabulary	.36 (13/36)	.32* (6/19)	.35* (19/55)
Minimal Vocabulary	.28 (11/40)	.14 (4/28)	.22 (15/68)
Content Control	.15 (4/26)	.14 (4/28)	.15 (8/54)
Game Control	.36 (8/22)	.10 (3/29)	.22 (11/51)
Reversed Control	.29 (9/31)	.12 (4/34)	.20 (13/65)

Note. The reversed control group received the Software decision prior to the Tic-Tac-Toe decision.

* p < .05 for the contrasts of the Extensive Vocabulary group with all remaining groups.

Lastly, we note that there was a reliable effect of the game vocabulary simply on answering the tic-tac-toe decision correctly. Those receiving game vocabulary (there was no difference between the two vocabulary conditions prior to making a choice for this decision) were more likely to answer the tic-tac-toe decision correctly than those not receiving game vocabulary (62% vs. 46%), χ^2 (1, N=293) = 6.72, p < .01. This is evidence that even the minimal vocabulary condition was of some benefit, even if it was not sufficient to yield transfer advantages on the software decision scenario.

Discussion

Thinking about decisions using words from the vocabulary of games facilitated generating correct explanations that appropriately considered contingencies. Specifically, even simple words from the vocabulary of games led to greater success on a tic-tac-toe decision scenario. And more extensive support from the vocabulary of games that encouraged thinking through sequences of moves led to an advantage for considering contingencies to correctly explain the right choice on a distinct challenging business decision scenario. This was the case even though the words were presented in the context of the tic-tac-toe decision scenario, and hence this advantage of game vocabulary required participants to transfer that framework to the software decision scenario. The implication is that vocabularies can (1) invoke particular understandings of decision situations, (2) guide reasoning through those decisions and (3) facilitate transfer to subsequent decisions.

General Discussion

These studies represent a first step in examining vocabulary-level toolkits for framing decision situations and guiding subsequent reasoning. In two studies with two decision scenarios, we found that describing contingencies using the vocabulary of games in a familiar game facilitated reasoning about contingencies to correctly elucidate a subsequent, novel decision situation.

Presenting words from the vocabulary of games about contingencies appeared critical. Explicitly referencing the vocabulary of games but not its terms for handling contingencies was ineffective, perhaps because for these participants the vocabulary of games is a loose rather than tightly integrated and coherent framework. Perhaps students of game theory would need less prompting. Explicitly describing the contingencies in the tic-tac-toe decision using words specific to tic-tac-toe rather than words from the vocabulary of games was ineffective. This is most likely due to a transfer failure. That is, we assume people thought about the contingencies in the tic-tac-toe problem because they were clearly described, but because these descriptors were tied to the specific game itself, they did not facilitate transferring that framework to interpret and reason through the subsequent decision scenario. Vocabularies are effective both because they articulate key domain relations and because they can be used across situations (Gentner & Loewenstein, 2002; Loewenstein & Gentner, 2005).

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Appendix

The Party Hat Decision Scenario

You are at a birthday party and the host drags out an unusual assortment of activities. You get trapped in the following situation: You and a guy at the party are seated, both facing the same way. You are in front, so he can see you but you can't see him. Someone puts a hat on your head, and you are told the man also had a hat put on his head. You are then told that there are two white hats and one black hat available, and the first person to guess the color of their own hat within 30 seconds will win a prize. However, wrong guesses are heavily penalized: you will have to wear a ridiculous costume for the rest of the party. You scramble to think about whether you can claim the prize. Before you know it, the host warns that 25 seconds have gone by. In the remaining seconds, should you: 1. Announce you have a white hat; 2. Announce you have a black hat; or 3. Say nothing? Please describe how you arrived at your choice.

The Software Decision Scenario

Creative Designs is a company that designs games for videogame consoles (such as Microsoft's Xbox, Sony's Playstation or Nintendo's Game Boy) and computers (desktops and laptops). A major software company, Nanosoft, announced that they will be launching THREE new games, TWO for game consoles and ONE for computers. Nanosoft will develop one of these games themselves, and will hire two companies for the other two games. Creative Designs won one of the bids. The other winning bidder was Game Driver. Nanosoft told Creative Designs and Game Driver that it would take two months for them to know which game format each company should use.

The two-month delay was a big problem for Creative Designs. The sooner they finish, the more money they can make, especially if they finish before Game Driver. Specifically, if they start planning for a videogame console game early, and this is what Nanosoft ultimately asks them to make, they will make an extra $1 million in profit. But if they are wrong about the format, they will lose $2 million in extra expenses. On the other hand, if they start planning for a computer game early, and this is what Nanosoft ultimately asks them to make, they will earn an extra $2 million in profit. However, if they are wrong about the format, they will lose $1 million in extra expenses. Creative Designs knows that Game Driver is in the same situation.

Two weeks later, the CEO of Creative Designs became aware of some key information. A sales representative at Creative Designs learned that Game Driver discovered 4 days ago which format Nanosoft will assign Creative Designs to work on, even though Game Driver still doesn't know what they themselves will be working on. The CEO also knows from Creative Designs' Human Resources Manager that Game Driver has not done any planning or hiring yet on their Nanosoft game.

Please advise the CEO on the right decision.

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