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# The Effect of Information Overlap on Communication Effectiveness

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**Abstract**

It makes sense that the more information people share, the better they communicate. To evaluate the effect of knowledge overlap on the effectiveness of communication, participants played a communication game where the "director" identified objects to the "addressee." Pairs either shared information about most objects' names (high overlap), or about the minority of objects' names (low overlap). We found that high-overlap directors tended to use more names than low overlap directors. High overlap directors also used more names with objects whose names only they knew, thereby confusing their addressees more often than low-overlap directors. We conclude that while sharing more knowledge can be beneficial to communication overall, it can cause communication to be locally ineffective. Sharing more information reduces communication effectiveness precisely when there is an opportunity to inform–when people communicate information only they themselves know.

*Keywords:* Communication effectiveness; Satisficing; Information; Language use; Reference

## 1. Introduction

Jenn and Kate were working in our laboratory when the phone rang. Kate prepared to answer it when Jenn said "It's Paul. ... I'm getting it." No one picked up the phone: Kate thought Jenn meant that Jenn was getting the phone because it was Paul, Jenn's boyfriend. But Jenn was just receiving a file electronically from Paul, and as she saw Kate about to answer the phone, she told her to let him know that she is getting the file. Classic miscommunication. In order to understand how communication normally works, it is useful to consider such cases, but only if they are systematic. We investigate one factor that is important to communication effectiveness, namely, the extent to which people share information. We would suggest that while sharing a lot of information would normally make communication more effective, it is also a systematic source of confusion.

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The notion of effective communication is notoriously elusive. We do two things to address this problem. We use a simple definition of effectiveness and we restrict the domain of inquiry. We define effectiveness in a way which is inversely related to the degree of confusion en route to successful communication. The less confusion, the more effective the communication is considered to be. We also restrict the domain of inquiry. What counts as effective communication may vary with the immediate goal of the interlocutors. One might chat to establish relationships, to feel better, to manipulate others, to convey information, etc. Here, we focus on conveying information. We consider the case of referential communication, where the goal is to identify referents in the world (Glucksberg, Krauss & Higgins, 1975; Krauss & Fussell, 1991). This domain has been extensively studied in the past and has proven useful in studying the way expertise affects communication (e.g., Bromme, Nuckles & Rambow, 1999; Bromme, Rambow, & Nuckles, 2002; Isaacs & Clark, 1987), the role that visual perspective plays in communication (Schober, 1993), the way communication affects category formation (Markman & Makin, 1998), and the way that intended audiences affect the nature of messages (Fussell & Krauss, 1989).

Referential communication is useful because it is a central function of language use, and because it makes the problem tractable. It is central and prevalent, as it appears whenever we attempt to identify objects in the world for other people. When we say "Could you hand me the towel?" or "I'll have what she's having" we identify specific objects for others in order to achieve our goals. Moreover, this domain is tractable as it provides an objective way to detect success.

The effectiveness of referential communication can be a function of many things. We focus on what has been considered central to communication effectiveness in general, information that people share. We define shared information slightly differently than the traditionally defined "common ground" (e.g., Clark, 1996; Clark & Marshall, 1981): A and B share information p if A knows p and B knows p, and they both know that the other knows p. This definition requires less than the more complex "mutual knowledge" construct as defined by Clark and Marshall (1981).

## 2. Does sharing more information affect communication effectiveness?

How much information, knowledge, experience and beliefs people share varies significantly. In principle, it makes perfect sense that there would be a close relationship between how much information people share and how effectively and successfully they communicate. The basic idea is, if sharing a piece of information facilitates communication, then sharing many pieces of information should facilitate it even more. Assume that Jenn, who knows about many things, attempts to communicate with others about them. In one case, Jenn is talking to Kate, who shares a great deal of her knowledge, and in the other case she is talking to Mark, who shares little of her knowledge. These are two points on a continuum that represents the overlap in knowledge between Kate and her interlocutor. Indeed, it seems almost self evident that Jenn would be more effective when she is talking to Kate than to Mark. This is captured in what Weigand (1999) calls the harmonious model: "Any differences in the communicative worlds of the interlocutors may lead to divergent understandings and increase the risk of mis-

understanding. Therefore, communication will function all the easier, the less differences there are" (p.766).

Evidence for this sentiment, however, is relatively indirect. Several studies by Fussell and Krauss (1989) show better communication with increased familiarity. For instance, Fussell and Krauss asked people to prepare messages for a friend so that he or she can identify certain obscure pictures. Later both the friend and a stranger used those messages to identify the pictures. Indeed, the friends were slightly more successful than the strangers. This is consistent with the idea that the more knowledge people share, the more effectively they communicate. Many studies consider the effort that is invested in successful communication. Typically, the proxy for effort is the amount of "stuff" required to successfully identify an object, as measured in number of words, phrases or conversational turns. Not surprisingly, the more knowledge people share, the less effort is required to identify a referent. For example, Isaacs and Clark (1987) show that New Yorkers who attempt to identify New York City buildings to others are more efficient when talking to other New Yorkers than to non-New Yorkers. They tend to use names of buildings when talking to native New Yorkers but they use longer descriptions with others. Also, as people accumulate shared knowledge over time by talking about the buildings, they are able to more efficiently establish a reference (Isaacs & Clark, 1987; Clark & Wilkes-Gibbs, 1986).

But how does shared knowledge affect effectiveness? We propose that the extent of information overlap, or how much information people share, affects communication effectiveness in a more complex way. It is not simply the case that the more overlap the more effective communication is. We will suggest that the degree of overlap affects the reliance on a certain heuristic that could make communication more effective overall but less effective locally.

## 3. The knowledge overlap heuristic

Consider two ways that sharing information could impact communication, what we call "local" and "global." Jenn may say to Kate "Paul is leaving the party" if they both know his name, but "The guy with the goatee is leaving the party" if Kate does not know his name. Such "local" sensitivity to shared information implies that people rely on knowledge in communication only when it is known to be shared with the other. Several studies demonstrate such local sensitivity. For instance, Krauss and Fussell (1991) show that people are sensitive to differences in what people know, Isaac and Clark (1987) show that New Yorkers are more likely to use names of buildings in Manhattan when they talk to other New Yorkers, but use more descriptions of those buildings when they talk to non New Yorkers, Horton and Keysar (1996) show that when they are not distracted, speakers are more likely to refer to shared context than to non shared context (See also, Hanna, Tanenhaus, Trueswell, 2003; Roßnagel, 2000; 2004; but for counter-evidence see Brown & Dell, 1987; Dell & Brown, 1991; Keysar, Barr, Balin & Brauner, 2000).

Saying that Paul is leaving is easy, but calling him Paul only if your addressee knows Paul's name is more complicated. In general, using information is simpler than using it only when it is shared with the other. This is where global information may play a role. People may avoid altogether considering whether information is shared when they share a lot of information with the other. They may simply use their own information, behaving as if it is shared. One can think

about such a strategy as a satisficing strategy (Simon, 1956), a heuristic that simplifies matters and works well most of the time (Gigerenzer & Goldstein, 1996; Tversky & Kahneman, 1974). Indeed, when overlap in information between two people is extensive, using one's own information should work just fine because it is most likely to be shared. We will call this heuristic *The knowledge overlap heuristic*.

If people rely on such a heuristic, interesting patterns of behavior should emerge. Consider what should happen when two people communicate, given two extreme cases of information overlap. In one case, the information overlap between them is extensive, in the other it is relatively low. When knowledge overlap is extensive, if people adopt the overlap heuristic, they would be effective when they talk about things they share with the other, but they would be less effective when they talk about things they don't share. So, though the global strategy may make communication more effective overall, it is expected to lead to local inefficiencies. Our experiment is designed to test this idea.

In the experiment, pairs of participants first learned together novel names for novel objects. We manipulated the extent of knowledge overlap by allowing one participant (the "director") to learn the names for 24 objects while the other (the "addressee") learned either 6 (low overlap) or 18 (high overlap) of the names. Then the director attempted to identify these objects to the addressee in a referential communication game. We evaluated the effectiveness of this communication as a function of knowledge overlap.

## 4. Method

### *4.1. Participants*

Forty pairs of University of Chicago native English speaking undergraduates participated in the experiment. One pair was replaced because it did not follow instructions.

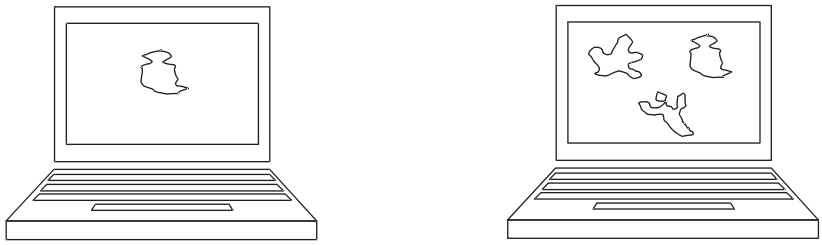
### *4.2. Materials*

Thirty novel figures with novel names served as stimuli in the experiment (Fig. 1; See Appendix for complete list). In the first phase of the experiment ("the naming phase") figures were printed on index cards. In the second phase ("the communication game") they appeared on a computer monitor. Thirty additional novel figures served as a pool for context figures in the communication game.

### *4.3. Procedure*

#### *4.3.1. Naming phase.*

Participants sat together across the table from the experimenter. The experimenter presented one card at a time, articulated the name slowly, and spelled it if a participant requested. After presenting the first six cards, the experimenter presented them again and the participants tried to name the figures. The experimenter corrected any error and repeated the procedure until




| | |
|---|---|
| Director: | Abypit |
| Addressee: | Describe, describe |
| Director: | umm, very non descript looking thing, umm, circle on the top and then two sort of arrows that come in the middle, so that it makes a little neck |
| Addresee: | Ok [clicks] |

Fig. 1. A typical exchange for identifying a figure from the high overlap/privileged figure condition.

both participants could name all six figures flawlessly. The experimenter then moved on to the next group of six cards.

To manipulate knowledge overlap, the addressee learned only a subset of the 24 figure names that the director learned (Fig. 2). For half the pairs, the addressee learned only the first 6 figures, and for the other half of the pairs the addressee learned the first 18 figures. After the addressees finished learning the figures, the experimenter took them out of the room to fill out unrelated surveys. The experimenter made it very clear to both participants that the surveys were completely unrelated to the figures, and thus that the addressee had no knowledge of the names of the objects that the director learned after the addressee left the room.

*4.3.2. The communication game.*

The experimenter randomly assigned the participants to the roles of "director" and "addressee." The pair sat across from each other, at a table with two back-to-back computer monitors. The monitors prevented the participants from seeing each other but they communicated verbally without obstruction. In each trial, a target figure appeared on the director's monitor and three figures appeared on the addressee's monitor, the target plus two distractors (Fig. 1). One distractor was randomly pulled from a set of 30 distractors, and the other distractor was pulled from the other targets. The director's task was to communicate to the addressee which figure is on his or her monitor so that the addressee can identify the target quickly and accurately. Participants were free to converse as they liked, and addressees indicated their choice by clicking on a figure. If they made a mistake, an error message appeared and they tried again. The communication game had two practice trials followed by 18 experimental trials, presented

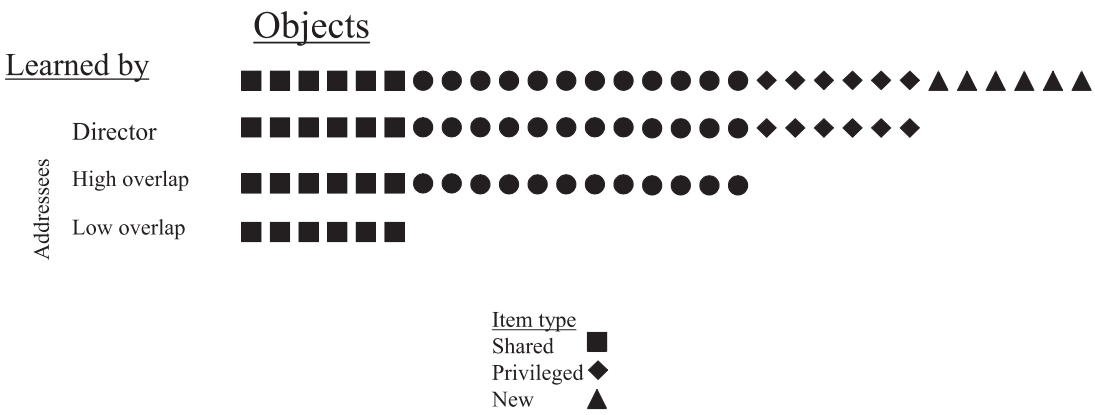



Fig. 2. Illustration of the manipulation of knowledge overlap. While the director learned names for 24 of the 32 figures, the addressee learned either the first 6 figures (Low overlap) or the first 18 figures (High overlap).

in a random order. A computer program controlled the presentation of stimuli and also recorded the session.

### *4.4. Design*

In addition to manipulating knowledge overlap, we manipulated the figure type used in the communication game. Six figures were "shared"; these were the figures participants learned together in the beginning of the naming phase. Six figures were "new," as they were not previously learned by either participant. Six figures were "privileged," as they were known only to the director. These were the figures the director learned as the last set. So the design of the experiment was a mixed 2x3 design, Knowledge overlap (high vs. low) × Figure type (shared vs. privileged vs. new). Knowledge overlap was a between subjects factor and Figure type was within subjects.

### *4.5. Coding*

A native English speaking coder transcribed all the conversations according to the Rules and Guidelines for Transcription for the Switchboard large vocabulary conversational speech recognition corpus.[1] The coder was blind to condition, and a second coder provided reliability with close to a perfect match. To evaluate the number of turns, each time one of the participants claimed the floor we counted that as a turn. So the minimum number of turns per trial was one, when the director gave a name or description and the addressee clicked on the target without saying anything. Requests for clarification served as an index for confusion, including when the addressee directly said something such as "I don't understand" or "could you explain?" or more implicitly as in "describe, describe," suggesting that the previous information was not clear enough (Fig. 1). Errors were recorded by the computer program whenever the addressee clicked on the wrong figure.

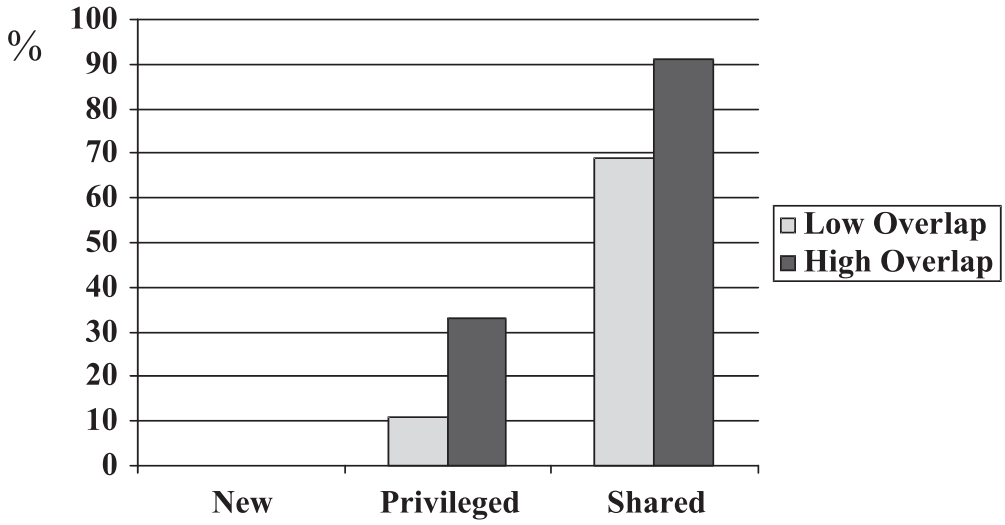
## 5. Results

Our hypothesis makes two main predictions. First, it suggests that with high knowledge overlap directors would behave as if most objects are shared. This should increase the use of names as opposed to descriptions. Indeed, the percentage of use of names was higher overall in the high overlap condition than in the low overlap condition (M = 41% vs. 27%, respectively; $F(1,38)= 12.12$, MSE = 0.05364, $p < .001$). Fig. 3a shows that this tendency depended on Figure type, which had a significant effect, as directors never used names with New objects ($F(2,76) = 185.58$, MSE = 0.03679, $p < .001$). This also resulted in an Overlap × Figure type interaction ($F(2,76) = 4.42$, MSE = 0.03679, $p < .05$). The second, more crucial prediction for our purposes was that such an increase will occur even when only the director knew the names of the objects. Indeed, high-overlap directors used three times as many privileged names as low-overlap directors (M = 33% and 11%, respectively; $t(38) = 3.2$, $p <.01$, $d = 1.04$; We performed arcsin transformation on all proportion statistical tests).

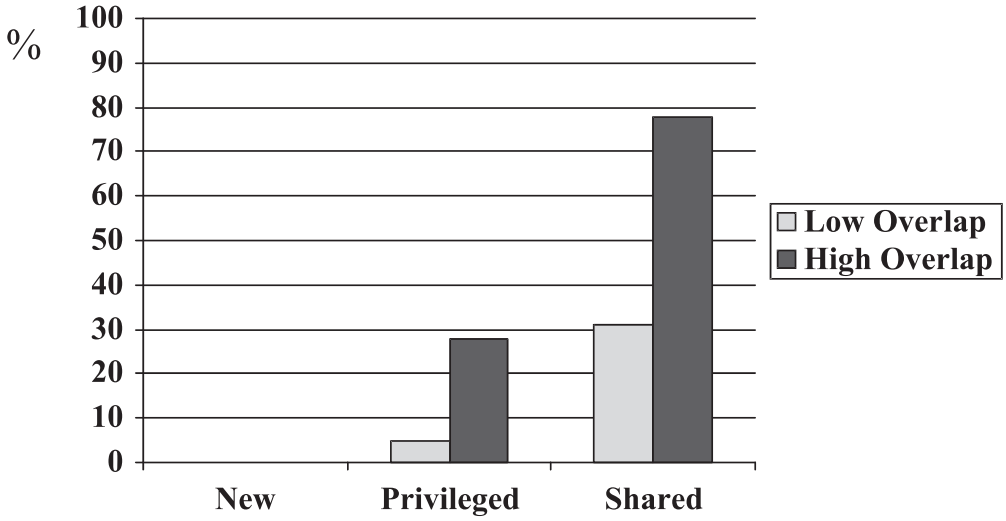
A more conservative measure is the tendency to use a name before providing any description. This eliminates cases in which speakers first described the object in order to identify it and then named it in order to inform their addressee about the name. This measure yields precisely the same pattern of results as the overall tendency to use a name (See Fig. 3b): Overall, speakers mentioned a name initially more in the high than the low overlap group (Means = 35% vs. 12%, respectively; $F(1,38)= 30.73$, MSE = 0.05442, $p < .001$). With shared objects there was an increase in the initial use of name for high compared to low overlap (Means = 78% vs. 12%, respectively; $p < .001$, $d = 1.79$) as well as with privileged objects (Means= 28% vs. 5%, respectively). Most importantly, the increase for the privileged objects was significant, $t(38) = 3.2$, $p < .01$. This pattern is precisely what the knowledge overlap heuristic predicts: An increase in the use of names when more is shared increases the use of shared information with shared names, but also with privileged names.

We are assuming that the use of a name as opposed to a description is directly related to communication effectiveness. A name is more concise than a description and should lead to easier recognition of the target, but only if the name is known also to the addressee. If the speaker uses a name the addressee does not know, then the addressee may be confused and is likely to request clarification, thereby reducing effectiveness. So the knowledge overlap hypothesis predicts two things. First, it predicts that overall people adjust to the situation and thus there would be no global difference in confusion between high and low overlap. Secondly, it predicts that with an increased use of name, communication will be differentially effective with shared objects and privileged objects, predicting an interaction between knowledge overlap and item type for requests for clarification.

There are two main reasons why addressees may ask for clarification. They may have had trouble understanding the speaker, or they may have made an error and are attempting to find out why. So they are either confused because of the instructions, or confused because they acted on those instructions incorrectly. A cleaner measure of our hypothesis involves the cases where addressees were confused before they acted on the instructions. Our account predicts differential confusion effects for high and low overlap depending on item type. We expect more confusion with high compared to low overlap for privileged than for shared objects. So we predict an interaction between item type and overlap. Overall, there was no effect of over-




Panel a. All cases a name was mentioned.




Panel b. Use of name of a figure before any description.

Fig 3. Percentage of trials where directors used the name of a figure as a function of Knowledge overlap and of Figure type. Note that in the "privileged" condition, only the director was familiar with the name.

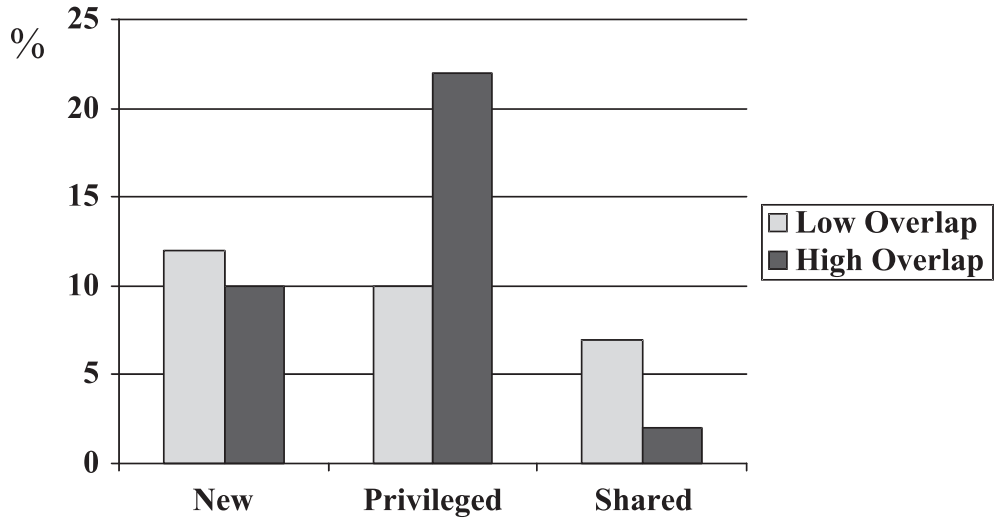



Fig. 4. Mean percentage of requests for clarification as a function of Knowledge overlap and of Figure type.

lap ($F < 1$), as the knowledge overlap hypothesis predicts. Item type did have a significant effect, with the most requests occurring with privileged objects ($F(2,76) = 5.85$, $MSE = 0.02519$, $p < .01$). As Fig. 4 demonstrates, for shared objects the request rate was minimal for both high and low (Means = 2% and 7%, respectively), and for new objects it was virtually the same for high and low (Means = 10% and 12%, respectively). Most importantly, when speakers attempted to identify privileged objects, addressees requested clarifications more than twice as often with high as with low overlap (Means = 22% and 10%). So as we predicted, the increase in requests for privileged items was apparent only for the high overlap, resulting in the predicted interaction, $F(2,76) = 3.56$, $MSE = 0.02519$, $p < .05$.

## 6. Discussion

The results clearly support the knowledge overlap hypothesis: The more information participants shared, the more they used their own knowledge. This facilitated communication when they talked about shared objects, but increased confusion with information that was privileged to the directors. High-overlap directors used more object names that were privileged compared to low-overlap directors, and high-overlap addressees were more confused than low-overlap addressees when trying to identify objects that were privileged to the directors. This shows that increase in knowledge overlap could benefit communication globally but could also introduce local inefficiencies.

Why do people adopt the knowledge overlap strategy? One possibility is that with high overlap, mutuality of information becomes less diagnostic, because most of the information is shared. Therefore, high overlap directors relied on their own knowledge, paying less attention to what information was available to their partners. While this strategy is adequate for informa-

tion that happens to be shared, it could backfire when communicating about privileged objects. In contrast, low overlap directors were more sensitive to the other's perspective precisely because most of the time their perspectives diverge. In general, our data demonstrate that sharing more information tends to exacerbate egocentric tendencies, reducing the effectiveness of communication, but only when perspectives diverge.

One aspect of our interpretation of the results is the idea that people can rely on shared information extensively and successfully simply by using their own knowledge, without considering that it is shared. A recent finding with amnesic patients strongly supports this assumption (Duff, Hengst, Tranel & Cohen, 2006). These patients performed a task similar to the one in Clark and Wilkes-Gibbs (1986), in which they repeatedly referred to objects. Just like non amnesics, with time the amnesics were able to move from a description to a label, which they kept using in further trials. They used their own knowledge of the label, but not because it was shared with the other. In fact, their memory limitation does not allow them to remember who knows what label. So while the acquired knowledge was shared with the other, they used it simply because it was their knowledge, and performed the same as non amnesics. This demonstrates that our assumption is reasonable. It is possible that high overlap directors used their extensively shared knowledge simply because it was their own.

What implications do our findings have for communication? This should depend on what people choose to talk about. In our experiment participants talked about equal numbers of privileged and shared objects during the test phase. This does not reflect the relative distribution of objects for the high overlap participants because shared objects are more common than privileged ones. When people's choice of referents reflects the overlap, people with high overlap will experience few cases of confusion because they may be less likely to talk about privileged things. The adoption of this strategy, then, makes sense especially when the distribution of what people talk about reflects the relative frequency of shared and privileged information.

There are important limiting conditions to our conclusions. If an increased overlap in information is coupled with re-conceptualization of the information, it is possible that the opposite pattern will emerge. Consider the case of expertise. Becoming an expert involves not only amassing information but also conceiving of it differently. In addition, Markman and Makin (1998) showed that communication promotes category coherence, a process that might endow experts with a unique category structure. So it is possible that when two experts on a certain domain communicate (high overlap), they will be more effective than when an expert communicates with a layperson (low overlap).

One related phenomenon suggests that even for experts increased overlap creates local inefficiencies. Bromme, Jucks and Runde (2005) asked senior pharmacy students to explain the relationship between laxatives and potassium deficiency to lay people who either had or didn't have a diagram illustrating this relationship. The pharmacy students communicated better when the layperson did *not* have the diagram. Bromme et al. call this the "illusion of evidence." The pharmacy students had the illusion that the diagram is more useful for the layperson than it really was. In our terms, increasing the overlap of information by providing the diagram actually reduced the effectiveness of the communication.

It is also possible that communication that is less direct (Holtgraves, 1997, 1998a, 1998b), might be less susceptible to the overlap heuristic. For instance, Holtgraves (2005) demonstrated that speakers and listeners interpret indirect speech systematically differently, creating

a potential source of confusion. Perhaps such differences would be reduced with an increase in knowledge overlap.

Despite a strong common-sense feeling that in communication sharing more information is better, it could actually be worse. More overlap could be better when information is already shared and it doesn't make a difference when information is completely new. It is worse only when the speaker is privy to information. We therefore demonstrated that information overlap reduces communication effectiveness only when there is a real opportunity to be informative.

## Notes

1. For details see http://www.cavs.msstate.edu/hse/ies/projects/switchboard/doc

## Acknowledgments

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## Appendix: Shapes of the Stimulus Objects and their names

*Practice objects*:

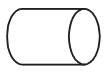

Lembop


Postich

*Experimental objects:*

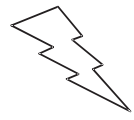

Bluchek


Chitey


Incylder


Nelke


Cortlog


Jovethun


Bolgan

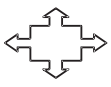

Molget


Penand


Nealch


Fluliket


Trimult


Floogle


Danzo


Buttly


Flukium


Grampent


Inta

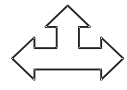

Flazap


Abypit


Etrett


Portrim

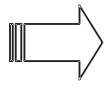

Rovzer


Archow

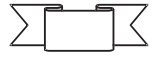

Bleez


Hydron


Stoggy


Pright


Anustick


Banpar