

Coordinating Beliefs in Conversation

DEANNA WILKES-GIBBS

Wesleyan University

AND

HERBERT H. CLARK

Stanford University

We show that participants in conversation develop beliefs about shared information that others do not. So-called directors talked with two partners in succession (A and B) to arrange unusual figures. Directors went from long, indefinite descriptions of the figures to short, definite references as common ground was built up with A. When B had been a silent side participant in the first conversation, directors continued to use short references when they changed partners. References became less efficient when B had not been a participant—even when B had heard the first conversation and seen the figures. When B had only heard the first conversation, he or she was treated much the same as a completely naive partner. Apparently, conversation provides preferred evidence for coordinating beliefs about shared information. © 1992 Academic Press, Inc.

In conversation, speakers collaborate with their partners in making references. In an earlier paper (Clark & Wilkes-Gibbs, 1986), we proposed that when a speaker wants to refer to an object, it is not enough for her to utter a noun phrase such as *the Allen wrench*. She and her partner are also responsible for establishing that he has understood her as intended. What they do, therefore, is try to reach the mutual belief that he has understood her reference well enough for current purposes. They collaborate to reach this belief; she looks for reliable evidence of his understanding and he tries to provide it. In the process, he may offer alternative phrasing and ask for repeats or repairs (*you mean the small metal thing shaped like an L?*); she may offer more information and ask for confirmation.

Predictions of the collaborative theory, as we will call it, have been confirmed for repeated references to objects (Clark & Wilkes-Gibbs, 1986), for partners with disparate goals (Wilkes-Gibbs, 1986), and dis-

parate expertise (Isaacs & Clark, 1987), for understanding by partners versus overhearers (Schober & Clark, 1989), for partners trying to conceal their references from overhearers (Clark & Schaefer, 1987b), and for partners with continuous evidence of understanding (Brennan, 1990). The theory has been extended to tasks such as giving directions (Wilkes-Gibbs, 1986) and to general contributions to discourse (Clark & Schaefer, 1987a, 1989).

In this paper, we compare several ways in which people might coordinate beliefs about their mutual understanding of references. Past work has looked mainly at the process when people talk to one another. When one person speaks to another, she is trying to add what she says to their common ground—to the information they believe they share (Clark, 1985; Clark & Marshall, 1981; Cohen, 1978; Gazdar, 1979; Stalnaker, 1978). She accomplishes this by choosing her wording based on their common ground so far, and by collaborating with her partner to reach the mutual belief that he has understood her. Throughout this process, the partner tries to interpret

Send correspondence and reprint requests to D. Wilkes-Gibbs, Department of Psychology, Wesleyan University, Middletown, CT 06457.

what she says based on his beliefs about their common ground. When they accept that he has understood appropriately, that understanding is added to their shared knowledge. So common ground in a discourse is continually growing. In making a reference, the speaker must design what she says against the *current* common ground with her partner. His beliefs about their common ground should be coordinated with hers if they are to understand one another efficiently, and collaboration helps them solve this coordination problem.

Accumulating common ground has predictable effects on the referential process, as an example from a previous study illustrates (Clark & Wilkes-Gibbs, 1986). In that study, a director (D) was asked to get a matcher (A) to put 12 so-called tangram figures (see Fig. 1) one-by-one into a particular order. (For convenience, we will consider the directors female and the matchers male, even though this was not always the case.) The director and matcher could not see each other's arrangements, but they could talk as much as they needed. They matched different arrangements of the same figures six times, which we will call Trials A1 through A6. On the very first trial (A1), D got A to identify one tangram figure (labeled A in Fig. 1) this way:

D: Okay the next one is . . . resembles someone that looks like they're trying to climb stairs. There's two feet, one is way above the other, and—

A: And there's a, there's a, a diamond on the right side, on a slant?

D: Yeah.

A: Got it.

D: Like, kind of looks like it's off the back.

A: Right, I got it.

According to the collaborative theory, once D and A reached the mutual belief that A had understood, they incremented their common ground with descriptions of the figure as (1) "someone that looks like

they're trying to climb stairs," (2) as having "two feet, one way above the other," and (3) as having "a diamond on the right side, on a slant" that "kind of looks like it's off the back." Later when D wanted to refer to the same figure, she could presuppose this information and form a simpler description based on it, as she did in this example from Trial A3:

D: Uh, the next one is the person climbing the stairs.

A: Okay.

After this exchange she could presuppose the new description and be even briefer, as on Trial A6:

D: Um, stair climber.

A: Okay.

Accumulating common ground affected two main features of the referential process: *type of reference* and *efficiency of reference*. First, in our study, D almost always introduced the figures on Trial A1 with indefinite references (e.g., "someone that looks like . . .") or descriptions ("is climbing some stairs"). But from Trial A2 on, she switched to definite references ("the person climbing the stairs") or nominals without articles ("stair climber"). For simplicity, let us call this a change from indefinite to definite references. Second, D and A made great gains in efficiency over repeated references to the same figures on Trials A2 through A6. On Trial A1, the two partners we cited took 54 words and six turns before going to the next figure. By Trial A3, they were down to 11 words and two turns, and by Trial A6, four words and two turns. In our study, D and A's increasing efficiency was shown in words, turns, and elapsed time. This pattern has been replicated in many other studies (e.g., Krauss & Weinheimer, 1964, 1966; Isaacs & Clark, 1987; Schober & Clark, 1989; Wilkes-Gibbs, 1986).

What evidence, then, do people use for coordinating their beliefs about the buildup of common ground in order to design and interpret references? The collaborative the-

ory proposes that people rely on the verdicts of mutual understanding they collaborate to reach. But how do people coordinate when they have not been collaborating with one another directly? The issue we consider here is how speakers judge whether to rely on common ground built in collaboration with one person as also being common ground with someone else. To study this, we looked at how a speaker who had been collaborating on references with one partner would refer to the same things for a different addressee. Many kinds of information could conceivably affect people's beliefs about their common ground. Here, we examined three combinations of evidence available to the speaker: (1) whether the new addressee had heard the speaker's previous conversation, (2) whether he knew, in addition, exactly what the speaker intended to refer to with each of her references in that conversation, and (3) whether he had also been a sanctioned (though silent) participant in the speaker's prior conversation.

Concretely, we asked a director to perform six trials (A1–A6) in our matching task with one partner (Matcher A), and then to carry out six more trials (B1–B6) with a second partner (Matcher B), using the same 12 tangram figures. The crucial trial, really, is Trial B1, when D first began speaking directly to B. How will the type and efficiency of her references be affected by the change of addressee? That should depend on D's beliefs about her common ground with B. To look at some possible influences on D's beliefs about common ground, we placed B in one of four circumstances while D was discussing the figures with her first partner. We varied both the amount of information from the first six trials that B had access to, as well as his status in the first conversation.

In one condition, matcher B sat next to D as a silent *side participant* in the session with matcher A. Side participants are what Goffman (1979) called "unaddressed recipients" of talk. Even though they are not

addressed directly, they are nonetheless ratified parties in a conversation (Clark & Carlson, 1982). According to the collaborative theory, all participants in a conversation assume responsibilities for their mutual understanding, and therefore can be taken to accumulate common ground along with the speaker and addressee(s). If D considered matcher B a side participant in her conversation with A, she should assume the same common ground with him on Trial B1 as she had with A after their last trial. This means she should use definite references, and the only loss of efficiency on Trial B1 should come from B's lack of practice in working with the figures.

In a second condition, matcher B had been what we will call an *omniscient bystander* during D's conversation with A. Bystanders are observers of a conversation without being participants in it (Clark & Carlson, 1982; Goffman, 1979). They do not always have full knowledge of what a speaker intends to refer to, or of her common ground with the participants. But since the side participants had such information, in this condition we wanted to give the same knowledge to nonparticipants. During Trials A1–A6, we placed B in another room where he could hear and see all of D's actions on a video monitor. Since D knew about B's access to all this information, what should she presuppose in making her references on Trial B1? If she considered him equivalent to a silent side participant, then these two conditions should look the same. But if she were less certain about their common ground, then she should initially use fewer definite references and more elaborate phrasing.

Information about omniscient bystanders, then, is crucial. Do speakers build up common ground with these listeners as confidently as they do with side participants? On informational grounds, they should. The side participant and the omniscient bystander see and hear the same information on Trials A1 through A6, and D knows this. Yet, for other reasons, speakers may not

hold such firm beliefs. First, speakers do not normally need to represent the information being accumulated by people who are not parties to a conversation in order to converse sensibly. Even when they intend to keep track of nonparticipants, how certain can they be that the nonparticipants know this, are paying attention, and actually *are* accumulating the proper information? Because of this, speakers and nonparticipants may face difficulty in coordinating their beliefs about what information they share. For these reasons, then, the omniscient bystander and side participant conditions may differ.

In the third condition, matcher B was meant to be considered a *simple bystander* during D's first conversation—a bystander who was not given privileged information about D's figures as they were being discussed. These bystanders were in the same room with D and A and could hear everything that was said. However, they sat farther from D than the side participants, and could not see the figures. This allows us to see what assumptions D will make from knowing B has overheard her conversation with A. On informational grounds, D should be less confident in this simple bystander's understanding than for the omniscient bystander or side participant. If so, she may use more indefinite references, and the collaborative process between D and B should be less efficient.

In the final condition, matcher B was a fully *naive partner*, completely unfamiliar with D's first conversation. With no shared information, D should make a fresh start and treat matcher B much as she initially did matcher A. This condition should tell us how D's own practice with one partner affects her references for a second person. To the extent that changes in type and efficiency of references depend on common ground between partners, D should still use indirect references and lengthy collaboration on the B1 trial.

In summary, this study looks at how

three levels of evidence for common ground affect references for a person with whom the speaker has not directly collaborated. These are: (1) whether or not the addressee has heard the speaker refer to the same figures in the past; (2) whether he knows, in addition, what those figures are; and (3) whether he might also have been considered a silent participant in the speaker's previous conversation.

METHOD

Three students arrived at the laboratory, read a general description of the task, and drew lots to see who would be the director, matcher A, and matcher B. The director and matcher A then took seats at tables on opposite sides of an opaque screen. On each table were the 12 tangram figures shown in Fig. 1 (without the identifying letters), each made of black construction paper pasted on a white 15 by 20 cm card. The director's cards were face down in a matrix of 2 rows by 6 columns, and the matcher's were arranged in a 2 by 6 matrix in a different random order. The 12 figures had been selected from Elffers (1976) to give a range of difficulty.

The three students listened to the instructions together. They were told that D and A were to arrange A's figures into the same order as D's (the target order) and that they could talk back and forth as much as they needed to do this accurately and quickly. They were to go through the figures in sequence, working from left to right in the first row before going through the second row in the same way; the cells of the matrix were numbered 1 through 12 to make this easy. All three were told that D and A would do the task six times (six trials) with the same 12 figures in different target orders, and that each trial would be tape recorded and timed. They were also told that when D and A finished, D would then do another six trials with matcher B, using the same figures.

It was at this point that matcher B was

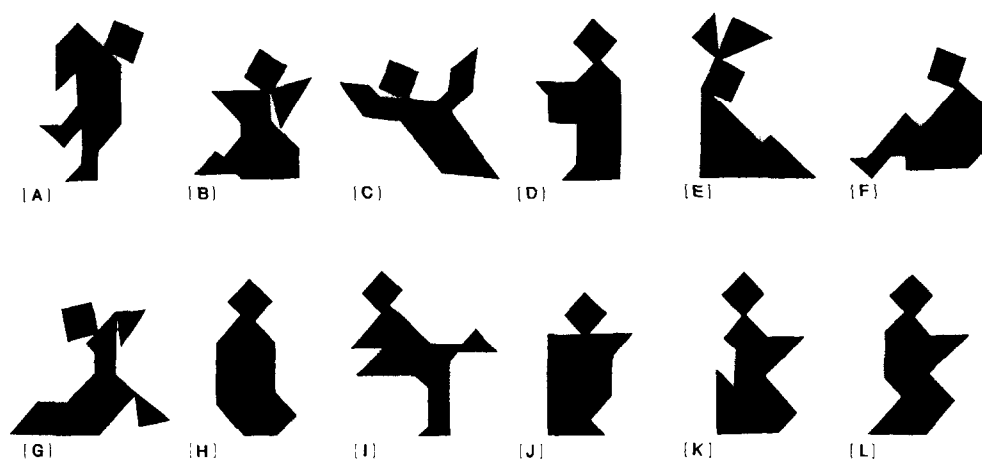


FIG. 1. The 12 tangram figures used in the matching task.

moved to one of four places. *Side participants* were seated at D's table, about 1 m from D's chair. From here, B could see D's figures, hear everything that was said on Trials A1–A6, but also feel included in the partnership. Their proximity allowed D and B to see what the other was attending to and otherwise easily keep track of each other's movements and expressions. *Omniscient bystanders* were taken to an adjacent room, where they watched an audiovisual monitor attached to a video camera that gave a full view of D's stimuli. The perspective was the same as for the side participants. Because of the camera's built-in microphone, these bystanders could also hear everything D and A said. The director knew from the start that B was in the next room watching her figures and listening to the conversation. *Simple bystanders* were placed about 2 m behind the director such that they could hear everything that was said but were not able to see the figures nor be easily monitored by the director. *Naive partners* were taken to a separate room, where they performed an unrelated task.

After B took his place, D and A proceeded through Trials A1 through A6. On each trial, a timer was started when the two of them had turned over all their cards and said they were ready to begin, and it was stopped when they said they had matched

orders. The matcher's arrangement was then checked, and the two partners were told of the positions of any errors. (The 2.3% error rate did not vary significantly by condition, so errors will not be discussed further.) Finally, all the cards were turned face down, randomly reordered, and the procedure was repeated. After Trial A6, matcher A was replaced by matcher B for six more trials with the same figures, following the identical procedure.

All trials were timed and tape recorded, and the critical Trials A6 and B1 were transcribed, complete with details about changes in speaking turns, backchannel responses, interruptions, hesitations, and false starts. All 12 trials were transcribed for the naive partner condition.

Each condition involved eight groups of three students each, for a total of 96 subjects. Although technically the four conditions were conducted as separate experiments, we will treat them as four conditions of a single experiment. The omniscient bystander condition was carried out with Wesleyan students and the other conditions with Stanford students. As the results will show, there were no differences between the two populations on basic measures (Trials A1–A6). Both men and women served in all three roles, and they participated to fulfill a course requirement or for pay.

RESULTS

Efficiency

In keeping with past findings, efficiency should increase from Trial A1 to A6 with the first matcher, and it did. As Table 1 shows, the average time per trial dropped dramatically over these six trials: from 340 to 174, 98, 67, 57, and 49 s overall (linear trend $F(1,28) = 44.3, p < .001$). There were no reliable differences among the four conditions on the A trials. The mean time per trial did not differ across conditions ($F(3,28) = 0.28, p > .10$), nor did the times on individual trials when analyzed separately (e.g., Trial A1, $F(3,28) = 1.92, p > .10$). Likewise, there was no significant interaction between A-trial times and conditions ($F(3,28) = 1.31, p > .10$). The crucial trial for our purposes is Trial A6. The average time the first two partners spent on it was 44, 55, 50, and 48 s for the side participant (SP), omniscient bystander (OB), simple bystander (SB), and naive partner (NP) conditions, respectively. These times are not reliably different ($F(3,28) = 0.64, p > .10$). So on Trials A1 through A6, it did not matter where matcher B was—beside the director, in the same room, in the next room watching, or in the next room doing something else. The four sets of directors

were equal in efficiency up to the point at which matcher A was replaced by matcher B.

By contrast, efficiency on the B trials should vary with the second matcher's background, and it did. On these trials, average times for the four conditions were significantly different ($F(3,28) = 7.96, p < .001$). The overall time per trial was fastest when B was a former side participant (44 s), intermediate when he was an omniscient bystander (66 s), and slowest when he was either a naive partner (88 s) or simple bystander (93 s). (Specific comparisons: SP vs OB, $F(1,14) = 9.70, p < .01$; OB vs NP, $F(1,14) = 3.75, p < .08$; NP vs SB, $F(1,14) = 0.12, p > .10$.) The pattern is the same on the critical B1 trial taken by itself. The average time was fastest (70 s) with the former side participant, intermediate (128 s) with an omniscient bystander, and slowest (196 and 217 s) with a naive partner or simple bystander (specific comparisons: SP vs OB, $F(1,14) = 9.76, p < .01$; OB vs NP, $F(1,14) = 6.70, p < .05$; NP vs SB, $F(1,14) = 0.39, p > .10$).

Similar results turn up when we look instead at the difference in times for matcher A's final trial and matcher B's first trial—the difference between Trials A6 and B1. First, there was a decrease in efficiency for

TABLE 1
MEAN TIMES PER TRIAL FOR BOTH FIRST AND SECOND MATCHERS, IN ALL FOUR CONDITIONS

Condition	Matcher	Trial (times in seconds)					
		1	2	3	4	5	6
Side participant	A	459	228	97	59	52	44
	B	70	46	41	37	33	38
Omniscient bystander	A	332	153	98	69	63	55
	B	128	66	54	57	46	47
Simple bystander	A	263	184	116	74	63	50
	B	217	106	76	62	48	49
Naive partner	A	304	131	83	67	49	48
	B	196	116	78	45	55	40

each of the four types of second matchers taken separately (SP, $F(1,7) = 19.35$, $p < .01$; OB, $F(1,7) = 15.92$, $p < .01$; SB, $F(1,7) = 38.23$, $p < .001$; NP, $F(1,7) = 41.02$, $p < .001$). In all conditions, people worked more slowly when matcher A was replaced by matcher B. But the relative cost of changing partners in the different conditions follows the same pattern as before. Trial B1 with former side participants was 33 s longer than Trial A1, but 73 s longer with omniscient bystanders, versus 156 and 167 s longer with naive partners and simple bystanders (SP vs OB, $F(1,14) = 6.20$, $p < .05$; OB vs SB, $F(1,14) = 8.29$, $p < .05$; SB vs NP, $F(1,14) = 0.30$, $p > .10$).

Efficiency can also be measured by the number of words D used to get each figure placed, and this shows much the same pattern. (This is not surprising, since words per figure and time per trial correlated at .98 in this study, for the trials that were transcribed.) The mean numbers of words per figure on Trials A6 and B1 for the four conditions are shown in Table 2. On Trial A6, the conditions were not reliably different ($F(3,28) = 0.95$, $p > .10$). On Trial B1, they were ($F(3,28) = 12.22$, $p < .001$). In all four conditions, more words were needed to place the average figure on Trial B1 compared to A6 (SP, $F(1,7) = 19.84$, $p < .01$; OB, $F(1,7) = 19.02$, $p < .01$; SB, $F(1,7) = 37.56$, $p < .001$; NP, $F(1,7) = 59.34$, $p < .001$). But the number of words increased by just 67% with former side participants and 100% with omniscient bystanders, compared to 275% with naive partners and

360% with simple bystanders (specific comparisons: SP vs OB, $F(1,14) = 4.17$, $p < .07$; OB vs NP, $F(1,14) = 4.51$, $p < .06$; NP vs SB, $F(1,14) = 5.40$, $p < .05$).

On the whole, then, directors were most efficient working with side participants, less so with omniscient bystanders, and least efficient with either simple bystanders or naive partners.

Efficiency increased from Trial B1 to B6 just as it did from Trial A1 to A6. The only difference was that, as just discussed, each condition started at a different level of efficiency on Trial B1. So the average time per trial decreased over the six trials: 153, 84, 62, 50, 46, and 44 s (linear trend, $F(1,140) = 307.45$, $p < .001$). The slope of this trend was -5.71 for the former side participants, -13.23 for the omniscient bystanders, -28.48 for naive partners, and -29.39 for simple bystanders.

The naive partner condition is of additional interest because it clarifies how much D's own familiarity with the figures affects her references as she goes along. We think that the growth of common ground between partners allows them to be more efficient across trials (e.g., Clark & Wilkes-Gibbs, 1986). But D's expertise could certainly affect their efficiency as well, and practice has always increased along with common ground in past work.

To look at this, we can compare D's efficiency with matcher A against her efficiency with the second naive partner. As Table 1 shows, time per trial in the naive partner condition decreased over the six trials for matchers A and B taken together (linear trend: $F(1,35) = 288.58$, $p < .001$). The slope of this decrease was -44.14 across the A trials and -28.48 across the B trials; these are not reliably different ($t(8) = 0.74$, $p > .10$). The same is true for the number of words used per figure (Table 3). This measure confirms that conversations became more and more efficient overall (linear trend, $F(1,35) = 198.96$, $p < .001$), but they did so at a similar rate on both A

TABLE 2
MEAN NUMBER OF WORDS PER FIGURE USED BY
DIRECTOR ON TRIALS A6 AND B1

Condition	Trial	
	A6	B1
Side participant	8.81	15.42
Omniscient bystander	11.25	22.59
Simple bystander	9.76	45.51
Naive partner	8.24	30.43

TABLE 3
MEAN NUMBER OF WORDS PER FIGURE USED BY
DIRECTORS ON EACH TRIAL IN THE NAIVE
PARTNER CONDITION

Trial	Matcher	
	A	B
1	40.7	30.4
2	19.1	18.1
3	13.1	13.4
4	11.0	8.2
5	9.2	7.8
6	8.2	6.7

and B trials (A slope -5.65 , B slope -4.55 , $t(8) = 0.17$, $p > .10$).

This similarity with first and second matchers is striking when one thinks about the strategies that practiced directors might have tried. For example, after they initially identified a figure on Trial B1, D could have introduced her short label for them to use the next time around: e.g., "Let's call this one stair climber from now on." But we found no evidence of this strategy in the transcripts, and as the results show, D did not shortcut the collaborative process much at all.

The only exception is on Trial B1, which tended to be shorter (by 108 s on average) than Trial A1 ($t(7) = 2.18$, $p < .07$). Apparently D found it a bit easier to come up with her initial descriptions the second time around. But beyond this first trial, collaboration was much the same with A and B. Trials B2-B6 took 15, 5, 22, -6, and 8 s less time than A2-A6 had ($t(28) = 0.24$, $p > .10$). Likewise, references on Trials B2-B6 were only 1, 0, 3, 1, and 1 words shorter than on Trials A2-A6 ($t(28) = 0.14$, $p > .10$). So D's previous experience with A and the same figures helped a little with matcher B, but only with the first descriptions.

A final thing we examined was the director's and matcher's individual influences on efficiency. One possibility was that directors who took longer with matcher A would be able to go more quickly with matcher B

because they had already worked out better references. If this were true, it would be harder to interpret D's efficiency with matcher B in the different conditions. But the data show quite the opposite. Over all groups, directors who went more quickly with matcher A also went more quickly with matcher B ($r = .42$, $F(1,190) = 40.19$, $p < .001$). This shows that directors exert a strong influence on the collaborative process. They presumably vary in collaborative styles and abilities, and these qualities would affect the efficiency of collaboration with any partner.

Types of Reference

Our directors had four main ways of introducing the tangram figures. We scored their initial presentation as (1) *definite*, if it had the form "the x ," "this/that x ," or "the one with x "; (2) *indefinite*, if it had the form "an x ," "another x ," or "someone y -ing"; (3) *no article*, if it had the form " x ," " x y -ing," " x with the y "; or (4) *description*, if it had the form "has y ," "is y -ing," and so on. As we reported previously (Clark & Wilkes-Gibbs, 1986), directors almost always introduced the figures in Trial A1 with an indefinite reference or a description. Since they had not yet established their perspectives for the figures in common ground, they could not use a definite reference or a nominal without an article. From Trial A2 on, however, they used mostly definite references or nominals without articles, and almost no indefinite references or descriptions.

In the present study, the type of reference directors chose on Trial B1 should depend on matcher B's background if this affects D's confidence in common ground. As Table 4 shows, it did. The percentages of reference types used on Trials A6 and B1 are shown in the table for all four conditions. Consider indefinite references first. As expected, very few of the presentations were indefinite by Trial A6. On Trial B1, the percentage of indefinite references increased by only 1% with a former side par-

TABLE 4
PERCENTAGES OF INITIAL PRESENTATION TYPES, ALL CONDITIONS

Condition	Trial	Description	Presentation type		
			Indefinite	Definite	No article
Side participant	A6	10.4	8.4	59.9	21.2
	B1	4.3	9.7	74.5	11.6
Omniscient bystander	A6	5.2	5.2	77.1	11.5
	B1	29.2	19.8	45.8	4.2
Simple bystander	A6	5.2	2.1	86.5	6.3
	B1	21.3	61.0	15.6	2.1
Naive partner	A6	15.6	1.0	62.5	20.8
	B1	33.8	56.5	5.3	4.4

ticipant, and by 15% with an omniscient bystander (SP vs OB, $F(1,14) = 1.27$, $p > .10$). It went up by 56 and 59%, however, when B was a naive partner or simple bystander (OB vs NP, $F(1,14) = 13.23$, $p < .01$; NP vs SB, $F(1,14) = 0.15$, $p > .10$).

Now consider the other side of the coin—definite references and nominals without articles. We will call these both definite constructions. By Trial A6, as expected, these accounted for 86% of the references overall. On Trial B1, the percentage actually increased 5% when matcher B was a former side participant. In contrast, it dropped by 38% when D switched to an omniscient bystander, and by 75% when B was a naive partner or a simple bystander (SP vs OB, $F(1,14) = 6.03$, $p < .05$; OB vs SB or NP, $F(1,14) = 6.29$, $p < .05$).

A possibility we considered was that directors might have built their confidence in the side participant only after they had begun to collaborate with him on the B1 trial and he had proved his knowledge of the first few figures. If this were true, though, then we should see fewer definite references in the beginning of Trial B1, and more as the director gained confidence. We examined the crucial side participant data for this possibility, but found no support. Fully 100% of the references to the first figure were definite; 88% of references to the first three figures were, followed by 71% (posi-

tions 4–6), 88% (positions 7–9), and 54% (positions 10–12). This is a slightly negative rather than positive slope (linear trend, $F(1,21) = 4.03$, $p < .06$). So it does seem that D expected to rely on common ground with the former side participant from the beginning of the B1 trial.

In short, type of reference tells much the same story as efficiency. Both show that directors held different beliefs about common ground with the different second matchers. In going from matcher A to a former side participant, directors kept using a large proportion of definite references. They used somewhat fewer definite constructions when changing to a former omniscient bystander, and eschewed definite constructions almost entirely when changing to a naive partner or to someone who had been a simple bystander during the first conversation.

DISCUSSION

This study shows that speakers think people who were silent participants in a conversation with them have certain advantages over hearers who were not. But these hearers also differed in their knowledge of the conversation, and this, too, affected the speakers' beliefs about common ground. Together, these differences produced different "levels" of shared information.

Levels of Shared Information

Two people may share information at many different levels. We created five levels in our task, although only four were reliably different.

1. *No shared information.* When matcher B was entirely new to the situation, he and the director shared no information about the figures. As expected, the director used indefinite references with the naive partner just as she had done initially with matcher A. She was, as we showed, more efficient in presenting her initial perspectives on the figures the second time around. We assume this is because she had worked out perspectives through her previous collaboration and did not have to generate them on the fly.

2. *Shared descriptions only.* Simple bystanders and directors shared information about how the director had previously described the figures but not about the figures themselves. For these partners, apparently, it was no more helpful to share descriptions alone than to have no shared information at all. The director made references for the former bystander in much the same way she first did for matcher A, and this makes sense. Imagine that Ben overhears Alex talking about someone who looks like a bird. Just hearing this description does not guarantee that Ben would easily recognize the right person on the street. And, as we found in our task, it seems unlikely that Alex would expect him to. Ben's understanding of what "the bird" refers to must be established in their own common ground.

3. *Fully known information.* When matcher B had seen and heard all of the first conversation over an audiovisual monitor, he shared all the information the director used in talking to matcher A. The director knew this. In fact, matcher B had an advantage over matcher A in that he knew for certain what figure D was trying to refer to each time. This level of information

strengthened the director's assumptions about B's understanding compared to Levels 1 and 2. On the first trial with matcher B, the director introduced more of the figures with definite constructions and the referential process was more efficient.

4. *Indirect collaborative information.* When matcher B had been a side participant in the first conversation, he, too, had access to the director's information. But he was more than just a witness to that conversation. He was in effect a party to it. Under these circumstances, director, matcher, and side participant accumulated common ground together. This, at least, is what the director seemed to assume. On the first trial with matcher B, she used as many definite constructions with him as she had on the former trial with matcher A, and collaboration went more smoothly than in the other conditions.

5. *Direct collaborative information.* If the director and matcher A had continued for a seventh trial, it probably would have been shorter than Trial B1 with the side participant. The original partners would have two advantages over Level 4. First, they would have secured their common ground through direct instead of indirect collaboration. Matcher A could influence their perspectives for the figures in a way that the side participant could not, and this could make it easier for him to understand them. Second, matcher A would have had more practice working with the cards. We presume both advantages would have been at work.

Shared Information and Past History

The simplest lesson of our results is that people take the past history of their partners into account in making references. By itself, this seems unsurprising. Almost all theories, for instance, use previous utterances to predict anaphoric references such as pronouns later in the same conversation. But we have shown that history goes beyond this. What is surprising is how few

theories can account for even the most basic of our findings.

Most theories of reference (e.g., Olson, 1970; Hawkins, 1978), for example, are unable to predict our Level 1 results. By these theories, once the director has decided that "the stair climber" is sufficient to discriminate one tangram figure from the others, there is no reason to think she should not use that description with matcher B. But by the collaborative theory, the director should recognize that the description is effective because of the common perspective she has established with matcher A. Once she begins talking to another person with whom she shares different common ground, she must reestablish a joint perspective. This is what we found.

Most theories of discourse (e.g., Gazdar, 1979; Stalnaker, 1978) cannot distinguish Levels 3 and 4 either. In our task, omniscient bystanders (Level 3) and side participants (Level 4) were privy to the same objective information about the first conversation, and the speakers knew that. By these theories, then, the two should be treated as equivalent. But by the collaborative theory, the directors still had to coordinate their beliefs with the bystanders, and this is why the referential process should be more elaborate. The more people do know in common, the easier it should be for them to establish that this knowledge is shared. But that is the function collaboration serves: to establish reliable evidence for coordinating beliefs about common ground. To understand referring, we must consider people's beliefs about shared information, as well as the information itself.

Our results show that speakers are generally more confident about information shared with participants than nonparticipants. This is consistent with the idea that participants in a conversation share in the beliefs about mutual understanding that result from collaboration, even when they did not talk as part of that process. What, then, makes one person a sanctioned participant

in a conversation and another not? In our study, participants and nonparticipants differed in how their presence was felt. During the A trials, the side participants were in eye contact with the director and therefore recognizable as being "together" with her. The nonparticipants were not. Now, for collaboration to serve its purpose, a speaker has to believe that her listener is acting in accordance with a principle of mutual responsibility (Clark & Wilkes-Gibbs, 1986). Because of this belief, a lack of action—such as letting the speaker continue—can be taken as a signal of understanding rather than a sign of nonhearing. So people may need evidence that a listener has been offered and has accepted mutual responsibilities. We suggest that (a) when a speaker and hearer feel themselves to be present together and (b) can mutually believe the hearer is attending to what is said and is intended to understand it, then that hearer may be considered a participant. He or she may be considered party to the common ground the participants are collaborating to build. Participating in a conversation is not the only way to build common ground with confidence. But our evidence suggests it is a preferred way.

In sum, this work confirms that people's utterances change in predictable ways depending on what they take to be common ground with their partners. Referring requires that speakers and addressees coordinate their beliefs about common ground, and there are regular procedures for doing this. Our findings show that people prefer to coordinate their beliefs by participating in conversation, and this is consistent with the predictions of the collaborative theory.

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