Cooperrider, Kensy (*to appear*). The co-organization of demonstratives and pointing gestures. *Discourse Processes*.

Abstract: Demonstratives and pointing gestures are universal, early emerging, and ubiquitous, and it has long been claimed that there is a special relationship between them. But what exactly is the nature of this relationship? The present study investigates this question using a referential communication task. Speakers referred to targets that were near or far, and pointed with the hand (more ambiguous) or a laser pointer (less ambiguous). Demonstratives and pointing frequently co-occurred, but they were also related in less obvious ways: 1) speakers used fewer demonstrative-pointing combinations when pointing was ambiguous; 2) preferred proximal demonstratives when pointing and distals when not pointing; and 3) used fewer proximal demonstratives when pointing was ambiguous. These findings suggest that the relationship between demonstratives and pointing goes beyond one of mere co-occurrence or functional resemblance, and reveal some of the principles by which speakers organize these two powerful tools in relation to each other.

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Introduction

Demonstratives like *this* and *that* are found in every human language (Diessel, 1999), are among the first words children learn (Clark & Sengul, 1978), and are pervasive in adult conversation (Wu, 2004). These tiny but powerful words are among our most basic resources for making reference and may also be among our most ancient (Diessel, 2006). In a similar way, pointing gestures are likely universal (Liszkowski et al., 2012), are among children's very first communicative acts (Bates & Dick, 2002; Cartmill, Hunsicker, & Goldin-Meadow, 2014), and are ubiquitous in adult interaction across settings (Kita, 2003). Demonstratives and pointing gestures thus appear to be among our most basic, early-emerging, and commonplace communicative tools, and, what is more, it is widely accepted that there is a privileged relationship between them (e.g. Tomasello, 2008). But what exactly is the nature of this relationship?

Over a long history of philosophical and linguistic interest in demonstratives and pointing, the relationship between these tools has more often been taken for granted than studied empirically. In Frege's discussion of verbal deixis, for example, he notes parenthetically that "the pointing of fingers, hand movements, [and] glances may belong here too" (Frege, 1918/1967, pg. 24). Bühler (1934/1982) claims that pointing gestures and words like *here* and *there* "function in a very similar way" (pg. 11), an observation echoed by numerous scholars since (e.g. Diessel, 1999; Diessel, 2006; Tomasello, 2008). Hanks (2005) comments that "while both indexicality and gesture are pervasive in language, referential deictics are unique in joining the two systematically" (pg. 195). But why do demonstratives and

pointing "belong" together, in what sense do they "function in a similar way," and what is the "systematicity" linking them? Comments like the above appear to be motivated by two observations. First, and most obviously, they *co-occur*: very often when people point they use a demonstrative, and very often when people use a demonstrative they point. Second, and less obviously, both pointing and demonstratives serve the same function to the extent that they draw attention to something— whether place, object, or person— with only minimal semantic characterization of that something. In a word, they both *indicate* (Clark, 1996). It remains possible, however, that there is more systematicity linking these tools than meets the armchair eye. That is, there may be less obvious principles by which these tools are bound up with each other.

Empirical work on relationships between demonstratives and pointing remains somewhat scarce. Several researchers have drawn on data from the "wild" to support the claim that demonstratives and pointing can only be meaningfully studied in relation to each other (e.g. Hindmarsh & Heath, 2000; Eriksson, 2009). However, few quantitative studies have examined the use of these tools in relation to each other, particularly in relatively unconstrained, interactive contexts. An important exception is Bangerter (2004), which quantified the use of both demonstratives and pointing and uncovered a non-obvious relationship between the two. Bangerter's study used a referential communication task in which two participants, seated side-by-side, identified faces from arrays that were set at different distances. People pointed no matter how distant the array, but with an interesting wrinkle. The rates at which participants used demonstratives along with

their pointing gestures *did* change with distance, and in a graded fashion: the farther away the target, the less likely speakers were to call attention to their pointing with *this*, *that*, *here*, or *there*. This pattern suggests that speakers are sensitive to the amibiguity of their gestures: speakers in Bangerter's study used demonstrative-pointing combinations when their gestures were able to pick out referents unambiguously, but refrained from doing so when their pointing gestures were ambiguous.

Another recent quantitative study provides evidence for an additional non-obvious sense in which these tools are related. Piwek, Beun, and Cremers (2008) used a referential communication task in which Dutch participants worked together to construct a model out of Lego blocks. In the task, the participants work in a shared space and used both speech and gesture to coordinate their actions. A striking relationship emerged between the form of the demonstrative chosen and the presence of pointing: speakers weakly favored proximals (like English *this, here*) over distals (like English *that, there*) when pointing, but overwhelmingly favored distals when not pointing. If Bangerter's (2004) study demonstrated a first sense in which pointing and demonstratives are co-organized, Piwek et al.'s (2008) study demonstrated a second sense: the form of the demonstrative chosen appears to be bound up with the presence or absence of pointing.

Piwek et al.'s (2008) finding is especially surprising given prevailing views of the semantic basis of proximal and distal demonstratives. After all, the nature of the contrast between these forms is invariably formulated without any reference to gesture. Rather, as suggested by the terms "proximal" and "distal," linguists have

long analyzed the terms as encoding relative distance from the speaker (e.g. Lyons, 1977). Such a distance-based treatment continues to predominate in linguistics as an analytic default, though there is also clear evidence that in several far-flung languages other parameters (e.g. visibility) may be involved (Diessel, 1999; Dixon, 2003). The intuition that distance matters has now begun to receive empirical support, with several recent studies presenting quantitative evidence that it does indeed shape the choice of demonstrative form (see, e.g., Byron & Stoia, 2005; Maes & de Rooij, 2007; Coventry, Valdés, Castillo, & Guijarro-Fuentes, 2008; Luz & Van Der Sluis, 2008; Bonfiglioli, Finocchiaro, Gesierech, Rositani, & Vescovi, 2009; Stevens & Zhang, 2013; Coventry, Griffiths, & Hamilton, 2014). At the same time, scholars across disciplines have also suggested a number of alternatives to— and refinements of— the standard distance-based treatment. Several have proposed that demonstrative contrasts are motivated by some alternative *non*-spatial parameter of the speech situation, such as *accessibility* (Hanks, 1990; Laury, 1996; Burenhult, 2003; Jarbou, 2010), *deictic force* (Piwek et al., 2008), or *control* (Brovold & Grush, 2012). Other scholars have sought to sharpen up traditional distance-based accounts by suggesting that demonstratives are rooted in the basic perceptual distinction between near (within arm's reach) and far (outside arm's reach) space (Coventry et al., 2008; but see also Kemmerer, 1999). In support of such an account, Coventry and colleagues have presented compelling experimental evidence for the importance of such a basic perceptual distinction in English and Spanish demonstrative reference, while presenting equally compelling evidence that demonstrative use is also shaped by *non*-spatial parameters, such as visibility,

ownership, and familiarity (Coventry et al., 2008; Coventry et al., 2014). Taken together, these recent findings suggest that, while distance is likely a critical part of the story, a satisfactory account of demonstratives must allow for the role of both spatial and non-spatial parameters. More speculatively, these findings also open the door to the possibility that demonstrative reference may be shaped by additional parameters that have yet to be investigated.

One candidate for a yet-to-be-investigated parameter gives gesture pride of place: the form of demonstrative chosen may be partly determined by the ambiguity of the concurrent pointing gesture. More specifically, speakers may prefer a proximal form when their pointing gestures can unambiguously pick out referents, whereas they may prefer a distal form when their pointing gestures are more ambiguous. This possibility is plausible given findings reviewed above that show non-obvious ways in which the use of pointing is bound up with the use of demonstratives, and, in particular, Bangerter's (2004) finding that speakers are sensitive to the ambiguity of their pointing gestures. This "ambiguity of pointing" parameter may have been overlooked to date for a simple reason: the ambiguity of pointing is so often confounded with distance. All other things being equal, as a referent gets further away from the speaker it becomes harder and harder to point to it unambiguously. This is because manual pointing projects a "cone" toward a region of space (Kühnlein & Stegmann, 2003; Kranstedt et al., 2007; van der Sluis & Krahmer, 2007). As the distance from the fingertip increases, the cone widens, encompassing a larger field of possible referents. Importantly, whether or not a potential target is easy to point to depends on more than distance from the speaker. It also depends on

properties of the target such as size (big referents are easier to point to than small referents) and on the type of pointing gesture involved (more precise pointing gestures are better able to point unambiguously). An index finger pointing gesture projects a narrower cone than does a head point; a pointing gesture with a laser pointer projects essentially no cone and is effectively unambiguous at any distance. As described above, Bangerter (2004) found that speakers are sensitive to the ambiguity of their pointing gestures. According to the current hypothesis, this sensitivity may show up, not only in whether or not speakers combine their pointing gestures with a demonstrative, but also in which *form* of demonstrative they choose when they do. If so, this would constitute a third non-obvious sense in which demonstratives and pointing are co-organized.

The present study used a referential communication task to examine the nature of the relationship between demonstratives and pointing in English. In particular, the study examines the evidence for three possible principles characterizing how these two indicating tools are co-organized in spontaneous acts of reference. First, it examines the prior finding that speakers use demonstrative-pointing combinations less often when their gestures are ambiguous. Second, it considers the finding, reported in Dutch but not yet examined in English, that speakers' choice of a distal or proximal demonstrative hinges on whether or not they are concurrently pointing, with proximals associated with the presence of pointing and distals associated with the absence of pointing. Third, it tests the novel hypothesis that a speaker's choice of demonstrative form will depend on the ambiguity of the concurrent pointing gesture: speakers will use fewer proximal

demonstratives when their gestures are more ambiguous. Of course, in order to test this third hypothesized principle, the ambiguity of pointing needs to be disentangled from distance. To this end, half of the participants in the present study were given a laser pointer so that they could point to targets unambiguously at any distance, while the other half were left to point with their hand. Pointing by hand is more ambiguous than laser pointing in general and, unlike laser pointing, becomes more ambiguous with increasing distance. Thus in addition to considering evidence for three principles by which pointing and demonstratives are co-organized, the present study investigates the possibility that a novel, non-spatial parameter shapes the choice between proximal and distal demonstratives.

Methods

Overview of the task

The present study adapted a referential communication paradigm originally used by Bangerter (2004) to investigate verbal and non-verbal strategies for coordinating attention in interaction. One key difference, however, between the present study and Bangerter's original study is the use of novel creatures— or, Fribbles— in place of human faces. A distinct advantage of Fribbles is that they are roughly comparable in terms of novelty, complexity, and salience. Since salience has been previously implicated in demonstrative reference (Clark, Schreuder, & Buttrick, 1983), it was desireable to equalize it across targets to the extent possible. Another important advantage of Fribbles over human faces is that they are less readily

codable in familiar terms (e.g. “The blond guy with the beard”) and thus may invite the use of a demonstrative strategy.

In the current task, pairs of participants worked together, using both speech and gesture, to identify novel creatures from arrays that were projected on a screen in front of them. Both distance and ambiguity of pointing were manipulated between participants to investigate their effects on demonstrative usage. Distance was manipulated by having the dyads sit at two different distances from the arrays, creating a near condition and a far condition[1]. Ambiguity of pointing was manipulated by having participants point by hand (more ambiguous) or with a laser pointer (less ambiguous). In contrast to the index finger, which projects a growing cone of possible referents, a laser pointer projects a narrow vector and thus allows unambiguous pointing at any distance. As a result, overall targets were more readily pointed to in the two laser-pointing conditions than in the two hand-pointing conditions. These manipulations yielded a 2x2 between-subject design with four conditions: near-hand, far-hand, near-laser, and far-laser.

Participants

Eighty-six UCSD students participated in dyads, either voluntarily or in exchange for course credit. 11 dyads (22 participants) were replaced for different reasons. One dyad was replaced for violating the instructions. Another dyad was

[1] Note that, in both the near and far conditions, the creatures are out of arm’s reach. The distance manipulation thus does not fall along the lines of the distinction between peripersonal space (within arm’s reach) and extrapersonal space (out of arm’s reach), as it has in other studies of demonstrative reference (e.g. Coventry et al., 2008).

replaced for correctly guessing our interest in the word *that*. Two dyads were replaced because they did not give permission to view the videotapes. Finally, seven dyads in the laser-pointing conditions were replaced because they completed the task using a gesture-only strategy. The key criterion for exclusion of these pairs was whether the finder produced six or fewer demonstratives along with laser pointing over the course of the experiment. Because these pairs did not produce enough of the behaviors of interest, their data was uninformative.

The final data set included data from 64 participants (33 male; *M* age= 20.7 years old), forming the planned 32 dyads, eight in each of the four conditions. Nine dyads were male-male, eight were female-female, and 15 were mixed. The majority of participants were monolingual native speakers of English. Eighteen participants were either bilingual from birth (10 participants) or had learned English later in childhood (8 participants). In these bilingual participants, second language experience was diverse, including languages such as Spanish, Farsi, Vietnamese, Korean, Mandarin, and Hungarian. All participants who had learned English later in childhood reported being exposed to the language by the age of 6 and, further, reported English as their dominant or co-dominant language at the time of the experiment.

Dyads were assigned to one of the four conditions based on a random order determined at the outset of the experiment. Dyads needing to be replaced were replaced at the end of the random order.

Materials

Stimuli consisted of novel creature-like objects (images courtesy of Michael J. Tarr, Carnegie Mellon University, http://tarrlab.cnbc.cmu.edu/). Four different types of novel creatures were used: blue Fribbles, multicolor Fribbles, Greebles (pink), and Yadgits (multicolor). The two types of Fribbles used are qualitatively very similar, as though belonging to the same "species" but differing in coloration; the Greebles and Yadgits are qualitatively distinct, as though belonging to completely different "species" of creatures. The novel creatures— for simplicity, in in the present report referred to as "Fribbles" or "creatures"— were arrayed on Keynote slides in a cloud-like fashion, such that they did not form easily describable patterns**,** following Bangerter (2004). Each stimulus slide consisted of 12 creatures, all of the same type (all blue Fribbles, all Greebles, and so on). Each dyad viewed 9 slides in all. They started with one practice slide (consisting of multi-color Fribbles), which was then followed by— in a different order for each dyad— two slides of blue Fribbles, two slides of multi-color Fribbles, two slides of Greebles, and two slides of Yadgits. All stimulus slides consisted of only the 12 creatures on a plain white background (see Figure 1).

Participants sat in folding chairs in front of a projection screen. All instructions and stimuli were embedded in a Keynote slideshow and projected onto the screen with a Powerlite Home Cinema 6100 Projector. The dimensions of the projection were 56 inches wide by 42 inches high.

The task involved two roles, finder and recorder. Finders were given a stack

of nine laminated 8.5 x 11 pages. Each page corresponded to a stimulus slide and included small pictures of the 12 Fribbles pseudo-randomly ordered in two columns along with their "names." Fribble names were always a single digit number coupled with a single capital letter, e.g. "8A". The finders' pages were placed on a music stand, which was positioned off to their left to allow unobstructed gesturing during the task. Small visual barriers were attached to the music stand so that recorders could not see the finders' pages. Recorders were given corresponding pages, one for each slide, which were three-hole punched, and placed in a binder. The recorders' answer pages had only the pictures of the Fribbles and blank lines on which to write in the creatures' names during the task. As a precaution, the positions of the small Fribble pictures were shuffled so as not to appear in the same places on the finder's and recorder's pages. To the upper right-hand corner of each one of the recorder's pages was attached a numbered list of eight Fribble names, which specified the order in which the Fribbles were to be identified for each slide.

Procedure

After giving consent to participate and to be videotaped, participants entered the experiment room and were invited to take a seat in either of the two chairs. This determined their roles in the experiment, with finders always on the left and recorders always on the right when facing the screen. Exceptions to this self-assignment procedure were as follows. All left-handed participants were guided to the recorder's seat, so that finders would be uniformly right-handed. Handedness was covertly monitored by the experimenter at the time consent forms were signed.

Further, participants who were known— or guessed— to be not native speakers of English were guided to the recorder's seat in a similar way, so that finders would be uniformly native speakers of English. Experimenter intuitions about whether or not a participant was a native speaker of English proved correct in every case, as revealed by a post-study language questionnaire.

Instructions were given on a Keynote presentation displayed on the projection screen. It was explained that participants would be working together at the Fribble family reunion to separate "real" Fribbles from "lookalikes" who were attempting to crash the party. Each slide consisted of eight real Fribbles that needed to be identified, as well as four lookalikes, which served as distractors. A name-list attached to each of the recorder's binder pages listed the names of the eight real Fribbles in the order in which they were to be identified. At the start of a trial (one slide), the recorder was instructed to read aloud the name of the first Fribble on the name list. The finder would then identify the Fribble for the recorder on the projection screen. After the recorder had successfully recorded the name of the first real Fribble on the answer page, he or she would announce the name of the second real Fribble on the list. Across participants, the eight target Fribbles were the same for each slide, but were identified in a different, randomly generated order for each of the 32 dyads.

Participants were asked to stay seated, and were invited to interact in any way they would like to accomplish the task. Though gesture was not explicitly mentioned, the instruction slides included a photograph of model participants pointing. For the two hand-pointing conditions, the model finder was shown

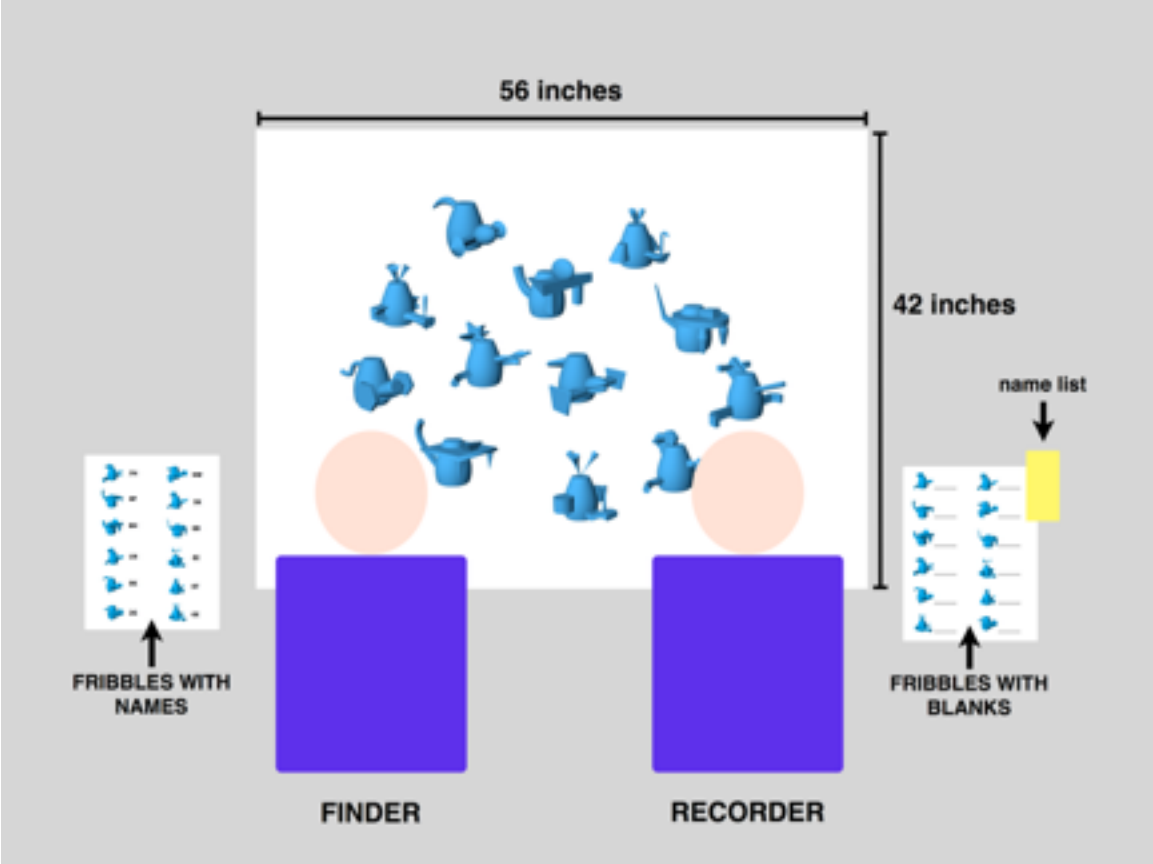

Figure 1: The set-up of the referential communication task, which was adapted from Bangerter (2004). The projection screen depicts an example slide (trial) consisting of one of the types of novel creatures used in the study.

pointing to the slide with her right hand, index finger extended; for the two laser-pointing conditions, the model finder in the photograph was shown pointing the laser at the slide. The text accompanying these photographs did not draw attention in any way to the strategy depicted, only to the fact that the task involves distinct roles. This photograph was included for two reasons. First, in pilot studies, many participants in the hand-pointing conditions did not point, on the assumption—which they made explicit in debriefing— that pointing was not allowed. Second, the mere availability of the laser-pointer constitutes a strong suggestion about how the task should be done, and in order to make the conditions more comparable we

wanted to include a covert suggestion that pointing was a useful strategy in all conditions. That the suggestion was subtle is evidenced by the fact that more than once participants still asked during the practice round whether or not pointing was permitted. Instructions in the four conditions were identical except for the manipulation of this photograph. After the instructions were given, a practice trial was carried out, after which the experimenter left the room and the dyad proceeded through the eight stimulus slides, identifying a total of 64 target Fribbles in all (not including the 8 practice targets).

In the near conditions, participants' chairs were placed facing the projection screen, such that the front of the chair was 47 inches from the plane of the screen (out of arm's reach); in the far conditions, the front of the chair was 77 inches from the plane of the screen. For laser-pointing dyads, the pointer was placed on the finder's stand before the start of the experiment.

Data collection and analysis

Sessions were video-recorded with a Canon HV20 HD digital camera. Tapes were digitized in Final Cut Pro, rendered into clips of separate slides (8 clips per dyad), and analyzed using ELAN video annotation software (available online: https://tla.mpi.nl/tools/tla-tools/elan/)

Each use of a demonstrative— *this, that, here, there, these, those*— by either participant was annotated, along with certain features of the context of use. Most importantly, it was noted whether or not the speaker was pointing concurrently (hereafter +pointing, or -pointing). Also noted was whether the demonstrative was

used in reference to a Fribble on the projection, a Fribble not on the projection screen, or to something besides a Fribble (e.g. the pen the recorder was using). Only demonstratives used in reference to Fribbles were analyzed. Uses of *that* as a complementizer (e.g. "The one **that's** on the right"), the *there* of existence (e.g. "**There's** a blue cone on its head"), and phrasal manner demonstratives (e.g. "It's shaped **like this***")* were not included in the analysis. Pointing in the hand-pointing conditions was operationalized as arm and finger extension towards the projection screen. Pointing in the laser-pointing conditions was operationalized as visible red light from the pointer directed at the screen. For the hand-pointing dyads, reliability was assessed by having a second coder judge the presence or absence of pointing during demonstrative references for two trials per dyad (i.e., 25% of the total trials). Agreement was almost perfect (94.3%; Cohen's Kappa= .887). The judgments of the primary coder were retained for the purposes of quantitative analysis.

Results

Qualitative description of the data

The task was carried out in the same basic way across the four conditions. Dyads identified the target Fribbles one at a time according to roughly the following steps. First, the recorder would announce the name of the Fribble (e.g. "The next one is 5W"). Finders would often confirm the name by repeating it aloud. They would then proceed to locate the correct Fribble on their own answer page on the music stand, then find it visually on the projection screen, and, finally, begin to identify the Fribble for the recorder. The launch of the identification sequence would often

Figure 2: A sequence from the near-hand condition that illustrates the use of different strategies for identifying targets on the projection screen.

include *it* (e.g. "**It** has the star nose"), *this* (e.g. "**This** one has the star nose"), *that* (e.g. "**That** one has the star nose"), or a repetition of the Fribble's name (e.g. "**5W** is the one with the star nose"). Which demonstratives were used at the start of identification sequences differed from finder to finder, but not in a systematic way across conditions. Such demonstratives referred to the Fribble as part of a sequence of Fribbles that had to be identified. As the identification process proceeded, the finder would then coordinate the sequence referent—i.e. the current targeted Fribble— with one of the 12 visible creatures on the projection screen. Following the successful identification of the target on the screen, recorders then needed to find the corresponding Fribble on their own answer pages in order to write in the name in the blank. Recorders would often conclude a target identification sequence by re-coordinating the projection referent with the sequence referent, either aloud

or quietly to themselves (e.g. “Okay, so that one’s 5W”).

Strategies for identifying the projection referent differed systematically in the different conditions. In the near-hand condition, finders used demonstratives, deictic gestures, location descriptions, feature descriptions, and iconic gestures to identify Fribbles on the projection screen, and they often used these resources in combination. This mix of strategies is evident in the following example (depicted in Figure 2):

Example 1: Near-hand condition

Recorder: Um, 3Z.
Finder: 3Z. Alright, it’s the one right next to the chubbier one with the uh- uh with the goofier mustache. It’s like in the second row up.
Recorder: That one? *[pen pointing]*
Finder: Yeah.
Recorder: Or that one? *[pen pointing]*
Finder: No, that one. *[hand pointing]*
Recorder: That one. *[pen pointing]*

Finders did not use demonstratives on every trial, and there was considerable inter-participant variation in how often finders used a demonstrative as part of their referring expressions (see quantitative analyses below).

In the far-hand condition, the rate of demonstrative-pointing combinations dropped off considerably — indeed, several finders rarely used this strategy. Most relied instead on a combination of feature descriptions, location descriptions, and iconic gestures, as evident in the following example:

Example 2: Far-hand condition

Recorder: 3Q.
Finder: 3Q. The gun one we just did… up to the left diagonally. It’s got

	the square coming off the back with the kickstand and the two cylinders on the side going forward holding like a ball.
Recorder:	The square one. Okay. So- so- from the one we did…
Finder:	Mm-hm.
Recorder:	The- the to the left- it's to the top left.
Finder:	Yeah, yeah.
Recorder:	Okay.
Finder:	It kinda looks like a dragon, picking up a dragon or something.
Recorder:	That's 3Q.

In both of the hand-pointing conditions, participants occasionally attempted the strategy of carving the array into numbered rows and columns. This strategy met with mixed success, however, because of designed irregularities in the arrays. In every case participants also found it useful to supplement with the strategies just described above.

In the laser-pointing conditions, finders used almost exclusively laser pointing accompanied by demonstrative reference and in most cases were very efficient, as in the following example:

Example 3: Far-laser condition

Recorder:	Um, 2D.
Finder:	And that's this one. *[laser pointing]*
Recorder:	Cool.

Finders also occasionally provided minimal feature descriptions in addition to pointing out the target.

Recorders participated to different degrees in the identification of the Fribbles. Some finders adopted a strategy in which they first described the Fribble in detail based on the small image on their answer sheet before even looking up, thereby effectively recruiting the recorder to help locate the target on the projection screen. In other cases Finders would only appeal to the Recorder for help when

having difficulty, as in the following example:

Example 4: Far-laser condition

Recorder: 3M.
Finder: 3M. Uh, kind of could be this one. *[laser pointing]*
But the things look kind of fatter.
Recorder: Oh- oh is it straight?
Finder: Yeah.
Recorder: It's- all the way down. Is it that one? *[hand pointing]*
Or no?
Finder: This one? *[laser pointing]*
Recorder: Yeah.
Finder: No. Cause the things are on the bottom.
Recorder: Oh, okay.
Finder: Is it-?
Recorder: That one. *[hand pointing]*
Finder: This one yeah. *[laser pointing]*

As is evident in this example, recorders also sometimes used demonstratives and pointing gestures— sometimes with their pens— both to suggest and to confirm targets. But, again, recorder involvement varied widely across dyads.

Quantitative results

The task elicited a large number of demonstrative references (2463), with the majority (1888, or 77%) produced by finders. Quantitative analyses focused on those demonstratives that were singular (including *this*, *that*, *here*, and *there* but eliminating *these* and *those*), produced as part of reference to a Fribble (eliminating uses such as "**This** is getting difficult"), and produced by the finder. Recorders' references were not analyzed for two reasons: 1) as mentioned above, many recorders were largely silent, while others participated actively, resulting in wide variability across dyads; 2) recorders were not furnished with laser-pointers in the

two laser-pointing conditions, making one of the key manipulations of the design specific to finders. The remaining 1545 demonstrative references were analyzed for evidence of the three principles of co-organization described above (see Table 1).

Demonstrative-pointing combinations and pointing ambiguity

A first set of analyses considered whether finders used demonstrative-pointing combinations at different rates depending on the ambiguity of pointing. Finders used a higher rate of demonstratives (+pointing) per slide in the near-hand condition than in the far-hand condition (near-hand: M= 3.13, SD= 2.04; far-hand: M= 1.16, SD= 1.00); and they used a still higher rate in the two laser-pointing conditions (near-laser: M= 6.83, SD= 2.80; far-laser: M= 7.42, SD= 1.96) (see Figure 3). These mean rates were analyzed using a two-way independent samples ANOVA with distance (near, far) and pointing type (hand, laser) as between-subjects factors. The analysis revealed a main effect of pointing type (F(1,31)= 47.17, p< .001), but no main effect of distance (F(1,31)= 0.89, p= .35) and a trending interaction effect (F(1,31)= 3.14, p= .09). This observed main effect of pointing type provides a conceptual replication of Bangerter's (2004) finding that speakers use demonstrative-pointing combinations less frequently when their pointing gestures are ambiguous. Further, the overall pattern is consistent with the interpretation that ambiguity of pointing— not distance *per se*— is what drives the differences in demonstrative (+pointing) rates across conditions.

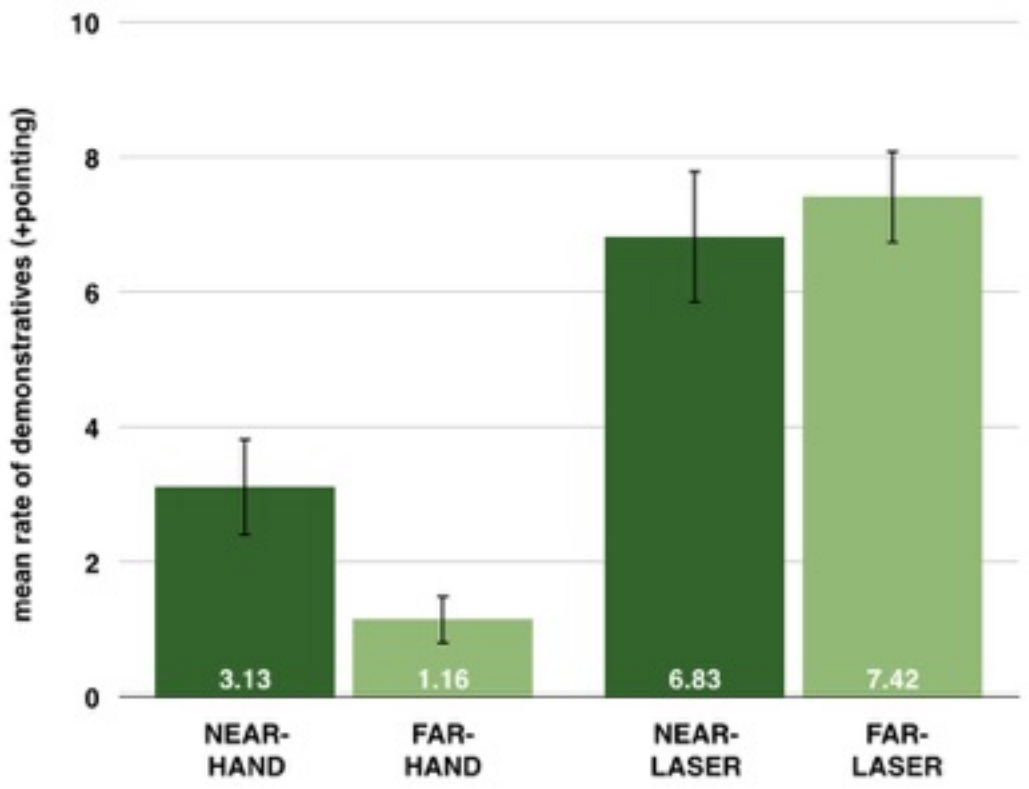

Figure 3. Mean rates at which finders across the four conditions used demonstratives accompanied by pointing gestures. Error bars represent standard errors.

The above results provide evidence of coarse-grained differences across the four conditions in the rates at which demonstratives-pointing combinations were used. A further question, however, is whether use of this strategy was also modulated by fine-grained distance contrasts. Since finders are seated on the left side of the projection screen (see Figure 1), they were not equally distant from each target, with some targets farther toward the right side of the screen or the top of the screen. It is thus also possible to investigate whether they keyed on distance target-by-target, referring to closer targets differently from the farther targets. This possibility was examined *post hoc* by, for each of the 64 target creatures,

determining the distance along the projection plane (in inches) from an idealized reference point. The idealized reference point was set so as to approximate the height and horizontal position of the average finder's nose. Distances from this reference point ranged from 2.2 inches along the plane of the projection screen for the nearest target creature to 32.0 inches for the farthest target creature. Then for each of the 64 targets, it was determined whether or not the finder used a demonstrative (+pointing) to refer it during the course of the trial[2]. This yields, for each target, the total number of finders out of a possible 8 per condition who referred to it with a demonstrative (+pointing). Next, the correlation between each creature's distance (from the idealized reference point, along the projection plane) and the number of finders who referred to demonstratively (+pointing) was calculated. In the near-hand condition, this correlation was highly significant (r= -.54, r^2= .29; $t(62)$= -5, two-tailed p< .001), as it was in the far-hand condition (r= -.43, r^2= .19; $t(62)$= -3.8, two-tailed p< .001). In the laser-pointing conditions, however, there were no such correlations (near-laser: r= .10, r^2= .01; $t(62)$= 0.79, two-tailed p= .43; far-laser: r= .026, r^2= .001; $t(62)$= 0.2, two-tailed p= .84). Participants in the hand-pointing conditions were thus less likely to use demonstrative-pointing combinations for targets farther away along the projection plane, as such targets were harder to point to unambiguously; but participants in the laser-pointing conditions used demonstrative-pointing combinations regardless of a creature's

[2] This analysis is slightly noisy for one reason. The video recording does not allow us to see *where* on the screen speakers are pointing, only *whether* they are pointing. It is likely that finders occasionally made mistakes, pointing to the wrong creature. However, overall, participants did not consider the task particularly challenging and most dyads carried it out with minimal back-tracking to previous targets, suggesting such mistakes were probably rare.

location on the screen, as pointing was always unambiguous. This result provides another, more fine-grained conceptual replication of Bangerter's (2004) finding that the use of demonstratives (+pointing) hinges critically on the ambiguity of pointing.

Demonstrative form and presence of pointing

A second set of analyses considered the evidence for the second principle of co-organization: that speakers use different demonstratives forms when pointing than when not. Combining all conditions, in their demonstrative references to the creatures, finders preferred proximals (*this* and *here*) over distals (*that* and *there*) when pointing (825/1186 proximals, or 70% proximals and 30% distals) and distals over proximals when not pointing (153/359 proximals, or 43% proximals and 57% distals) (χ^2= 86.12, *df*=1, *p*< .0001) (see Figure 4). In terms of rates, finders used proximals (+pointing) an average of 3.22 times (*SD*= 2.97) per trial and (-pointing) 0.6 times per trial (*SD*= 1.25); they used distals (+pointing) an average of 1.4 times per trial (*SD*= 1.69) and (-pointing) 0.8 times (*SD*= 0.99). These means were analyzed using a two-way repeated measures ANOVA, with type of demonstrative and presence of pointing as within-subjects factors. The analysis revealed a main effect of type of demonstrative (*F*(1,31)= 5.52, *p*= .025), a main effect of presence of pointing (*F*(1,31)= 23.41, *p*= < .001), and an interaction between the two (*F*(1,31)= 8.84, *p*= .006). Finders produced a higher rate of proximal demonstratives overall, produced a higher rate of demonstratives (+pointing) than demonstratives (-pointing), and used different rates of proximal and distal demonstratives depending on whether or not they were pointing.

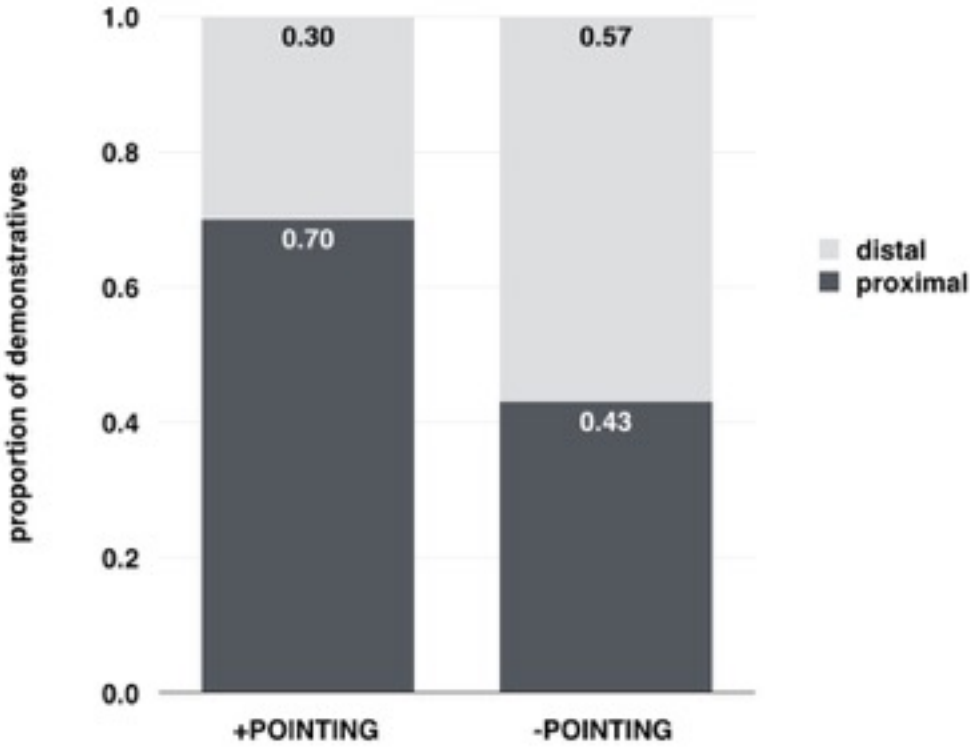

Figure 4. Overall proportion of proximal (*this, here*) and distal (*that, there*) demonstratives, broken down according to whether the speaker was concurrently pointing.

Demonstrative form and ambiguity of pointing

A third series of analyses considered whether finders across conditions differed in their choice of proximal or distal demonstrative forms. Overall, in the near-hand condition, finders used proximals on 131 out of 200 demonstratives references (66%); in the far-hand condition 32/74 (43%); in the near-laser 348/437 (80%); and in the far-laser 314/475 (66%). Next, the mean proportions of proximal demonstratives used by finders in each of the four conditions were compared. (Note that one finder from the far-hand condition did not produce any demonstratives (+ pointing).) Finders used a higher mean proportion of proximal

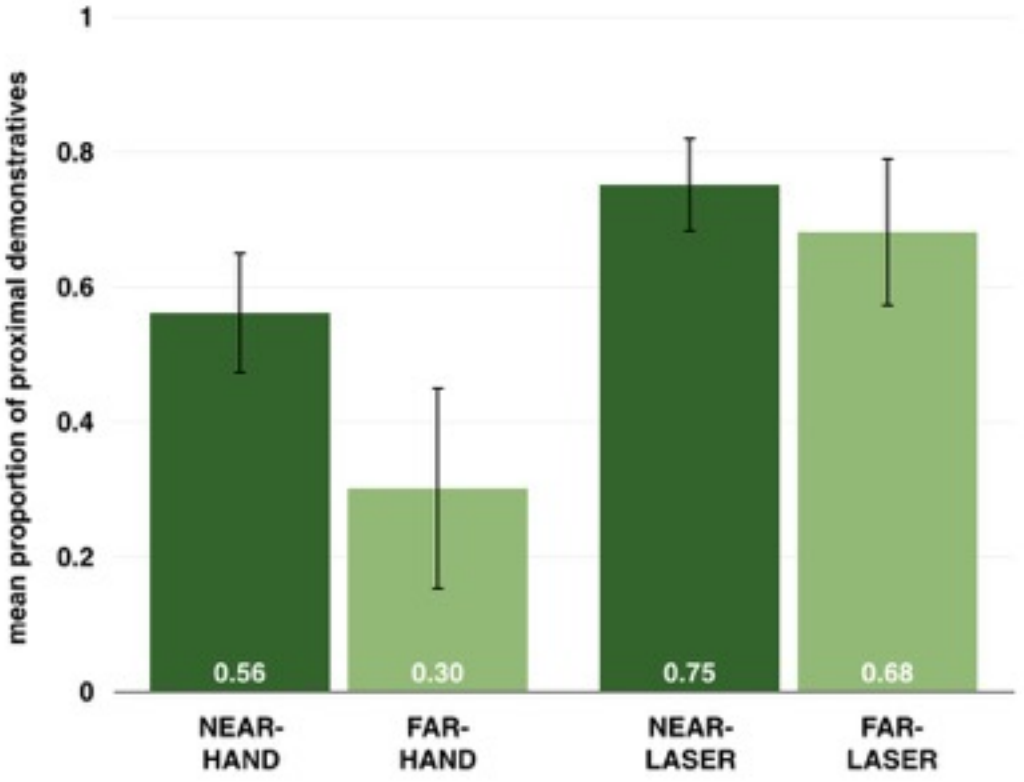

Figure 5: Mean proportions of proximal demonstratives (+pointing) used by speakers in the different conditions. Error bars represent standard errors.

demonstratives in the near-hand condition (*M*= .56, *Mdn*= .58, *SD*= .26) than in the far-hand condition (*M*= .30, *Mdn*= .17, *SD*= .39). In the laser-pointing conditions, Finders used a higher mean proportions of proximals than in the hand conditions (near: *M*= .75; *Mdn*= .76, *SD*= .20; far: *M*= .68; *Mdn*= .81, *SD*= .32) (see Figure 5). These mean proportions were first analyzed using a two-way independent samples ANOVA with distance (near, far) and pointing type (hand, laser) as between-subjects factors. The analysis revealed a significant main effect of pointing type ($F(1,30)= 6.78$, $p= .015$), but no main effect of distance ($F(1,30)= 2.07$, p= .16) and no

interaction effect ($F(1,30)= 1.15$, $p= .29$)[3]. The robustness of this observed main effect was further investigated using a non-parametric Mann-Whitney U test, grouping the hand-pointing and laser-pointing conditions together, and was found to be significant ($U= 60$, n1= 16, n2=15, $p= .009$).

Individual variability

An unexpected finding to emerge from the study was the high level of variability across speakers, both in the rates of demonstratives (+pointing) used and in the choice of forms used. In the near-hand condition, finders used between 1.38 and 7.63 demonstratives (+pointing) per trial; in the far-hand condition, finders used between 0.00 and 2.63 per slide. In the laser-pointing conditions, finders also varied widely in their rates of demonstrative (+pointing) usage (near-laser: 1.75 to 11.00; far-laser: 3.13 to 9.38). Perhaps more strikingly, proportions of proximal usage across different speakers were also highly variable (near-hand: .07 to .89; far-hand: .00 to .90; near-laser: .43 to 1.00; far-laser: .04 to 1.00). Such variability complicates statistical analysis, but also provides a crucial datum about the nature of demonstrative use, as discussed further below.

Discussion

The present study examined patterns in the spontaneous use of demonstratives and pointing gestures. It has long been taken for granted that there

[3] The same analysis performed by first arcsin-transforming the proportions yields the same pattern of significance: a main effect of pointing type ($F(1,30)= 7.68$, p= .01), but no main effect of distance ($F(1,30)= 2.63$, $p= .12$) and no interaction effect ($F(1,30)= 1.32$, $p= .26$).

is a privileged relationship between these two communicative tools, an idea probably based on informal observations that the two frequently co-occur and both function to indicate. These observations may be accurate as far as they go, but they do not go far enough. Speakers organize their use of these powerful tools in relation to each other— in a word, they *co-organize* them. The present study provides evidence for three principles that characterize this co-organization, two that had been supported by previous findings and a third based on a novel hypothesis about the relation between demonstrative contrasts and pointing ambiguity. Importantly, these principles are not mutually exclusive; they are interrelated ways of characterizing how speakers design their spontaneous acts of reference.

According to the first principle of co-organization investigated here, the use of demonstratives hinges in a particular way on pointing. Speakers use demonstratives without pointing, and point without using demonstratives, but the two tools are only joined together under certain conditions. Evidence for this was first presented in Bangerter (2004), in which it was found that speakers (who were pointing by hand) only used demonstrative-pointing combinations when targets were relatively close; their pointing gestures were thus able to single them out unambiguously. The present study conceptually replicated this finding, at both coarse-grained and fine-grained levels. On the coarse-grained level, finders used demonstratives (+pointing) more in the near-hand condition than in the far-hand condition and still more in the two laser-pointing conditions. On the fine-grained level, in both hand-pointing conditions there was a negative correlation between how far away a Fribble was and the rates at which finders used demonstratives

(+pointing) to refer to it. The present study also provided additional evidence for the general nature of this relationship. In addition to manipulating distance, one important determinant of pointing ambiguity, the present study also manipulated another determinant: the precision of the pointing gesture involved. When a speaker uses the hand to point, the farther away the referent the harder it is to point to; when a speaker uses a laser-pointer, however, referents are equally easy to point to at any distance. Speakers using laser-pointers should thus feel licensed to use demonstrative-pointing combinations at any distance, and, indeed, this is what the present study found. Participants used demonstratives (+pointing) at comparable rates in the two laser-pointing conditions; and, in contrast to the two hand-pointing conditions, speakers in the laser-pointing conditions where no more likely to use demonstratives (+pointing) for near than for far fribbles. Thus, in addition to marshaling further support for a first principle characterizing the co-organization of demonstratives and pointing, the present study also further demonstrated the generality of pointing ambiguity as an important parameter shaping reference strategies.

A second principle of co-organization corroborated in the present study is that the form of demonstrative a speaker chooses— proximal or distal— hinges on the presence of pointing. Specifically, speakers used a higher proportion of proximals when pointing than when not. This finding corroborates a similar finding reported by Piwek et al. (2008) for Dutch demonstratives. In their analysis of 93 initial references to Lego blocks in a controlled referential communication task, they found that speakers used proximals in 26/50 (52%) cases when pointing but only in

1/43 (2%) cases when *not* pointing. The present findings show the same general pattern, but in a different task setting, in English instead of Dutch, and across all references rather than in initial references only. Further work is needed to explore the generality of this pattern and to puzzle out its implications. Are there contexts in which such a pattern would not hold? If so, why? What, if anything, does this association between proximals and pointing suggest about the *meaning* of demonstrative contrasts? It is at least possible that this association contains a clue to the semantic basis of demonstrative contrasts (c.f. Piwek et al., 2008), a possibility further explored below.

The third principle of co-organization explored here is that the form of the demonstrative a speaker chooses— proximal or distal—hinges on the ambiguity of pointing. When pointing by hand, speakers used a numerically higher proportion of proximals for near than for far arrays. Crucially, however, at both distances speakers used a higher proportion of proximal demonstratives when pointing with the laser. Ambiguity of the pointing gesture thus shaped a speaker's choice of demonstrative form over and above sheer distance. It must be cautioned that, given the present study is the first demonstration of such a relationship and involved a relatively low-powered design, this pattern requires both replication and generalization. One way to generalize the finding would be to show that other ways of manipulating the ambiguity of pointing would show similar effects. After all, the ambiguity of pointing is multiply determined: it is affected by properties of pointed-to targets— how far they are, how large, how many competitor targets are nearby— and by properties of the pointing act itself— whether it projects a wide cone, a narrow cone, or

effectively no cone. Here only one of these factors (i.e. the type of pointing gesture used) was manipulated while the other determinants were held constant.

Caveats aside, the interest of the above finding goes beyond what it tells us about the relationship between demonstratives and pointing *per se*. It also informs our understanding of the nature of the contrast between proximal and distal forms, a topic of long-standing cross-disciplinary debate. But where exactly does this finding fit? One possibility is to assimilate the finding into an emerging account that emphasizes the choice of demonstrative form is driven by multiple contextual parameters. On this account, pointing ambiguity would take up a place alongside the classic distance parameter as well as more recently studied parameters, such as visibility, ownership, familiarity, and shared space that have been found to modulate demonstrative use and comprehension in English (Coventry et al., 2008; Coventry et al., 2014; Peeters et al., 2015). A key challenge for such accounts is understanding how these different parameters are related to each other— for example, whether they all represent extensions from a basic distance parameter based on the peripersonal/ extrapersonal distinction— and how they are weighted relative to each other.

Another possibility is to view the present findings in light of more radical revisionist accounts of the nature of demonstratives. According to such accounts (e.g. Hanks, 1990; 2005; Brovold & Grush, 2012), a single, non-spatial "super-parameter" motivates the distance parameter as well as all the observed non-spatial parameters. One recent proposal for such a super-parameter centers on the notion of deictic *force* (see, especially, Piwek et al., 2008; also Wu, 2004), a construct readily

relatable to the present findings on pointing ambiguity. The core idea of the force account is that demonstratives are tools that are primarily used, not just to refer, but to re-orient listener attention. If this is their primary function, then the contrast between proximal and distal demonstratives forms may be seen instead as one between two contrasting ways of re-orienting attention: re-orientation with high intensity and and re-orientation with neutral intensity. On this account, the relationship between proximal and distal is a privative one (c.f. Enfield, 2003; Levinson, 2004), with proximal terms used for intense indicating, and distal terms are used for neutral indicating.

What does it mean for *that/there* to be neutral force tools, and why might a speaker choose them over the high-force tools *this/here*? If, for instance, the audience is already attending to the referent, a high-force term might be over-kill. The high-force tool may also be inappropriate if the hearer is unlikely to successfully locate the referent— in other words, if speaker is not confident in being able to re-orient listener attention. In the present study, finders may have chosen high-force forms (i.e. *this* and *here*) when attention re-orientation was assured because pointing was unambiguous, but neutral-force forms (i.e. *that* and *there*) when attention re-orientation was not assured because pointing was ambiguous. The idea that demonstratives are used in a way that both reflects attentional states and functions to alter them may be a relatively novel proposal as applied to English, but it is one that has been suggested and supported empirically in other languages (Burenhult, 2003; Küntay & Özyürek, 2006). Much work remains, however, to sharpen up the predictions made by the force account and put them to the test.

An appealing aspect of the force account is that, compared to many other accounts (though see also Hanks, 2005), it would seem to allow more room for subjectivity in demonstrative use. Degree of force is a choice, not an objective property of context. As described above, an unexpected finding to come out of the present study is that demonstrative use is highly variable across speakers, even in a constrained task in a well-controlled physical setting[4]. Part of this variability may be due to the fact that the particular type of demonstrative reference examined here— namely, reference to clusters of objects in extrapersonal space— is relatively under-determined. Such variability is likely not uniformly high in all contexts, and a priority for future work might be to identify contexts in which demonstrative use is highly consistent across speakers, as well as other contexts in which it is highly variable. Still, the level of variability observed here strongly suggests that any account of demonstratives based solely on objective physical parameters of the context (e.g. sheer distance) will prove inadequate.

Demonstratives have long been of special interest to philosophers, linguists, discourse analysts, and anthropologists; only in recent years have they have begun to enjoy a revival of interest among cognitive scientists. The reasons for this revival should be clear enough. Demonstratives sit at the intersection of several research areas— including language production and processing, joint action, and gesture— and offer a paradigmatic case of everyday reference for investigation across cultures, across development, and across contexts. Demonstratives and pointing are often regarded as primordial and therefore simple. But, as the present study and other

[4] Coventry et al. (2008) also report high variability across speakers (see data tables, pgs. 893-4) in an even more tightly constrained task.

recent work has begun to reveal, their use involves unexpected complexities, making them all the more tantalizing as an interdisciplinary puzzle. Future work on this puzzle must take more seriously the relationship between demonstratives and pointing. Demonstratives are not merely the verbal form of pointing; and pointing is not merely the gestural form of demonstratives. Nor do they merely co-occur. Rather, in the basic setting of co-present interaction, speakers organize these two tools in tight coordination with each other.

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Table 1. Counts of demonstratives produced by each participant

		+pointing				-pointing				
		proximal		distal		**proximal**		**distal**		**TOTAL**
CONDITION	**#**	*this*	*here*	*that*	*there*	*this*	*here*	*that*	*there*	
near-hand	1	28	22	9	2	7	0	5	0	**73**
near-hand	2	26	5	3	1	1	0	33	0	**69**
near-hand	3	6	6	10	0	40	0	2	0	**64**
near-hand	4	5	0	8	0	29	1	2	0	**45**
near-hand	5	6	1	4	0	6	0	22	0	**39**
near-hand	6	8	4	8	2	0	0	3	1	**26**
near-hand	7	5	8	6	2	0	0	3	0	**24**
near-hand	8	0	1	5	9	0	0	8	0	**23**
far-hand	9	6	13	0	2	12	12	5	1	**51**
far-hand	10	0	0	15	5	0	0	4	0	**24**
far-hand	11	0	1	4	1	0	0	13	0	**19**
far-hand	12	8	3	3	0	0	0	2	0	**16**
far-hand	13	0	0	2	1	0	0	9	0	**12**
far-hand	14	0	0	3	3	0	0	4	1	**11**
far-hand	15	0	1	2	1	0	0	4	0	**8**
far-hand	16	0	0	0	0	0	0	1	0	**1**
near-laser	17	69	0	18	1	19	0	26	0	**133**
near-laser	18	37	8	20	0	0	0	6	0	**71**
near-laser	19	55	2	7	0	0	0	1	1	**66**
near-laser	20	24	1	9	0	17	0	14	0	**65**

near-laser	21	12	52	0	0	0	0	0	0	**64**
near-laser	22	39	17	2	0	1	0	2	0	**61**
near-laser	23	21	5	13	11	5	0	2	0	**57**
near-laser	24	4	2	7	1	1	0	5	0	**20**
far-laser	25	22	6	37	3	1	0	15	1	**85**
far-laser	26	72	0	3	0	0	0	0	0	**75**
far-laser	27	4	0	30	37	0	0	2	1	**74**
far-laser	28	51	1	9	2	0	0	1	1	**65**
far-laser	29	37	20	0	4	1	0	2	0	**64**
far-laser	30	32	2	22	5	0	0	0	0	**61**
far-laser	31	47	0	4	0	0	0	0	0	**51**
far-laser	32	13	7	4	1	0	0	2	1	**28**
TOTALS		**637**	**188**	**267**	**94**	**140**	**13**	**198**	**8**	**1545**

Note: Within each condition, participants are ordered in descending order by the total number of demonstrative references they produced.