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Brief article

Language within your reach: Near–far perceptual space and spatial demonstratives

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ABSTRACT

Spatial demonstratives (*this/that*) play a crucial role when indicating object locations using language. However, the relationship between the use of these proximal and distal linguistic descriptors and the near (peri-personal) versus far (extra-personal) perceptual space distinction is a source of controversy [Kemmerer, D. (1999). "Near" and "far" in language and perception. *Cognition 73*, 35–63], and has been hitherto under investigated. Two experiments examined the influence of object distance from speaker, tool use (participants pointed at objects with their finger/arm or with a stick), and interaction with objects (whether or not participants placed objects themselves) on spatial demonstrative use (e.g. *this/that red triangle*) in English (*this/that*) and Spanish (*este/ese/aquel*). The results show that the use of demonstratives across two languages is affected by distance from speaker and by both tool use and interaction with objects. These results support the view that spatial demonstrative use corresponds with a basic distinction between near and far perceptual space.

1. Introduction

Spatial demonstratives, such as *this* and *that*, occur in all languages, and are more frequent within a language than other spatial terms.[1] They are also more closely associated with deictic gestures than any other linguistic items (Diessel, 2006, p. 481); spoken expressions such as *this coffee pot* or *that pencil* are often accompanied by pointing with index finger, arm outstretched. So demonstratives are a natural place to start to examine whether language and perception/action are associated with the same or different underlying representations – a current central topic in cognitive science (for differing views, see Crawford, Regier, & Huttenlocher, 2000; Hayward & Tarr, 1995; Munnich, Landau, & Dosher, 2001). In this context the relative paucity of experimental research on demonstratives compared to other spatial terms is somewhat surprising. Below we begin to unpack what determines the use of spatial demonstratives, and whether their use maps onto perception/action representation.

In a large-scale analysis of demonstrative systems across over 234 languages, Diessel (2005) found that the most basic distinction languages make is a binary proximal/distal contrast, present in over half of the languages sampled (127; *English* among them). The next most common system is a three term system which can be considered either distance oriented (as is often assumed for Spanish: Kemmerer, 1999; Levinson, 2004), or person oriented (e.g., *Japanese*; Diessel, 2005). Languages with three

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[1] For example, compared to *above* and *over*, two of the most studied spatial terms, the frequencies from Kucera and Francis (1967) are: *This*: 5146, *That*: 10596, *Above*: 301, *Over*: 1306. From Yahoo the frequencies are *This*: 5,770,000,000 *That*: 4,070,000,000 *Above*: 638,000,000 *Over*: 2,250,000,000. (These frequencies do not discriminate between different types of uses, such as exophoric and endophoric uses.)

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demonstratives that are distance oriented (around 37.6% of languages sampled), distinguish between proximal, middle and distal locations from the speaker, while person oriented systems distinguish between "near speaker," "near addressee," and "far from both speaker and addressee". Additional (less frequent) distinctions languages make include whether an object is visible or not (*Tiriyó*; Meira, 2003), and whether or not an object is owned by the speaker (*Supyire*; Diessel, 1999).

Given that the majority of languages sampled by Diessel differentiate between near space and far space, a natural question to ask is if this contrast originates from a basic perceptual dissociation. There is strong experimental/neuropsychological evidence to support a distinction between two separate brain systems that represent near/peripersonal and far/extrapersonal perceptual space (for recent reviews see Berti & Rizzolatti, 2002; Legrand, Brozolli, Rossetti, & Farnè, 2007; Làdavas, 2002). This dissociation comes from single cell activation studies on nonhuman primates (e.g. Iriki, Tanaka, & Iwamura, 1996), neuropsychological studies with patients who exhibit visual neglect in near space but not in far space (and vice versa; e.g., Brain, 1941; Cowey, Small, & Ellis, 1994; Halligan & Marshall, 1991), and from both experimental (e.g. Gamberini, Seraglia, & Priftis, 2008) and Transcranial Magnetic Stimulation studies (Bjoertomt, Cowey, & Walsh, 2002) with healthy participants.

Although the link between the near-far perceptual space distinction and demonstrative contrasts across languages is intuitively appealing, the direct connection between demonstratives and this perceptual distinction has been challenged. The fact that languages lexicalise demonstratives in ways other than a simple near-far distinction, together with the fact that the use of proximal demonstratives can apply beyond arm's reach, has led Kemmerer (1999, 2006) to argue that "...demonstratives do not encode metrically precise degrees of remoteness from the deictic centre, but rather have abstract meanings that are pragmatically modulated by either the discourse context or the referential scenario, thereby allowing speakers to flexibly expand or contract the concentric zones so as to express a potentially unlimited range of distance contrasts – e.g., *here is this room* vs. *here in this galaxy*" (Kemmerer, 2006, p.1608; see also Talmy, 1988).

The fact that proximal demonstratives can be used to refer to a distant object is not evidence per se that demonstrative contrasts do not originate from a basic perceptual distinction. In line with other work on spatial language (cf. Coventry & Garrod, 2004) a different take on demonstratives has to do with the function distance serves us. Objects in near space are accessible, while objects in far space are inaccessible. So being able to interact with an object through being able to reach and contact it may serve as a basis for some of the extended uses of demonstratives found in English, and furthermore may underlie some of the more 'exotic' distinctions demonstratives can make in some other languages. Consistent with this, Berti and Frassinetti (2000) document the case of a patient who showed a dissociation between near and far space in the manifestation of neglect, illustrated by impaired performance on a line bisection task in near space but not in far space when using a light pen to perform the task. Critically when the participant performed the same task using a stick, performance on the task in far space deteriorated, mirroring the performance in near space. Berti and Frassinetti argue that the stick extended the body, remapping far space as near space (see also Longo & Lourenco, 2006; Pegna et al., 2001). Indeed, recent literature suggests that the peripersonal space representation is constrained by multisensory inputs where not only the physical properties of the visual scene are needed but a representation of the body in action at a functional level is essential (Coello & Delevoye-Turrell, 2007; Farnè, Iriki, & Làdavas, 2005; Holmes & Spence, 2004; Legrand et al., 2007; Làdavas, 2002).

Using a new "memory game" paradigm, we set out to examine for the first time whether there is a relationship between near/far space and demonstrative use in two languages: English and Spanish. These languages were chosen as they represent examples of two-term and three-term demonstrative systems, respectively. We manipulated distance between the deictic centre and the object location to be described. If distance matters for demonstrative use, then one should find a switch in English from *this* to *that*, and from *este* (translated as *this*) to *ese* and *aquel* (*that*) in Spanish, at the point where participants can no longer reach the object. We also manipulated interaction between the participants and the object in two ways. First, inspired by the Berti and Frassinetti finding, we reasoned that near space may well be extendable if participants could reach for an object and make contact with it outside their immediate grasp using a tool (stick). Hence the use of *this* and *este* should be extended to positions further away from the body, but reachable with the tool, with tool use as compared with no tool use. Second, if peripersonal space is associated with use of proximal demonstratives, one might also expect that interacting with an object in near space by placing the object oneself should also be associated with an increased use of proximal demonstratives compared to the case where the object is placed by someone else. This would be consistent with recent neuropsychological evidence showing that interacting with an object can result in a carryover of a near space representation (Dupierrix, Alleysson, Ohlmann, & Chokron, 2008; Farnè & Làdavas, 2000).

2. Method

2.1. Participants

Participants were native English speakers ($N = 48$) or native Spanish speakers ($N = 52$). The English participants were students at the Northumbria University and the Spanish participants were students at the University of Granada, Spain.

All participants received course credit or payment for participation.

2.2. Stimuli and procedure

Both participant and experimenter sat at a long table covered with a tablecloth on which 12 positions were

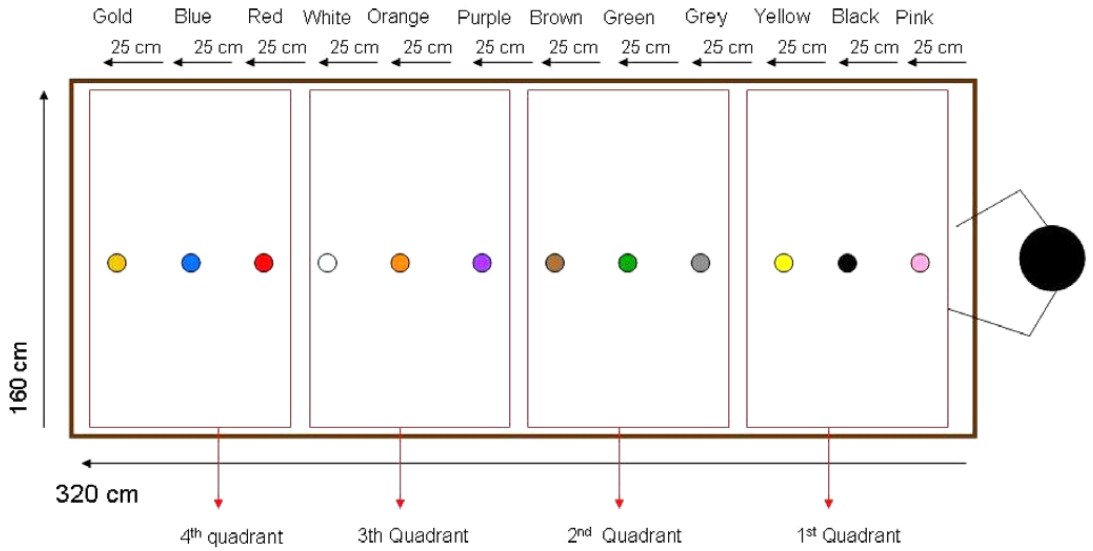

Fig. 1. Schematic picture showing the location marks on the table where the objects were placed with respect to the participants' position.

marked with coloured dots spaced equidistantly from the edge of the table directly in front of where participants were seated (see Figs. 1 and 2). Participants and experimenter played a 'memory game'. Participants were told that they were taking part in an experiment on the effects of language on memory for object location and that they were in the 'language condition'. They were instructed that the object of the game was to remember the positions of objects (2D coloured geometrical shapes; see Fig. 3) placed on coloured dots on the table. As they were in a "language group" they had to use verbal language and body language to point and name each object using a combination of three words: a demonstrative, a colour and a shape (e.g., *this red triangle*; *este triángulo rojo*; *that red triangle*; *ese/aquel triángulo rojo*). Participants understood that they could only use the given (three term) structure so that everyone in the 'language condition' experienced the same level of language coding.

This 'memory game' cover meant that participants produced demonstratives without being aware that we were interested in their choice of demonstrative (confirmed on debriefing). We manipulated distance between the participant and placed object, whether participants used their hand or a 70 cm stick when pointing at/contacting the objects, who placed the object, and the position of the addressee (whether the experimenter was seated either beside the participant or at the other end of the table). This latter manipulation was of interest for Spanish as there is debate regarding whether Spanish spatial demonstratives are distance-based (*este* < *ese* < *aquel*; Kemmerer, 1999; Levinson, 2004), person oriented – affected by distance from both speaker and interlocutor (*este*: near speaker; *ese*: near hearer; *aquel*: far from both speaker and hearer; Cifuentes-Honrubia, 1989), or both (Jungbluth, 2003).

Thirty-six instruction cards indicated "who" was to place each object (*"I Place"*, *"You Place"*, *"Close Your Eyes"*), "which" object to place (e.g. red triangle, blue star, etc.), and "where" the object should be placed (e.g. blue dot, red dot, gold dot, etc.). One set of coloured shapes was placed next to the participant and the other next to the experimenter.

At the beginning of each trial, the experimenter lifted an instruction card, and read out the instructions (e.g. "You place red circle over blue dot"). During the "*Close Your Eyes*" condition, the participant kept his/her eyes closed until the experimenter had silently placed the object. To place the objects the actor (participant or experimenter) selected the shape referred to and placed it on the coloured dot mentioned on the instruction card. This involved reaching or walking (of course depending on the distance between the dot and actor) to place the object. Once the object was placed and both players were back on their seats, the participant (opening his/her eyes if needed) pointed at the object and named it using a demonstrative (e.g. "*this black triangle*").

Across groups half of the participants used a 70 cm stick to point at the objects while naming them (see Fig. 2). Although not explicitly instructed to touch the objects with the stick, participants were implicitly primed to do so as the stick had a hook at the end of it, thus drawing the stick to make contact with the objects.[2] At the end of each testing session reaching measurements were taken for every participant (They were asked to reach as far as they could while remaining seated in their chairs). The mean reachable distance for the no-tool use groups was between the second and third dot locations (first quadrant) and the reachable distance for the tool use groups was between the 4th and 6th dots (second quadrant).

[2] Neuropsychological work indicates that an extension of near space to far space with tool use occurs when the tool is used to functionally interact/make contact with an object (e.g., Farnè et al., 2005; Iriki et al., 1996; Witt, Proffitt, & Epstein, 2005). We did not ask participants explicitly to touch objects with the stick as we wanted to prevent participants using a conscious touching versus no touching strategy to determine demonstrative choice. However the use of a stick with a hooked end meant that the majority of participants did touch the objects with the end of the stick.

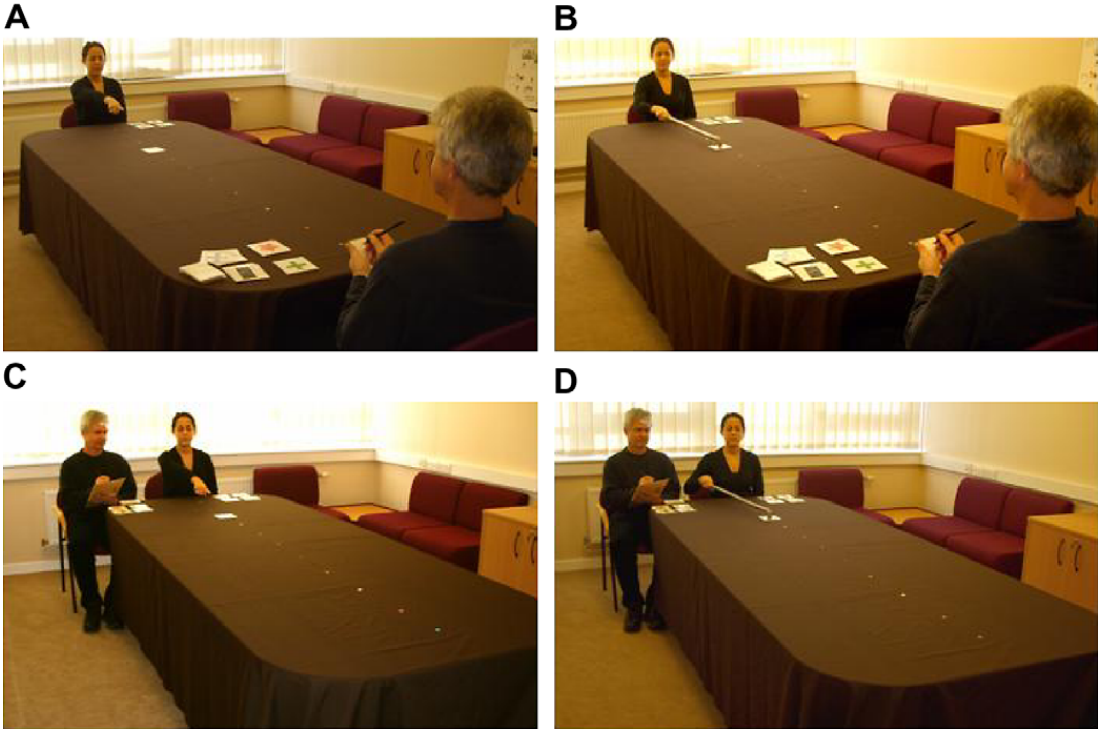

Fig. 2. Experimental set-up showing the two levels of Addressee position (A, B versus C, D) and two levels of tool use (A, C versus B, D).

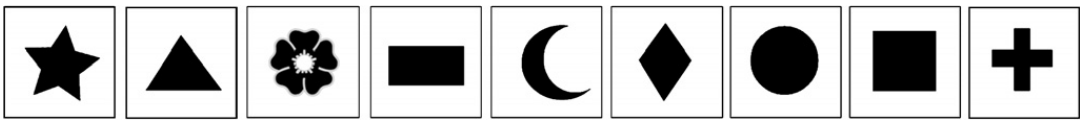

Fig. 3. The objects employed in the study comprised 9 different shapes (Star, Triangle, Flower, Rectangle, Moon, Diamond, Circle, Square, Cross) as shown, each presented in 4 different colours, to produce 36 objects in total.

For the Addressee manipulation in half of the experimental sessions the experimenter and participant were seated beside each other, and for the other half the experimenter was seated at the other (far) end of the table facing the participant (see Fig. 2).

The experimenter noted responses on a sheet marking down the demonstrative used for each trial. There were 36 trials in total for each participant. At the end of the experiment a brief memory for location test was conducted to maintain consistency with the memory game cover.

To summarize, the design used was a 4 (Distance: separated into 4 quadrants, each comprising three dots from the most proximal to the most distal) × 3 (Actor: Experimenter places, Participant places, Eyes closed) × 2 (Tool use: With or without tool use) × 2 (Addressee position: Side-by-side or Opposite) mixed design, with repeated measures on the first two variables.[3]

3. Results

3.1. English data

The percentages of *this* responses were computed for each quadrant (three dot region) by condition, and are displayed in Table 1[4].

A 4 (Distance) × 3 (Actor) × 2 (Tool use) × 2 (Addressee position) mixed ANOVA was performed on the percentage of *this* responses, with repeated measures on the first two variables. Follow-up analyses were performed using LSD tests. There was a main effect of Distance, $F(3,132) = 78.33$ $MSE = 1366.7$ $p < 0.01$; *this* responses were produced more for the first two (near) quadrants than for quadrants 3 and 4 (the far quadrants). Furthermore, there was a significant Distance * Tool use interaction, $F(3,132) = 3.0$, $MSE = 1366.7$, $p < 0.05$, displayed in Fig. 4a. *This* was produced more for quadrant 2 with the tool use than without the tool use ($p < 0.01$). So *this* is affected by distance from speaker, and extending reach leads

[3] We manipulated tool use between participants, again to avoid any conscious strategy of choosing language based on a salient manipulation in the experiment.

[4] As only two demonstrative options are available in English, the results for *that* are the same as the results for *this* (and the mean percentage values in Table 1 and in the text are the compliments of those for *this*).

Table 1
Percentage of "THIS" responses for each quadrant by condition

		Quadrant 1 (reachable with hand)		Quadrant 2 (reachable with tool)		Quadrant 3 (not reachable with tool)		Quadrant 4 (not reachable with tool)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Experimenter places	No tool	61.11	43.59	22.22	28.94	4.17	11.26	2.78	9.41
	Tool	61.11	44.69	47.22	39.22	9.72	15.48	1.39	6.80
Participant places	No tool	72.22	34.98	30.56	35.33	12.50	23.70	4.17	11.26
	Tool	68.06	41.10	51.39	39.29	11.11	27.22	11.11	25.38
Close your eyes	No tool	55.56	37.64	20.83	27.47	4.17	14.95	1.39	6.80
	Tool	56.94	42.25	41.67	39.62	4.17	11.26	4.17	11.26

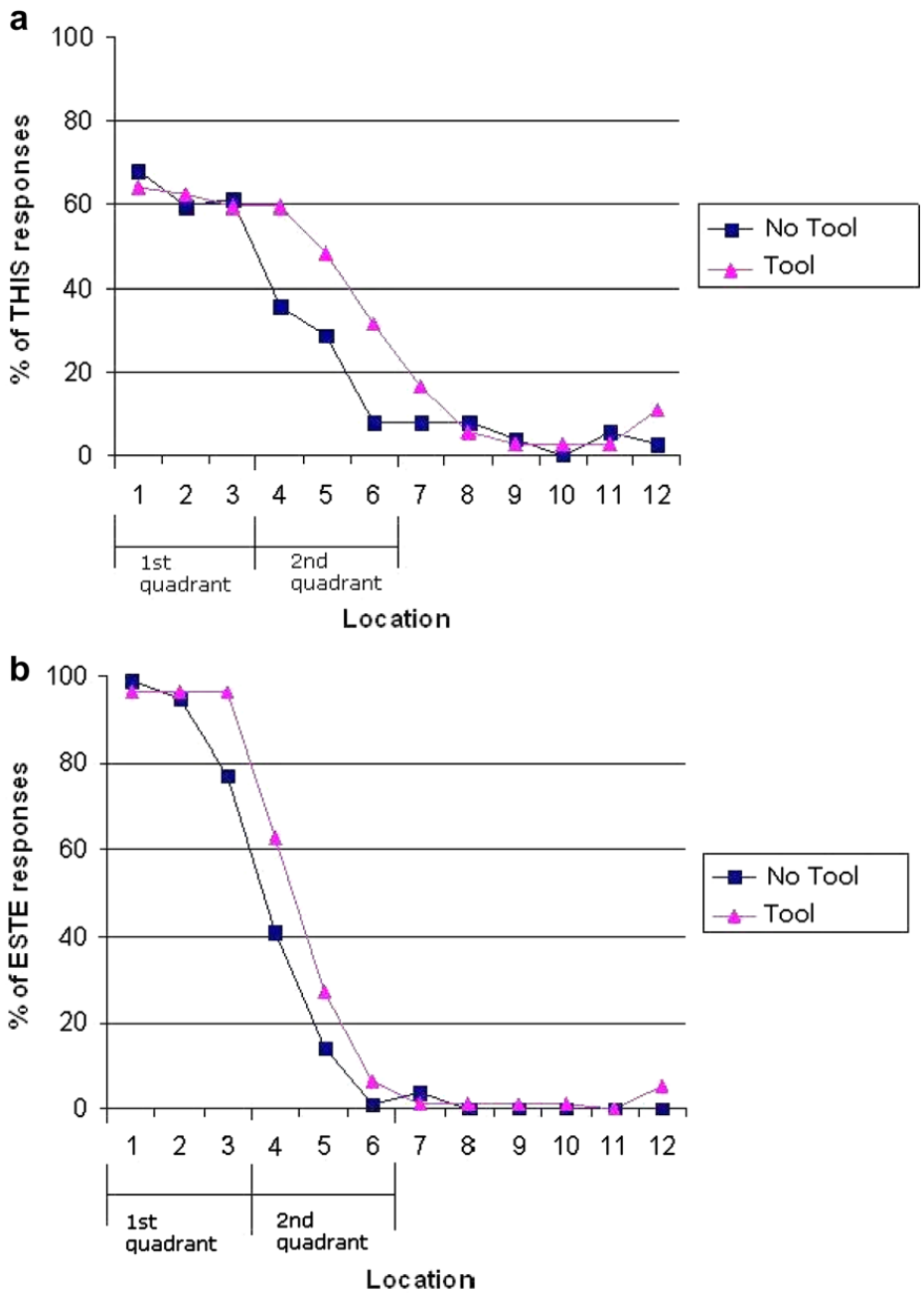

Fig. 4. (a) The interaction between tool use and distance for mean use of *THIS*. (b) The interaction between tool use and distance for mean use of *ESTE*. Locations in the 1st quadrant were reachable with the hand, locations in the 2nd quadrant were reachable with the tool (but not the hand), and locations in the 3rd and 4th quadrants were not reachable with the tool or hand.

Table 2
Percentage of "ESTE" responses for each quadrant by condition

		Quadrant 1 (reachable with hand)		Quadrant 2 (reachable with tool)		Quadrant 3 (not reachable with tool)		Quadrant 4 (not reachable with tool)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Experimenter places	No tool	88.46	18.72	15.38	23.53	0.00	0.00	0.00	0.00
	Tool	96.15	10.86	32.05	29.03	2.56	9.06	1.28	6.54
Participant places	No tool	89.74	15.69	19.23	21.44	2.56	9.06	0.00	0.00
	Tool	96.15	14.38	32.05	24.00	0.00	0.00	3.85	10.86
Close your eyes	No tool	92.31	17.15	21.79	22.98	1.28	6.54	0.00	0.00
	Tool	96.15	10.86	32.05	24.00	1.28	6.54	1.28	6.54

to a corresponding extension of the use of *this* to describe object location.

Finally, there was a significant main effect of actor/interaction with object, $F(2,88) = 5.3$ $MSE = 782.8$ $p < 0.01$. *This* was produced significantly more when participants placed objects (32.64%), than when the experimenter placed the object (26.22%) or when participants closed their eyes (23.61%), both $p < 0.05$.

3.2. Spanish data

The percentages of *este*, *ese* and *aquel* responses were computed for each quadrant (three dot region) by condition. The percentages of *este* responses for each condition are displayed in Table 2.

4 (Distance) × 3 (Actor) × 2 (Tool use) × 2 (Addressee position) mixed ANOVAs were performed separately for the percentage use of each demonstrative.[5]

For all three demonstratives there were main effects of Distance; *este*: $F(3,144) = 903.5$, $MSE = 326.4$, $p < 0.01$, *ese*: $F(3,144) = 144.5$, $MSE = 1049.7$, $p < 0.01$, *aquel*: $F(2,96) = 387.64$, $MSE = 764$, $p < 0.01$. *Este* was preferred for the nearest quadrant (93.16%), *ese* for the 2nd quadrant (70.08%), *aquel* for the 4th quadrant (91.45%), and *ese* and *aquel* were both frequently produced for the 3rd quadrant (45.73% and 52.99%, respectively).

Mirroring the results for *this* in English, for *este* there was a significant main effect of Tool use, $F(1,48) = 12.1$, $MSE = 369.2$, $p < 0.01$, and a reliable Tool use * Distance interaction $F(3,144) = 4.051$, $MSE = 326.4$, $p < 0.01$, displayed in Fig. 4b. Use of *este* was significantly higher for quadrants 1 and 2 when the stick was used (means of 96% and 32%, respectively) than when the stick was not used (means of 90% and 19%) (both $p < 0.001$).

In addition to effects involving distance, there were a number of effects involving addressee position. For *este* there was a main effect of addressee position, $F(1,48) = 6.251$, $MSE = 369.2$, $p < 0.05$, and for both *este* and *ese* there was a reliable Tool use * Addressee interaction; *este*: $F(1,48) = 6.3$, $MSE = 369.2$, $p < 0.05$, *ese*: $F(1,48) = 7.5$, $MSE = 1414.1$, $p < 0.01$. For both *este* and *ese* there was only an effect of tool use when the participant and experimenter were seated side-by-side ($p < 0.001$). Use of *este* was higher for the tool use condition than for the no-tool use condition and vice versa for *ese*.

For *este* there was also a Distance * Addressee interaction, $F(3,144) = 4.2$, $MSE = 326.4$, $p < 0.01$, revealing that the use of *este* was higher for quadrant 2 when the experimenter sat in the opposite side of the table (31.62%), compared to the side-by-side position (19.23%). None of the other contrasts were significant. This result is consistent with the view that participants partition space into 'my interactive space' and 'your interactive space' when the experimenter is placed opposite.

Finally for *ese* and *aquel* there were also main effects of actor; *ese*: $F(2,96) = 4.6$, $MSE = 314.1$, $p < 0.05$, *aquel*: $F(2,96) = 4.15$, $MSE = 210$, $p < 0.05$. The use of *ese* was higher overall in the experimenter places condition (34.93%) compared to the eyes closed condition (29.65%) ($p < 0.01$), while the use of *aquel* was significantly higher for the eyes closed condition (52.14%) than for the Experimenter places condition (47.43%), $p < 0.01$); the mean for the participant places condition was 32.37% for *ese* and 49.36% for *aquel*. None of the other contrasts were reliable.

4. General discussion

The results across two languages show a correspondence between perceptual space distinctions and demonstrative use. First, distance between the speaker and located object is important for both Spanish and English. As an object moves outside of peripersonal space, there is corresponding drop in the use of *this* and *este* for those far locations. In Spanish, the position of addressee is also important, supporting the view of Jungbluth (2003) that demonstratives in Spanish are both distance and person oriented.

The two manipulations of interaction between speaker and object affect the likelihood with which a distal or proximal demonstrative will be used in both languages. First, the effect of Tool use for *this* in English and for *este* in Spanish are particularly striking – increased reach using a stick led to a corresponding increase in the use of proximal demonstratives, directly mirroring data from the perceptual space literature with neglect patients and normal participants (e.g., Berti & Frassinetti, 2000; Longo & Lourenco, 2006). Second, both English and Spanish were also affected by who performed the action of object placement. *This* was used more when participants placed objects, and *ese* and *aquel* were also affected by this manipulation.

[5] *Aquel* was not used at all for quadrant 1 in some conditions, and therefore only three levels of distance could be included in the analysis for *aquel*.

We contend that spatial demonstratives are generated from a basic (graded; Longo & Lourenco, 2006) perceptual distinction between near space and far space. Talking about objects in space is dependent on the perception of objects in that space, and that entails where the body is located functionally in relation to those objects. Moreover, this basic distinction can potentially be extended to other less frequent spatial demonstrative contrasts in languages, such as addressee position (my space versus your space), ownership (I interact with the object in near space, you interact with the object in near space, etc.), and visibility (objects out of visibility are beyond our interaction).

In conclusion the fact that the majority of languages have a binary distal/proximal demonstrative system (Diessel, 2005) as does the perceptual system is a reflection of a basic cognitive structure to represent our interaction with the world. The challenge now is to examine the relationship between this kernel distinction between demonstratives grounded in a perceptual distinction, and more removed uses of demonstratives that seem less easily reducible to this distinction (such as *this galaxy* and *that galaxy*, as Kemmerer has noted). Whether demonstratives are polysemous, with spatial uses as prototypes, or whether they should be treated as categories of unrelated senses ("homonyms"), remains to be established.

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