# Spatial Demonstratives and Perceptual Space: Describing and Remembering Object Location

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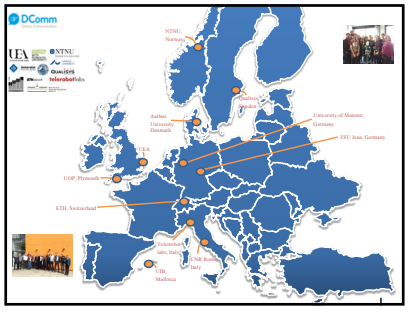
DComm Deictic Communication



## BACKGROUND

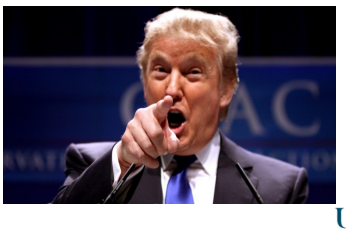
- What is the mapping between language and the vision and action systems?
- If space is so basic, why do languages carve up the spatial world in different ways?
- Can language tell us anything about object-location memory?

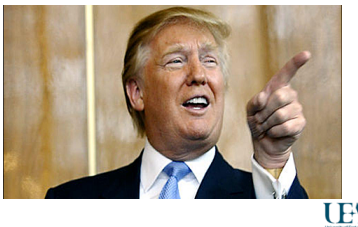
## Linguistic distinctions and cognitive preferences

1. Document differences between languages
2. **Make assumptions about those differences**
   ***key distinctions speakers make when using language**
3. Test differences on nonlinguistic (?) tasks
4. Conclude that language affects thought

## Gesture and language – demonstratives paradigmatic

## Language and action…





## Spatial demonstratives…

(1) Occur in all languages

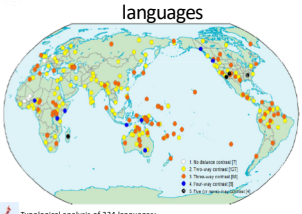
(2) Among the highest frequency words within a language

(3) Emerge as the earliest traceable words in languages (Deutscher, 2005; Diessel, 2006)

(4) Appear early in child language acquisition (Clark, 1978, 2003)

(5) More closely associated with deictic gestures than any other linguistic items (Diessel, 2006; Enfield, 2003; Levinson, 2004)

## Demonstrative systems across languages



Typological analysis of 234 languages:

54% of languages show a binary demonstrative contrast

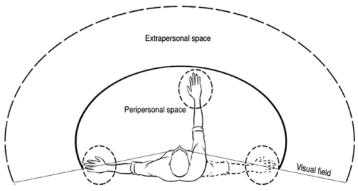
37% of languages exhibit a three-way demonstrative contrast

Languages lexicalise ownership/visibility/elevation, etc. (DIESSEL, 2005)

## Kemmerer (1999)

- "Demonstratives constitute an interesting case of divergence between linguistic and perceptual representations of space." (1999, p. 56; see also Enfield, 2003).
- No correspondence between near and far perceptual space and demonstrative use?

## Peripersonal versus extrapersonal space

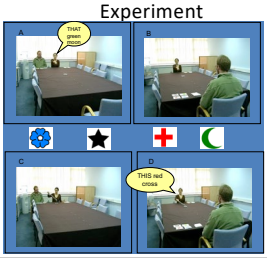



## Empirical work on demonstratives?

- Coventry et al. (2008)
- Bonfiglioli et al. (2009)

Starting to take off now…

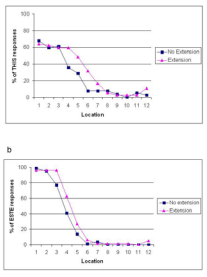
## Demonstrative 'Memory Game' Experiment



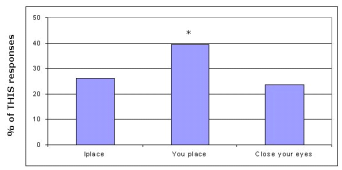

## Coventry, Valdés, Castillo, & Guijarro-Fuentes (2008)

- Manipulations:
  - Where object is placed: **distance** from speaker
  - Who places the object: object in peripersonal space immediately prior to description?
  - Pointing with arm or with a tool (extension of peripersonal space mirroring Berti & Frasinetti, 2000?)

## Near/far space matters… and tool use extends use of *this*

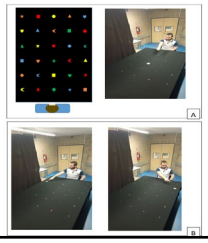


## Previously contacting an object matters for English




## Caldano & Coventry (2019). *Cognition* (just about…)

- To reach
- or
- not to reach?



## Coventry, Griffiths, & Hamilton (2014). *Cognitive Psychology*.

**Free to download from the journal website.**

- Is there a basic set of vision and action distinctions underlying demonstrative use across languages?

  *Does spatial demonstrative choice mirror nonlinguistic representation of space?*

- Are lexical distinctions really indicative of variables that affect language use?

## Experiment 1: **Ownership and Demonstrative Choice**

- Whether an object is owned or not is lexicalised in some demonstrative systems (e.g. **Supyire**; Diessel, 1999 )
- What about English?

2(ownership) x 2(who places) x 3(location) Design (N=25)

Ownership: participant's money or experimenter's money

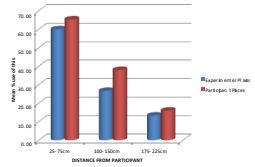
## Manipulations

- Participant places his coin
- Participant places experimenter's coin
- Experimenter places her coin
- Experimenter places participant's coin


## Who places effect? Location effect?

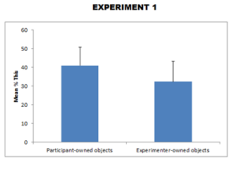
**YES**: main effect of who places, $F(1, 24) = 5.79$, $p = .02$, partial $\eta^2 = .194$;

**YES:** main effect of location, $F(2, 48) = 30.40$, $p < .0001$, partial $\eta^2 = .559$




## Ownership effect?

**YES**: main effect of ownership, $F(1, 24) = 7.44$, $p = .01$, partial $\eta^2 = .237$




## Experiment 2: **Ownership and Memory for Object Location**

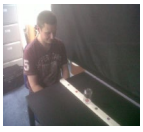
- Whether an object is owned or not affects memory for objects and words (Cunningham et al., 2008; Shi et al., 2011)
- Ownership affects how one interacts with an object (Constable, Kritikos & Bayliss, 2011)

2(ownership) x 9(location) design (N=22)

Ownership = your money (participation money)
*or*
my money (experimenter's money)


## Memory method

***Watch experimenter place (2 secs)***
↓
***Watch (10 secs)***
↓
***Eye closed (20 secs)***
↓
***Probe***



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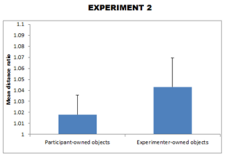
## Ownership effect? Distance effect?

**YES**: main effect of ownership, $F(1, 21) = 21.12$, $p < .001$, partial $\eta^2 = .501$; **YES:** main effect of distance, $F(2, 32) = 22.24$, $p < .0001$, partial $\eta^2 = .582$

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## Experiment 3: Visibility and Demonstrative Choice

- Whether an object is visible or not is lexicalised in some demonstrative systems (e.g. ***Tiriyó***, Meira, 2003; ***Sinhalese***, Diessel, 2005 ).
- English?
- 3(visibility) x 3(location) design (N=17)

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## Visibility manipulation…participant always places


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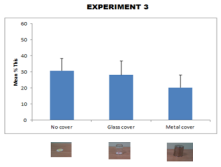
## So does visibility affect demonstrative choice in English?

**YES**: main effect of visibility, $F(2, 32) = 8.24$, $p < .0001$, partial $\eta^2 = .340$ (Distance? **YES**)

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## Experiment 4: Visibility and Memory for Object Location

- 3(visibility) x 9(location) design
- N=12

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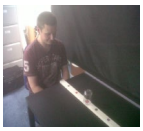
## Memory method

***Watch experiment place (2 secs uncovered)***
↓
***Watch (10 secs: covered in covered conditions)***
↓
***Eye closed (20 secs)***
↓
***Probe***

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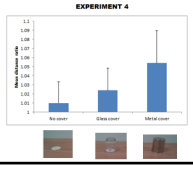
## So does visibility affect memory for object location?

**YES**: main effect of visibility, $F(2, 22) = 9.59$, $p < .005$, partial $\eta^2 = .466$ (Distance? **YES**)

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## Experiment 5: Familiarity and Demonstrative Choice

- Whether an object is familiar or not
- 2(familiarity) x 3(location) design (N=22)
- Familiar objects (e.g. orange square) or unfamiliar objects (veridian nonagon)

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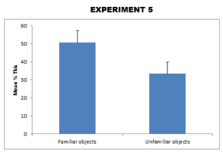
## Familiarity effect?

**YES**: main effect of familiarity, $F(1, 21) = 7.40$, $p = .01$, partial $\eta^2 = .261$ (Distance? **YES**)

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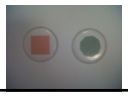
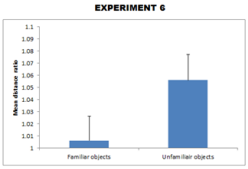
## Experiment 6: Familiarity and Memory for Object Location

- Tracking familiar objects is easier (Pinto et al., 2010)
- 2(familiarity) x 9(location) design (N=19)
- Familiar objects (e.g. orange square) or unfamiliar objects (veridian nonagon)

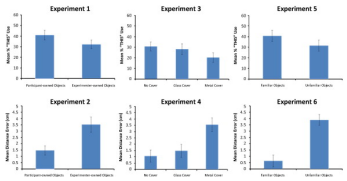


## Familiarity effect?

**YES**: main effect of familiarity, $F(1, 18) = 76.49$, $p < .00001$, partial $\eta^2 = .810$ (Distance? **YES**)




## Summary so far




Main effects of object knowledge found across Experiments 1–6. The top panel shows the results of the demonstrative experiments (mean percentage use of *this* by condition), and the bottom panel shows the memory results (mean signed distance errors).

## So – what IS the relationship?

- **Language parasitic on non-linguistic spatial perception and memory** (Clark, 1973; Jackendoff, 1983; Landau & Jackendoff, 1993; Mandler, 1996; Talmy, 1983).
- **Spatial categories themselves are shaped by language** (Bowerman, 1996; Brown & Levinson, 1993; Pederson et al., 1998; Levinson, 2003; Majid et al., 2004).
- **Language and memory both independently draw on the same set of spatial properties** (Crawford, Regier & Huttenlocher, 2000).

## Experiment 7: Familiarity – within participants

- 2(familiarity) x 2(location) x 3(condition) design
- N=32 (16 male/16 female)

- Conditions
  - Memory
  - Memory with verbal interference
    - Modeled on Trueswell & Pagafragou (2010)
      - *Ba Be Bi Bo Bu*
  - Language

## Language results

- ***Main effect of familiarity***: $F(1, 30) = 13.04$, $p < .005$, partial $\eta^2 = .303$
- ***Main effect of location***: $F(1, 30) = 12.29$, $p < .005$, partial $\eta^2 = .291$

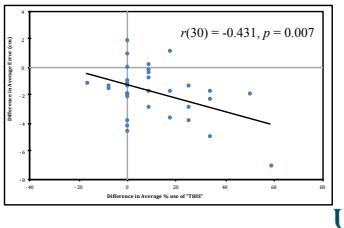
***Main effect of gender***: $F(1, 30) = 6.49$, $p < .05$, partial $\eta^2 = .178$

Overall women used *this* ($M = 52\%$) more than men ($M = 36\%$).

## Memory results

- ***Main effect of familiarity***: $F(1, 30) = 42.67$, $p < .0001$, partial $\eta^2 = .587$
- ***Main effect of location***: $F(5, 150) = 20.42$, $p < .0001$, partial $\eta^2 = .405$
- ***No interactions with condition!***

## Memory effects and language effects?




## Model of memory…and language

- the distance an object is expected to be located is combined with the actual distance an object is located (with an associated estimation error) in memory, as follows:
- $M_D = f(D_a, D_{exp}, D_{err})$
- where M = signed memory error, D = distance, $_a$ = actual, $_{exp}$ = expected and $_{err}$ = estimation error.

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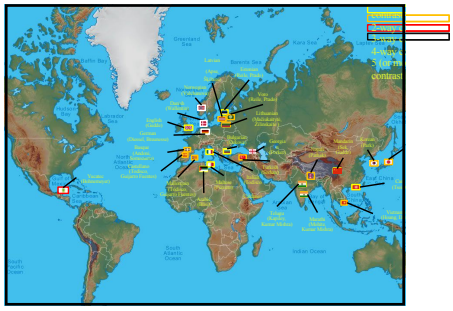
**Other languages?**



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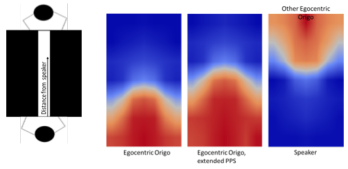
## Japanese versus English?

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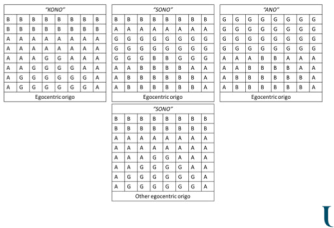
## Japanese

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## Extending the Expectation Model


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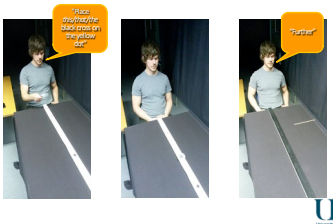
Gudde, Coventry & Engelhardt (2016). *Cognition.*

**Free to download from the journal website.**

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## Other accounts?


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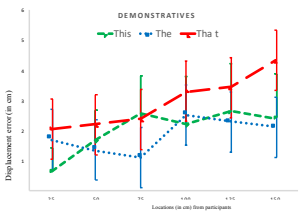


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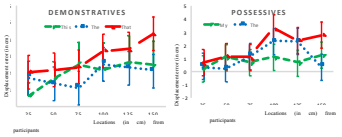
## ...and similar results with possessives



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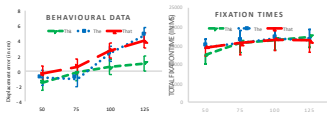
## Another explanation – does language might affect attention




(N=16)
**Demonstrative:** $F(2,30) = 5.77, p < .01, \eta p^2 = .28$
**Location:** $F(1,45) = 9.69, p = .003, \eta p^2 = .39$
Interaction: $F(6,90) = 1.61, p = .15, \eta p^2 = .1$

(N=16)
Demonstrative: $F(2,30) = .13, p = .81, \eta p^2 = .009$
**Location:** $F(1,45) = 4.66, p < .05, \eta p^2 = .24$
Interaction: $F(6,90) = .62, p = .71, \eta p^2 = .04$

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## From space…to time

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## SPACE AND TIME

***At the church***
***This cup***

***At 7pm***
***This month***

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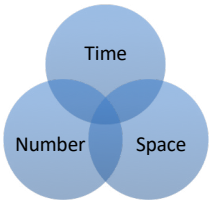
## Walsh (2003) - A Theory of Magnitude (ATOM)

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## Conceptual Metaphor theory

- Happy is up and sad is down (Lakoff & Johnson, 1980).
  - "I'm under the weather."
  - "I'm over the moon."
  - "I'm in a trance."
  - "I'm on the wagon."
  - "The future is in front, past is behind."
- **Space-time relationship is asymmetric** (e.g. Casasanto & Boroditsky, 2008; Casasanto, Fotakopoulou & Boroditsky, 2010 ).

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Griffiths, Bester & Coventry (2019). *Cognitive Science.*
**Free to download from the journal website.**

- What is the relationship between spatial and temporal uses of demonstratives?


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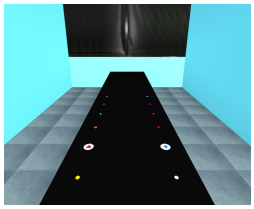
## Virtual Reality – Model of room used in earlier experiments



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## Same method as before


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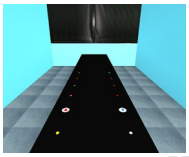
## Method

- Participant in fully immersive Virtual Reality with VR glove



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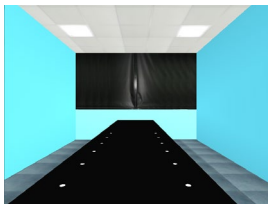
Procedure 1



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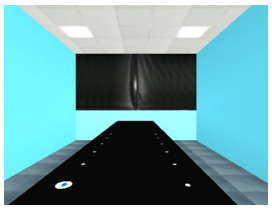

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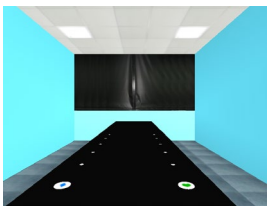
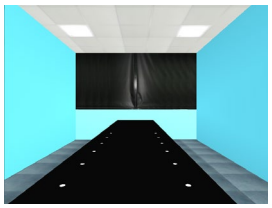


Procedure 2



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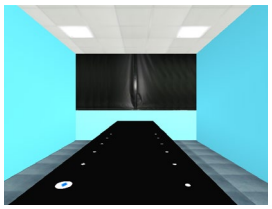

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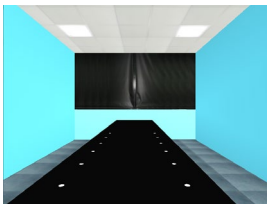
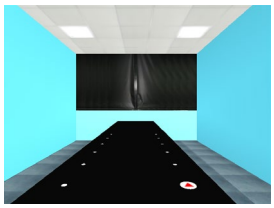


3 seconds



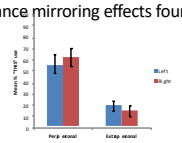
**Results?**

**Space trumps time!**

No effects of when objects appear.

Clear effects of distance mirroring effects found in real space.

One interaction:



## Conclusions

Spatial demonstrative choice in English is much more similar to demonstrative contrasts in other languages than a simple binary proximal-distal contrast in English would suggest

Put simply, lexical distinctions for these terms are not diagnostic of the parameters that affect their usage.

Memory is similarly affected by object knowledge.

Results support the expectation model, consistent with predictive coding in perception (e.g. Friston, 2005).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