RUNNING HEAD: NEAR and FAR in English and Finnish

The influence of geometrical and non-geometrical features on the use of the lexical concepts NEAR and FAR in English and Finnish

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Abstract

This paper investigates the impact of geometrical and non-geometrical features on the use of the lexical concepts NEAR and FAR in English and Finnish. Participants' acceptability ratings for these concepts demonstrate that a bar in between a Figure and a Ground acts as a scale-setting object but not as a distance enhancing barrier, shows that the influence of the geometrical feature Figure-Ground distance exceeds the influence of several non-geometrical features, but most of all reveals that language specific lexical properties associated with NEAR and FAR predict language dependent effects for functional relatedness in interaction with Figure-Ground distance and bar presence.

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Introduction

In English the adpositions *near* and *far* can be used to describe the proximal and distal separation of a Figure in relation to a Ground (Miller & Johnson-Laird, 1976). Research has shown that the size, shape, and extension of regions corresponding to *near x* and *far from y* depends on geometrical features such as Figure-Ground distance, relative Ground size, distracter presence, perspective, observer distance, object shape and object orientation (Carlson & Covey, 2005; Colombo & Seymour, 1983; Ferenz, 2000; Hund & Plumert, 2007; Morrow & Clark, 1988; Burigo & Coventry, submitted), but also on non-geometrical features associated with the Figure and Ground objects, such as the way in which the objects are expected to interact (Ferenz, 2000; Carlson & Kenny, 2006). This means that *near* and *far* behave like other English adpositions, such as *in* and *on*, whose use also depends on both geometrical and non-geometrical features (see, for example, Coventry & Garrod, 2004; Carlson & van der Zee, 2005; Carlson-Radvansky & Radvansky, 1996). This paper investigates the role of geometrical and non-geometrical features on the use of the lexical concepts NEAR and FAR in both English and Finnish.

Experiments based on sentence acceptability ratings have shown - not unexpectedly - that the use of *near* is normally associated with a small Figure-Ground distance and the use of *far* with a large distance (for example, Hund & Plumert, 2007; Logan & Sadler, 1996). However, *near* and *far* are relative notions (Kemmerer, 1999; Langacker, 1987). For example, it is quite acceptable to say that Mercury is *near* the Sun, referring to a distance of approximately 30 million miles, but it is equally appropriate to say that the plant is *near* the window, referring to a distance as small as 2 cm. In this paper we investigate the lexical concepts NEAR and FAR in what Montello (1993) referred to as figural space, or space that is immediately accessible

and readily available for manipulation, as opposed to, for example, environmental space, which requires an integration of spatial information over significant periods of time in order to appreciate its spatial properties (see, for example, Fisher and Orf (1991) and Worboys (2001) for a discussion and empirical investigation of the use of NEAR in environmental space).

O'Keefe (1996) argued that the presence of a third object is both necessary and sufficient to provide a scale in relation to which *near* and *far* are interpreted. The influence of other objects apart from the Figure and Ground has been investigated by Hund and Plumert (2007) for *by*, and by Burigo and Coventry (submitted) for Italian *vicino* ('near') and *lontano* ('far'). This research has shown that the presence of other objects indeed sets the scale for lexical concepts encoding proximity, thus interacting with Figure-Ground distance (for example, a larger Figure-Ground distance as compared to a smaller distance decreased the acceptability ratings for the linguistic concept NEAR as opposed to FAR, but increased the ratings for NEAR if a distracter object was closer to the Figure than to the Ground – but was not in between the Figure and the Ground).

Interestingly, O'Keefe (1996, p295) also argued that "the presence of barriers [does not seem] to influence our judgement of *near* or *far*, because [the following sentence] is permissible: The house is nearby, but it will take a long time to get there since we have to go the long way around." In this paper we pit O'Keefe's observations about the presence of a third scale-setting object and the influence of a barrier against each other: what happens if a third object that potentially sets the scale for NEAR and FAR is a barrier? The observation that a third scale-setting object is necessary and sufficient for using *near* and *far* predicts that the presence of a bar in between the Figure and the Ground has a positive effect on the acceptability ratings of

both *near* and *far*. However, O'Keefe's observation that barriers do not seem to influence the use of *near* or *far* predicts that the presence of a bar has no effect on acceptability ratings for either *near* or *far*. And there is third prediction as well. As shown by Kosslyn, Pick and Fariello (1974), and Newcombe and Liben (1982), barriers can enhance the effect of spatial separation between two objects when participants are asked to judge the distance between these objects (either directly or from memory). If barriers would have such an influence on Figure-Ground separation, the prediction is that bar presence has a positive effect on the use of *far*, but a negative effect on the use of *near*, and that bar absence has the reverse effect. This paper considers which of these predictions is correct, and in doing so uses a bar that is devoid of explicit functional properties, so that its mere presence (as referred to by O'Keefe) but not its functional properties may take priority.

Research about the contribution of non-geometrical features on the use of proximity terms has so far only focused on English *near*. Ferenz (2000, p48-50) reported an experiment in which participants rated "*The [Figure] is near the [Ground]*" as more appropriate for short distances if there was a functional relation between the Figure and the Ground, compared to when there was no such relation. Ferenz used object pairs that were assumed to portray functional as opposed to non-functional relationships based on canonical interaction (as in Carlson-Radvansky & Radvansky, 1996), and by manipulating the orientation of the objects involved (for example, rating the appropriateness of "*The couch is near the tv"* when both were oriented towards each other, as opposed to both being oriented away from each other). Carlson and Kenny (2006) designed stimuli to show that general knowledge about the functional parts of a Figure and a Ground along with their expected zone of interaction resulted in more Figure placements *near* a Ground on the basis of

'simulated interaction' than other placements. In the experiments below we adopt an idea similar to that employed by Carlson and Kenny: Figure-Ground pairs are considered functionally related if one of them is normally used in an action with respect to the other object (for example, a pencil sharpener in relation to a pencil), but unrelated if they are not normally used in an action together (for example, a matchbox and a pencil). Both the Figure and the Ground objects are presented at the same (horizontal) level, and both are oriented towards each other (whether functionally related or not). Pre-tests were carried out to guarantee that participants rate the Figure-Ground pairs used in the experiments as related or unrelated (see below). We will consider the contribution of "expected interaction" in relation to both NEAR and FAR. And, we expect that the presence of such a functional relation gives better ratings for English *near* compared to *far*, modified by the previously discussed factors of Figure-Ground distance and bar presence.

The contribution of non-geometrical features on acceptability ratings for NEAR and FAR does not only need to come from features associated with the objects involved, but can also stem from the particular terms - or grammars - involved. Apart from the fact that Finnish differs typologically from English (it is not an Indo-European language), Finnish is of special interest in this study, since Finnish *lähellä* ('near') differs in an important aspect from English *near*, but also from Finnish *kaukana* ('far'). *Lähellä* either assigns partitive or genitive case to a Ground, for example, "*Olen lähellä talo-a"* 'I-am near [the] house-PARTITIVE', and in doing so assumes the absence of a functional relation between the Figure and the Ground (that is, *lähellä* 'strips' "[the] house" in the above example from any functional features by considering it as 'just any house'). *Kaukana* ('far') on the other hand either assigns elative or ablative case, for example elative "*Olen kaukana talo-sta"* ' I-am far [the]

house-within-from', or ablative "*Olen kaukana talo-lta"* 'I-am far [the] house-off-from'. In the latter two examples basic spatial and functional properties of the Ground object are assumed (respectively containment and a supporting surface), in the same way as such features are assumed for English *near* (for example, for the Figure and Ground objects to be at a short distance from each other, or to be associated with each other in an action; see Ferenz, 2000 and Carlson & Kenny, 2006). In other words, *lähellä* ('near') imposes insensitivity to functional features, whereas English *near* but also Finnish *kaukana* ('far') demand such a sensitivity. Based on these considerations it is to be expected that English *near* but also Finnish *kaukana* ('far') receive better ratings for functionally related Figure-Ground pairs whereas Finnish *lähellä* ('near') receives better ratings for functionally nonrelated Figure-Ground pairs, as modified for both languages by the previously discussed factors of Figure-Ground distance and bar presence.

Method

Participants. Eighty-five undergraduates with English as their first language from the University of Lincoln (UK) and eighty-nine undergraduates with Finnish as their first language from the University of Joensuu (Finland) volunteered for the experiment. All participants had right-hand dominance and normal or corrected-to-normal vision.

Materials. Sixteen coloured photographs of object-pairs were presented, one object being active (e.g. a hammer) and the other passive (e.g. a nail). Active objects were always presented larger than passive objects (at an 8:1 ratio), and on the right side of the screen, as would be normal for a right-handed person performing an action with an active object on a passive object (see figure 1). The bounding boxes around

the Figure and Ground objects were separated by 9cm in the near distance and 78cm in the far distance conditions as measured on the projection screen.

[INSERT FIGURE 1 ABOUT HERE]

Objects in Figure-Ground pairs were functionally related (e.g. a pencil sharpener and a pencil) or unrelated (e.g. a matchbox and a pencil), separated by a small or a large distance, and interspersed by a black bar or not (see Appendix 1 for all possible stimulus pairs in both English and Finnish). Each pair was presented within a simple declarative Subject + Verb + Locative NP sentence such as "*The nut is near the spanner"* (see figure 1) using the terms *near* and *far* in the English version of the experiment, and with the terms *lähellä* ('near') and *kaukana* ('far') in the Finnish version. This resulted in 64 term-object-pair combinations for each language. Each participant saw 32 object pairs, either functionally related or functionally unrelated Figure-Ground pairs: the 16 coloured photographs were presented twice, once at a near-distance and once at far-distance. Object functionality and bar presence were incorporated as between-factors in the experimental design in order not to alert participants to the fact that these factors were the focus of our investigation. Inter-object distance and term use were varied as within-participant factors so that participants were able to set a scale which – as discussed above - is necessary for the use of the lexical concepts NEAR and FAR.

Pre-tests with English participants were carried out to determine whether objects in the Figure-Ground pairs were judged to be functionally related or unrelated, and to determine whether the object on the right hand side of the screen in the experiment would be interpreted as active and the object to be shown on the left hand

side of the screen interpreted as passive. In a forced-choice design with only yes/no answers and with 50% filler items of the opposite category in the first two tests 13 participants confirmed that objects in all eight functionally related Figure-Ground pairs were indeed perceived as being functionally related (χ (1) = 92.35, $p < .001$), 12 participants confirmed that objects in all eight functionally unrelated Figure-Ground pairs were perceived as being functionally unrelated (χ (1) = 80.67, $p < .001$), 15 participants confirmed that objects presumed active in all eight functionally related Figure-Ground pairs were indeed perceived as active (χ (1) = 80.03, $p < .001$), and 17 participants confirmed that objects presumed passive in all eight functionally related Figure-Ground pairs were indeed perceived as passive (χ (1) = 70.62, $p < .001$).

Procedure. Figure-Ground pairs were presented on a projection screen at the front of a lecture theatre. Descriptions of the form ”The [passive object] is NEAR/FAR FROM the [active object]“ featured below each Figure-Ground pair (see Appendix 1 and figure 1), thus guaranteeing that the smaller (passive) object is in the Figure role, and the larger (active) object in the Ground role (and thus conforming to the Figure-Ground size asymmetry observed by Talmy, 2000; compare “The nail is near the hammer” with the less acceptable sentence “The hammer is near the nail”).

Participants indicated the acceptability of each statement by circling a number from 1 (highly appropriate) to 7 (highly inappropriate) in a response booklet. Participants were tested in different groups, only receiving functionally related Figure-Ground pairs with no bar separating them (English: 24, Finnish: 21), functionally related Figure-Ground pairs with a bar (English: 20, Finnish: 20), functionally unrelated Figure-Ground pairs without a bar (English: 21, Finnish: 20), or functionally unrelated Figure-Ground pairs with a bar (English: 20, Finnish: 28).

Results

A 2 (language: English versus Finnish) x 2 (concept; NEAR versus FAR) x 2 (distance; small versus large Figure-Ground distance) x 2 (function; related versus unrelated) x 2 (barrier; bar presence versus bar absence) mixed ANOVA with concept and distance as within participant factors, and language, function and barrier as between participant factors was carried out.

The analysis reveals main effects for concept and distance, with terms referring to the concept NEAR being more acceptable (M = 3.79) than terms relating to FAR (M = 4.26) (F (1, 166) = 64.51, MSE = 0.598, $p < 0.001$), and small Figure-Ground distances being rated as slightly more acceptable (M = 3.95) than large distances (M = 4.1) (F (1, 166) = 10.027, MSE = 0.372, $p = 0.002$). The effect for barrier is marginally significant (F (1, 166) = 3.351, MSE = 0.338, $p = 0.069$), with slightly more acceptable ratings for bar presence (M = 3.98) compared to bar absence (M = 4.07).

Distance interacts with concept (F (1, 166) = 2027.42, MSE = 1.324, $p < 0.001$), with terms referring to NEAR as being more acceptable for small Figure-Ground distances (M = 1.740) compared to large distances (M = 6.167) (t (173) = 49.017, $p < 0.001$), and terms referring to FAR as being more acceptable for large distances (M = 2.361) compared to small distances (M = 5.841) (t (173) = 33.554, $p < 0.001$).

The effect for Figure-Ground distance is mediated by language and function (F (1, 166) = 9.597, MSE = .372, $p = 0.002$). English speakers rated descriptions of functionally related objects as more acceptable if these objects were portrayed as being closer (M = 3.916), compared to when the objects were presented as being further apart (M = 4.267) (t (43) = 2.719, $p = 0.009$), whereas there is no difference in

the ratings for functionally unrelated objects (t (40) = 0.065, p = 0.948). Finnish speakers, however, show the reverse pattern, by rating descriptions of functionally unrelated objects as more acceptable if these objects were presented closer (M = 3.884), compared to when they were depicted as being further apart (M = 4.116) (t (47) = 3.939, p <0.001), whereas there is no difference for functionally related objects (t (40) = 0.081, p = 0.936).

Function appears to interact with concept, language and barrier (F (1, 166) = 8.96, MSE = 0.598, p = 0.003). Figure 2 illustrates this four-way interaction.

[INSERT FIGURE 2 ABOUT HERE]

Post-hoc t-tests with an adjusted α of .0125 show that the concept NEAR is preferred over FAR for both functionally related and unrelated object-pairs for both languages if a bar is present (all p's < .0125). However, when no bar is present there is no difference in acceptability ratings for the concepts NEAR and FAR for unrelated objects-pairs for English speakers and related objects-pairs for Finnish speakers (both p's > .0125), while *near* is more acceptable than *far* for related object-pairs for English speakers, and *lähellä* ('near') is more acceptable than *kaukana* ('far') for unrelated object-pairs for Finnish speakers.

Additional post-hoc t-tests reveal that when the bar is absent functionally related Figure-Ground pairs are more acceptable than unrelated Figure-Ground pairs for FAR for Finnish speakers (t (39) = 2.679, p = 0.011). All other differences are non-significant (all p's > .0125).

Discussion

The finding that both English and Finnish participants prefer the concept NEAR over FAR is congruent with Colombo and Seymour's (1983) finding that *near* was processed faster and was less prone to a variation in Figure-Ground distance than *far*, and Mainwaring, Tversky, Ohgishi and Schiano's (2003) finding of a preference for *near* over *far* when participants were asked to describe the location of an object or landmark either to themselves or to others. According to Clark and Clark (1977) *near* is more informative than *far*. Knowing that an object is near another object limits the search range for that object more than knowing that it is far from an object. Clark and Clark's observation that *near* is the unmarked term and *far* is the marked term thus explains both past and present findings.

The small and marginal main effect for bar presence over bar absence confirms that the bar in between the Figure and the Ground is interpreted more like a scale-setting object (Burigo & Coventry, submitted; Hund & Plumert, 2007; O'Keefe, 1996), than a barrier separating the Figure and the Ground (Kosslyn, Pick & Fariello, 1974; Newcombe & Liben, 1982). The fact that bar presence has any effect at all (even if small and only marginally significant) does not suggest that a barrier in between a Figure and Ground object is irrelevant for the use of *near* or *far*, as suggested by O'Keefe (1996). However, even though the effect of bar presence in itself is small and marginally significant, the fact that NEAR ratings are more acceptable than FAR ratings if a bar is present compared to when a bar is absent, irrespective of the language involved, and irrespective of the Figure-Ground relationship involved, seems to indicate that a combined influence of the lexical concept NEAR and bar presence is enough to overcome language specific differences in relation to NEAR as well as differences in functional relationships between the Figure an Ground objects.

Both English and Finnish participants prefer small Figure-Ground distances over large distances, in the same way that they prefer NEAR over FAR. However, the reasons for a preference of small Figure-Ground distances are different for the participants of the two languages. English participants' preferences are due to Figure-Ground pairs that are functionally related, whereas Finnish participants' preferences are due to Figure-Ground pairs that are not functionally related. An interesting question is whether the difference in Figure-Ground distance preferences between the two languages is matched by a difference in the use of English *near* and *far* versus Finnish *lähellä* ('near') and *kaukana* ('far').

The four-way interaction between function, concept, language and barrier confirms the predictions that were made for the differential effects on the acceptability ratings for English *near* and *far* as opposed to Finnish *lähellä* ('near') and *kaukana* ('far'). When no bar is present between the Figure-Ground pairs NEAR is more acceptable than FAR for English speakers for functionally related Figure-Ground pairs (with no difference in acceptability for functionally unrelated pairs), whereas NEAR is more acceptable than FAR for Finnish speakers for functionally unrelated Figure-Ground pairs (with no difference in acceptability for functionally related pairs). This shows that a preference for small Figure-Ground object distances and – in situations where no bar is present – a preference for the use of the concept NEAR are both linked to functionally related object-pairs in English, whereas similar preferences are linked to functionally unrelated Figure-Ground pairs in Finnish. Hayward and Tarr (1995), Crawford, Regier and Huttenlocher (2000), and Munnich, Landau and Dosher (2001) have discussed the possibility of a one-to-one relationship between spatial cognition on one hand and the use of spatial language on the other hand. In order to investigate whether the use of the concepts NEAR and FAR parallels

spatial cognition in English and Finnish speakers it would be interesting to investigate spatial memory organisation in these speakers independently from the linguistics tasks employed here.

The four-way interaction also reveals that functionally related Figure-Ground pairs are more acceptable than unrelated Figure-Ground pairs for FAR for Finnish speakers. This confirms - as predicted - that unlike Finnish *lähellä* (‘near’), Finnish *kaukana* (‘far’) is sensitive to functional features. The absence of a similar effect for English FAR may well be due to the fact that English speakers prefer functional relatedness more for NEAR than for FAR.

Finally, the experiments confirm a clear influence of inter-object distance on the ratings for NEAR and FAR: a small Figure-Ground distance is linked to a better acceptability of NEAR and opposed to FAR, and a larger Figure-Ground distance has the reverse effect. This finding is congruent with, for example, Logan and Sadler (1996) and Hund and Plumert (2007), and the size of this effect shows that the influence of this geometrical feature far exceeds the influence of any non-geometrical features.

In conclusion, the experiments presented here show a strong influence of the geometrical feature ‘distance’ and a weak but positive influence of bar presence in the guise of a scale setting object on the use of the lexical concepts NEAR and FAR. In addition, the experiments demonstrate a contribution of the functional feature ’expected interaction‘ that is dependent on the concepts used, the languages involved, and bar presence versus bar absence. The latter finding confirms that speakers’ linguistic evaluations of spatial scenes are influenced by the grammars that they use to describe NEAR and FAR in figural space.

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CAPTIONS

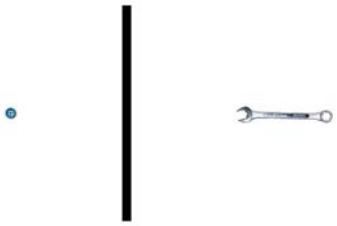
Figure 1. Four stimuli used in the English and Finnish versions of the experiment (with the images but not the text according to scale). The top two examples illustrate functionally related Figure and Ground objects, without a bar, with terms that are incongruent with distance. The bottom two examples illustrate functionally unrelated Figure and Ground objects, with a bar, with terms that are incongruent with distance.

Figure 2. The interaction between concept, language, function and barrier.

FIGURES

Mutteri on lähellä kiintoavainta
The nut is near the spanner

Mutteri on kaukana kiintoavaimesta
The nut is far from the spanner



Nappi on lähellä kiintoavainta
The button is near the spanner

Nappi on kaukana kiintoavaimesta
The button is far from the spanner

Figure 1.

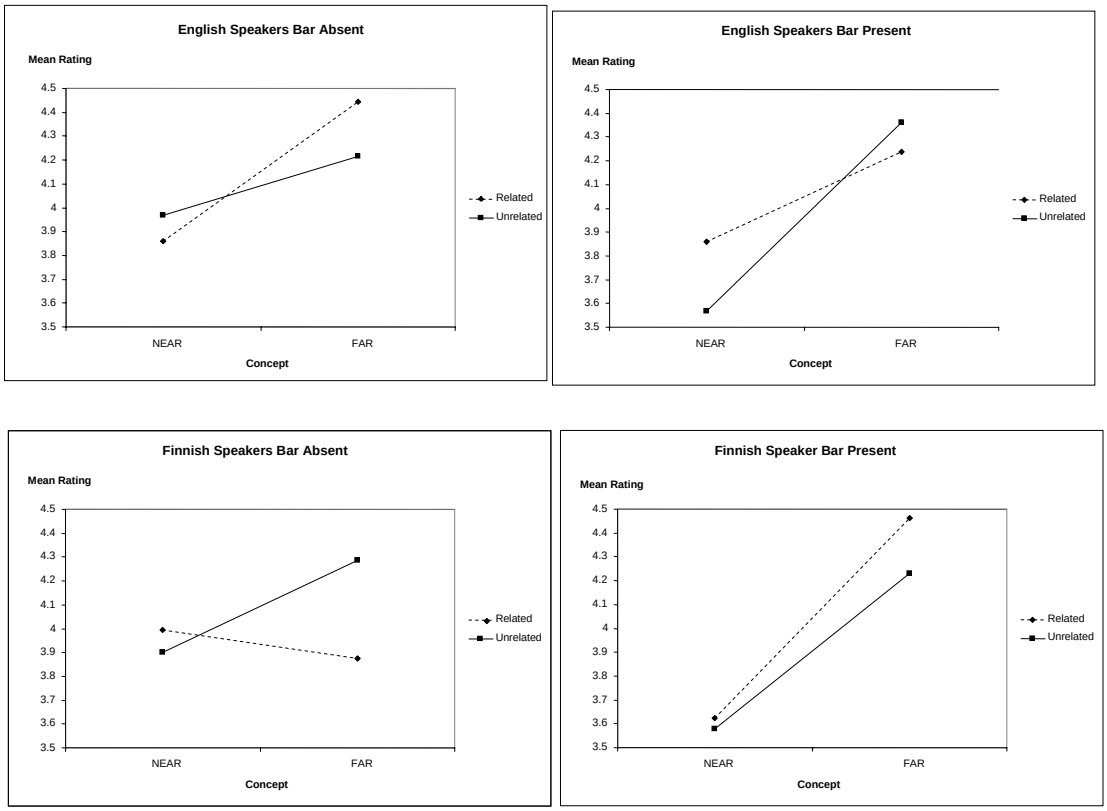

English Speakers Bar Absent
Mean Rating
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
NEAR
FAR
Concept
Related
Unrelated
English Speakers Bar Present
Mean Rating
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
NEAR
FAR
Concept
Related
Unrelated
Finnish Speakers Bar Absent
Mean Rating
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
NEAR
FAR
Concept
Related
Unrelated
Finnish Speaker Bar Present
Mean Rating
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
NEAR
FAR
Concept
Related
Unrelated

Figure 2.

Appendix 1

English near-distance and far-distance stimuli, functionally related, with and without a bar,	with a term that is
The ball is near the cricket bat.	congruent/incongruent
The nail is near the hammer.	congruent/incongruent
The screw is far from the screwdriver.	congruent/incongruent
The shuttlecock is far from the racquet.	congruent/incongruent
The paper is near/far from the scissors.	congruent
The sharpener is near/far from the pencil	congruent
The nut is near/far from the spanner.	incongruent
The ball is near/far from the hockey stick.	incongruent

English near-distance and far-distance stimuli, functionally unrelated, with and without a bar,	with a term that is
The egg is near the cricket bat.	congruent/incongruent
The button is near the spanner.	congruent/incongruent
The paperclip is far from the racquet.	congruent/incongruent
The twig is far from the scissors.	congruent/incongruent
The drawing pin is near/far from the screwdriver.	congruent
The matchbox is near/far from the pencil	congruent
The pen lid is near/far from the hammer.	incongruent
The muffin is near/far from the hockey stick.	incongruent

Finnish near-distance and far-distance stimuli, functionally related, with and without a bar,	with a term that is
Pallo on lähellä pesäpallomailaa.*	congruent/incongruent
Naula on lähellä vasaraa.	congruent/incongruent
Ruuvi on kaukana ruuvimeisselistä.	congruent/incongruent
Sulkapallo on kaukana mailasta .	congruent/incongruent
Paperi on lähellä/kaukana saksia/saksista.	congruent
Teroitin on lähellä/kaukana lyijykynää/ lyijykynästä	congruent
Mutteri on lähellä/kaukana kiintoavainta/ kiintoavaimesta.	incongruent
Pallo on lähellä/kaukana jääkiekkomailaa/ jääkiekkomailasta.	incongruent

Finnish near-distance and far-distance stimuli, functionally unrelated, with and without a bar,	with a term that is

Muna on lähellä pesäpallomailaa.*	congruent/incongruent
Nappi on lähellä kiintoavainta.	congruent/incongruent
Paperiliitin on kaukana mailasta.	congruent/incongruent
Oksa on kaukana sakista.	congruent/incongruent
Nasta on lähellä/kaukana ruuvimeisseliä/ ruuvimeisselistä.	congruent
Tikkuaski on lähellä/kaukana lyijykynää/ lyijykynästä	congruent
Kynän tuppi on lähellä/kaukana vasaraa/ vasarasta.	incongruent
Muffinsi on lähellä/kaukana jääkiekkomailaa/ jääkiekkomailasta .	incongruent

* The ‘cricket bat’ was replaced with a ‘baseball bat’ for the Finnish speakers. Finnish speakers appeared to be unfamiliar with the visual display of a cricket bat.