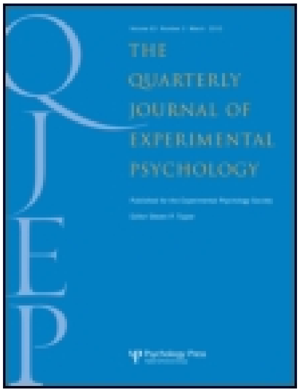

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Toddlers' language-mediated visual search: They need not have the words for it

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Toddlers' language-mediated visual search: They need not have the words for it

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Eye movements made by listeners during language-mediated visual search reveal a strong link between visual processing and conceptual processing. For example, upon hearing the word for a missing referent with a characteristic colour (e.g., "strawberry"), listeners tend to fixate a colour-matched distractor (e.g., a red plane) more than a colour-mismatched distractor (e.g., a yellow plane). We ask whether these shifts in visual attention are mediated by the retrieval of lexically stored colour labels. Do children who do not yet possess verbal labels for the colour attribute that spoken and viewed objects have in common exhibit language-mediated eye movements like those made by older children and adults? That is, do toddlers look at a red plane when hearing "strawberry"? We observed that 24-month-olds lacking colour term knowledge nonetheless recognized the perceptual–conceptual commonality between named and seen objects. This indicates that language-mediated visual search need not depend on stored labels for concepts.

Keywords: Colour; Lexical processing; Visual attention; Visual search; Language development; Toddler word recognition; Conceptual development.

In mature language users there is a tight coupling between visual processing and high-level mental representations involved in memory and language. This is particularly evident from eye gaze behaviour during language-mediated visual search (Cooper, 1974; see Huettig, Olivers, & Hartsuiker, 2011,

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for review; see also Desimone & Duncan, 1995; Wolfe, 1994). In such a situation, individuals establish matches at phonological, visual-feature (e.g., shape or colour), and semantic levels of processing between information extracted from the visual environment and information from the speech signal. Shifts in overt attention are codetermined by the type of information in the visual environment, the timing of cascaded processing in the word- and object-recognition systems, and the temporal unfolding of the spoken language (Huettig & McQueen, 2007).

Young children are also sensitive to the similarity between spoken referents and pictured objects (e.g., Arias-Trejo & Plunkett, 2010; Styles & Plunkett, 2009; Torkildsen et al., 2007; see also Mani & Plunkett, 2010). Recent studies have demonstrated that language-mediated shifts of attention to only partially matching referents in the visual field are even present in children as young as 3 years of age. For example, when 36-month-olds are asked to look at a strawberry, they tend to look at the red as opposed to the yellow plane (Johnson & Huettig, 2011; for similar effects in adults, see Huettig & Altmann, 2004, 2011).

Although language-mediated shifts of visual attention appear to be robust and to emerge early, the role of lexical knowledge in this process is not yet clear. Take, for example, shifts in attention to colour-matched distractors in the visual field. When a listener momentarily fixates a four-leaf clover upon hearing the word "frog", is this behaviour driven indirectly, through lexical knowledge of the colour label *green*? Or is it driven directly by the conceptual attribute "green" that is shared between the named and the seen object? In other words, when listeners hear the word "frog", do they retrieve the colour label *green*, which leads them to look at green things in the environment? Or do listeners, upon hearing the word "frog", retrieve the concept "green" (i.e., not the colour label), which then leads directly to a match with other items sharing this attribute in the visual surroundings? This question is difficult to address in adults, since most adults have a verbal descriptor for the colour concept "green". Children two years of age and under, however, typically lack reliable colour term knowledge (e.g., Bornstein, 1985; Johnson, 1977). Thus, by testing toddlers, one can address whether language-mediated shifts in attention are mediated by stored attribute labels.

Here we tested whether 24-month-olds exhibit shifts in overt attention to objects that match a named but missing referent along a perceptual dimension that the children do not yet have a verbal label for. That is, we asked whether a child who does not yet know the colour label "red" will nonetheless tend to fixate a red object longer than a blue object upon hearing the word "strawberry". If 2-year-olds who lack colour label knowledge show the same type of language-mediated shifts in visual attention to colour matched distractors as older children and adults have been shown to exhibit, then this would suggest that these attentional shifts are driven via a direct rather than an indirect route (i.e., that no mediation by colour label knowledge is necessary).

We compared target-absent trials testing toddlers' colour-label knowledge with those testing their knowledge of semantic categories (animal and food categories). We expected on the basis of prior research (e.g., Hudson & Nelson, 1984; Styles & Plunkett, 2009) that 24-month-olds would probably be able to use semantic knowledge to direct visual attention (e.g., to look at a dog rather than a shoe when hearing "Can you find the crocodile?"). We could thus also test whether there was any difference in the time course of eye movements between those driven by colour knowledge and those driven by semantic knowledge.

Method

Participants

Forty-eight Dutch-learning toddlers (average age: 751 days; range: 732 days to 766 days; 16 females) from the Nijmegen area of the Netherlands were tested. The data from 6 additional toddlers were excluded due to extreme fussiness (3), technical difficulties (2), or colour blindness in the immediate family (1).

Stimuli

All audio materials were digitally recorded in a child-directed manner by a female native Dutch speaker. Sixteen Dutch words typically learned early in childhood were chosen for use as verbal targets: six food words characterized by a typical colour (e.g., *aardbei*, "strawberry"), six animal words characterized by a typical colour (e.g., *kikker*, "frog"), and four words lacking a typical colour (e.g., *tafeltje*, "table"). An additional eight objects were chosen for use in filler trials (e.g., *boekje*, "book"). The main test trials were recorded in the sentence frame *Kun je de/het ____ vinden?*, "Can you find the ____?". Filler trial targets were recorded in a variety of frames (e.g., *Vind je de/het ___ leuk?*, "Do you like the ____?"). Additional questions asking for each of the seven colours of the typically coloured objects (e.g., *groen*, "green") were recorded in the sentence frame *Waar is de ___e?*, "Where is the ___ one?".

Design

Participants were randomly assigned to one of six test lists. All lists included four target trials, four related distractor trials, four unrelated distractor trials, seven filler trials, and seven colour trials (one trial for each colour tested; see Appendix for further details). Each child received one of each kind of four different types of distractor trials: one semantically matched animal distractor (SA), one semantically matched food distractor (SF), one colour-matched animal distractor (CA), and one colour-matched food distractor (CF). The conditions were counterbalanced so that no single participant was ever asked to find a particular target more than once.

Procedure

Twelve 4.5-min videos (6 lists, 2 orders each) were created containing 19 noun trials (12 test trials, 7 fillers) followed by 7 colour trials. Children received a pseudorandom pairing of colours during the colour label phase of the experiment (e.g., for some children, brown and purple were paired, and for other children, brown and green were paired; see Appendix for further details). The main experimental trials lasted 8 s, and target word onsets occurred 4 s after the pictures appeared (average target word duration = 629 ms). Colour labelling trials lasted 6 s, and target word onsets occurred 3 s after the pictures appeared (average target word duration = 721 ms). The test videos were exported to digital tape for playback on a digital video recorder during the experiment. Colour label trials were made shorter than the main experimental trials because the visual stimuli presented in the former trials were more repetitive and simpler than those presented in the latter trials.

Participants sat on a caregiver's lap. They each viewed one of the videos, presented on a 192-cm Sony LCD TV with built-in speakers. The screen was about 1 metre from the chair where the caregiver and participant were seated. Pictures were separated by 15 cm and were displayed at approximately a quarter of the height and width of the monitor. Each video began with four blocks of target noun trials that were presented in a pseudorandomized order within those blocks. During target trials, toddlers were asked to look at one of two pictures of objects on a screen (e.g., toddlers would hear "look at the elephant" while viewing an elephant and a pink boot). During related distractor trials and unrelated distractor trials, toddlers were asked to look at a missing referent while viewing two objects. During related distractor trials, one of the two pictured objects always shared an attribute (either a colour or a semantic relationship) with the named missing referent. During unrelated distractor trials, neither picture was related to the named missing referent. Note that the images shown during these trials were identical to those shown during the related distractor trials. The only difference was that the named missing referent bore no relationship to either pictured object. Thus, by comparing toddler's looking behaviour during related versus unrelated distractor trials, we could see how the stored lexical attributes of the named missing referent drove looking behaviour. Finally, during the second half of the experiment, toddlers were presented with colour label trials in which they would be asked to look at one of two smiley faces that were identical in all ways besides colour (e.g., toddlers would hear "look at the red one" while viewing a red and a yellow smiley face). Colour pairs were presented in random order, with each child being asked once to find each of seven colours. The children's eye movements during the experiment were recorded to digital video (DV) for offline coding. Caregivers listened to masking music over Sennheiser Noiseguard headphones.

After the experiment, the caregivers of the participants completed a vocabulary questionnaire. They were also asked to indicate whether their child knew any of the colour labels used in the main experiment and how accurately those colour labels were used.

Coding

The DV recordings of the children's eye movements were transferred from DV tape to computer. Testing sessions were then coded with the volume muted. The onsets and offsets of test trials were clearly visible due to lighting changes in the video. Each 40-ms frame of the test trials was coded as a look to the left picture, the right picture, or neither picture (see Johnson & Zamuner, 2010, for further details). Six of the videos were randomly chosen to be recoded by a second coder, and mean coding reliability was found to be acceptably high (91%).

Results and discussion

Figure 1 shows fixation proportions to targets broken down by trial type. In target trials, the target was the object that the child was requested to find. For related distractor trials, the target was defined as the object sharing an attribute with the named missing referent (either colour or category). In unrelated distractor trials, the target was defined as the object that served as the target in the visually matched related distractor trial.

For the statistical analyses, we computed the ratio between the proportion of fixations to the target and the sum of the target- and distractor-fixation proportions (see Huettig & McQueen, 2007; Johnson & Huettig, 2011). A ratio greater than .5 shows that the targets were preferred over the distractors. Direction of eye gaze was analysed over three time windows. The 4,000 ms of display exposure before target word onset served as the baseline. We calculated mean ratios during the baseline region to adjust for any bias in overt attention to a type of object before information from the critical word became available. Comparing these baseline ratios with the mean target/distractor ratios during later time regions allows us to test for any shifts in overt attention to particular types of objects at those times. The second time window ranged from word onset to 1,000 ms after this onset (to assess immediate shifts in eye gaze); the third window lasted from 1,001 to 2,000 ms after word onset (to assess later shifts).

A 2 × 2 repeated measures analysis of variance (ANOVA) revealed significant main effects of trial type, $F(2, 94) = 25.73$, $p < .001$, and of time window, $F(2, 94) = 16.51$, $p < .001$, and a significant trial type by time window interaction, $F(4, 188) = 8.41$, $p < .001$.

Paired t tests showed that the difference between mean target/related distractor ratio in the baseline region in the target trials (.54) and the mean ratio in the word onset to 1,000-ms time region (.60) approached significance, $t(47) = -1.82$, $p = .076$. The mean baseline related distractor trial ratio (.50) did not differ from the mean ratio during the word onset to 1,000-ms window (.51), $t(47) = -0.41$, $p > .1$. Similarly, the mean baseline unrelated distractor trial ratio (.52) did not differ from the mean ratio during the word onset to 1,000-ms window (.52), $t(47) = 0.19$, $p > .1$. These data suggest that, on hearing the critical spoken words, participants tended to shift their eye gaze immediately towards the targets in the target trials. There was no corresponding shift in the related distractor and unrelated distractor trials.

The difference between the mean baseline target trial ratio (.54) and the mean ratio during the 1,001–2,000-ms window was significant (.78), $t(47) = -6.34$, $p < .001$. Importantly, the baseline ratio for the related distractor trials (.50) differed from the related distractor trial ratio in the 1,001–2,000-ms window (.61), $t(47) = -3.31$, $p = .002$. However, the baseline unrelated distractor trial ratio (.52) did not differ from the corresponding ratio in the 1,001–2,000-ms window (.50),

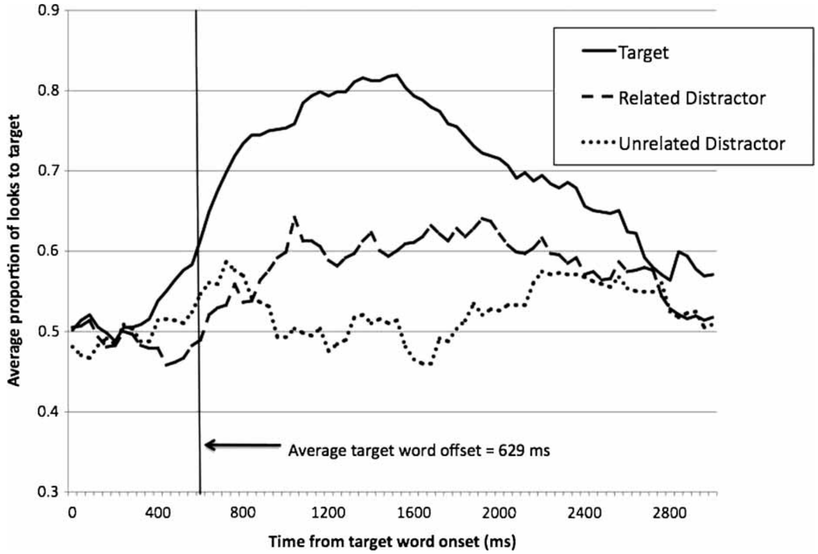

Figure 1. *Average proportion of looks to target as a function of time following target word onset.*

$t(47) = 0.65$, $p > .1$. These results suggest that the 24-month-olds understood the target words used in the experiment and looked to visually presented distractors that were either colour or semantically related to the named absent target (see Figure 1).

The results of the parental report questionnaire also indicated that the toddlers understood most targets. Parents completed vocabulary lists (including, e.g., the standard McArthur–Bates inventory; Dale & Fenson, 1996), which contained 10 of the 12 target words. On average, 88% of these target words were identified as being in the children's receptive vocabulary. Parental report of vocabulary knowledge may overestimate or underestimate a child's actual knowledge (e.g., Tomasello & Mervis, 1994), and preferential-looking data may be more reliable (e.g., Houston-Price, Mather, & Sakkalou, 2007). Nevertheless, the parental reports confirmed the results of the fixation analysis: Most of the 24-month-olds probably knew most of the target words.

It is conceivable that toddlers may behave differently on colour related distractor trials than on semantically related distractor trials. Thus we further broke down our related distractor trial analysis by type of distractor (colour or semantic). In the colour related and semantically related distractor trials there were no significant differences between mean fixation ratios in the baseline region and the word onset to 1,000-ms window. Paired *t* tests showed that the mean ratios during the baseline region in the colour related distractor trials (.44) differed significantly from those in the 1,001–2,000-ms window (.59), $t(47) = -2.7$, $p = .01$. Similarly, the mean ratios for the baseline region in the semantically related distractor trials (.53) differed significantly from those in the 1,001–2,000-ms window (.62), $t(47) = -2.3$, $p = .025$. These data suggest that colour-mediated and semantically mediated shifts in eye gaze had a similar time course (see Figure 2).

Next we turn to an analysis of the colour label trials presented during the second half of the experiment. In this case, target objects were defined as the smiley face bearing the mentioned colour (e.g., the red smiley face when hearing "look at the red one"). Proportion of looks to the target during the baseline region and the two subsequent critical time regions did not differ significantly for five out of the seven colours tested: orange, red, brown, pink, and yellow. For the colour grey, participants fixated the target more during the onset to 1,000-ms window, $t(46) = 2.16$, $p = .036$, and

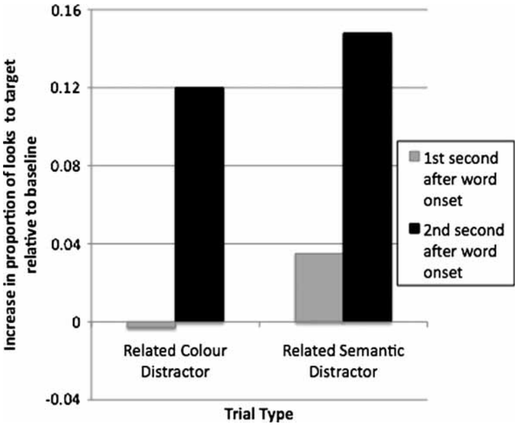

Figure 2. *Change in proportion of looks to target relative to baseline during related distractor trials broken down by trial type.*

the 1,001–2,000-ms window, $t(46) = 1.97$, $p = .055$, than the baseline region. For the colour green, the difference in looks to the target between the baseline and the onset to 1,000-ms windows approached significance, $t(43) = 1.73$, $p = .09$; for the 1,001-ms to 2,000-ms time region there was no significant difference. These results suggest that our 24-month-old participants comprehended at most two of the seven colour terms tested in the study.

Since the main goal of the experiment was to examine how toddlers who had no knowledge of colour labels performed on colour related distractor trials, however, we reanalysed toddler's fixations on the colour related distractor trials with all trials involving objects that were grey or green excluded. In this case, the results looked exactly as they had when trials involving grey and green objects had been included. There was no significant difference in mean ratios between the baseline (.37) and onset to 1,000-ms windows (.37), $t(47) = 0.03$, $p > .1$. There was, however, a robust difference between the baseline and 1,001–2,000-ms windows (.55), $t(47) = -3.13$, $p = .003$.

Our primary data come from the preferential-looking task, and therefore the best test of whether toddlers' colour-label knowledge could influence performance in that task should be based on preferential looking too, as in the above analysis. As noted above, parental report may overestimate or underestimate toddler knowledge (e.g., Houston-Price et al., 2007; Tomasello & Mervis, 1994). Nevertheless, in a final analysis we considered the toddlers' performance on the colour related distractor trials in the light of the parental reports of their knowledge and use of colour labels. The parents of 18 of the participants indicated that their child did not yet say any colour terms. Even if a child uses a colour term, however, he or she may not use it correctly. For example, a child might say red is their favourite colour but when asked to pick up the red ball they might pick up a blue ball. Or a child may memorize the phrase "yellow duckie" without actually understanding what the term "yellow" means. Our parental report data indicated that the children in our study did indeed not have firm colour-label knowledge. Only 12 of the 48 children were reported to use more than one colour term correctly, at least most of the time (but note that using a term correctly only "most of the time" still does not indicate that the child necessarily has full and reliable comprehension). Five children were identified as being able to use correctly (most of the time) the two colour terms associated with the related distractor targets that they heard in the main experiment. An additional two children used one of these colour terms correctly most of the time. According to parental report, therefore, there was in only 12 out of 96 trials (2 trials for each of the five children, 1 trial for each of the other two children) a reasonably high risk that the child could use relevant colour-label knowledge reliably. Even if we exclude these 12 trials (and trials involving grey and green objects) from our dataset, we still observe the same overall pattern of results. There was a robust difference between the mean ratios during the baseline region (.36) and the 1,001–2,000-ms windows (.58), $t(42) = -3.74$, $p = .001$. Children look to colour-matched competitors even if they do not know the label for that colour.

Conclusion

Listeners naturally recognize partial perceptual–conceptual matches between heard words and seen objects. For example, when asked to find an object with a typical colour, listeners will look more to a colour-matched distractor than to an unrelated distractor. The present results replicate previous findings (36-month-olds, Johnson & Huettig, 2011) with an even younger age group (i.e., 24-month-olds). More importantly, here we tested children lacking colour term knowledge to investigate whether these visual shifts in attention are lexically mediated. That is, would a listener who is unable to verbally encode the specific relationship between a spoken referent and a seen object nonetheless recognize the perceptual–conceptual commonality between the two and exhibit language-mediated shifts in visual attention during online listening?

Our test of colour label knowledge was unlike most past studies of colour label knowledge in young children in that it did not require children to produce colour labels verbally (e.g., Johnson, 1977) or produce a motor response such as pointing to the correct object (e.g., Davidoff & Mitchell, 1993; Gleason, Fiske, & Chan, 2004). Parental report suggested that a minority of the children knew and used some colour labels (though not consistently). The toddlers' tendency to look at objects with the colour associated with the word they heard remained, however, even after exclusion of trials where the toddler may have had some colour-label knowledge.

The most important finding, however, which circumvents the issues of exactly which toddlers knew which (few) colour labels and how well they did so, was the clear within-toddler dissociation we observed in the preferential-looking task. Our eye tracking results showed that words such as "banana" (typically yellow) resulted in shifts in visual attention to yellow things but colour words such as "yellow" did not. This demonstrated that hearing names of concrete objects with a prototypical colour evoked colour attributes and influenced visual orienting, whereas this was not the case for colour names. Language-mediated shifts in visual orienting must therefore be (at least partially) independent of knowing colour labels—that is, such shifts are not necessarily mediated by stored lexicalized labels. When a toddler who does not understand the colour term yellow is asked to find a banana, they will probabilistically fixate a yellow object more than an object of another colour even though they cannot verbally encode the colour property shared by the named and seen objects. Although older children tend to rely on verbal encoding to remember how familiar objects are typically coloured (Davidoff & Mitchell, 1993; Gleason et al., 2004), it appears that two-year-olds already have implicit knowledge about object colour.

Adults may have both direct and indirect routes linking colour attributes of words such as "frog" to colour concepts such as green. If so, it is difficult to say which developed first and hence whether the direct route existed before the acquisition of colour terms made development of the indirect route possible. By testing children who do not yet have colour terms, we have demonstrated that, at least for colour, the direct route exists before the indirect route has had a chance to develop. These findings thus make an important contribution to our understanding of how listeners integrate information arriving simultaneously through visual and speech channels. Perceptual–conceptual knowledge about colour can determine toddlers' language-mediated behaviour before they have colour words.

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APPENDIX
Test lists

List	*Trial condition*	*Pictured objects*	*Named target*[a]
1	Target	blue bike, banana	banana
1	Target	strawberry, blue chair	strawberry
1	Target	frog, red plane	frog
1	Target	pink boot, elephant	elephant
1	Unrelated distractor	turtle, aqua trousers	table
1	Unrelated distractor	blue ball, brown bag	soap
1	Unrelated distractor	flower, grapes	telephone
1	Unrelated distractor	orange couch, toothbrush	house
1	Related distractor (SA)	shoe, dog	crocodile
1	Related distractor (CA)	brown mitten, pink bottle	monkey
1	Related distractor (CF)	green glasses, brown sock	chocolate
1	Related distractor (SF)	loaf of bread, hat	tomato
1	Colour label	yellow, grey	grey
1	Colour label	brown, pink	brown
1	Colour label	green, red	red
1	Colour label	yellow, grey	yellow
1	Colour label	green, red	green
1	Colour label	brown, pink	pink
1	Colour label	purple, orange	orange
2	Target	banana, blue bike	banana
2	Target	blue chair, strawberry	strawberry
2	Target	red plane, frog	frog
2	Target	elephant, pink bottle	elephant
2	Unrelated distractor	turtle, aqua trousers	soap
2	Unrelated distractor	yellow couch, flowers	telephone
2	Unrelated distractor	ball, pink bag	table
2	Unrelated distractor	toothbrush, sandwich	house
2	Related distractor (CF)	blue hat, red mitten	tomato
2	Related distractor (SA)	pink bottle, yellow dog	monkey
2	Related distractor (CA)	green sock, shoe	crocodile
2	Related distractor (SF)	apple, green glasses	chocolate
2	Colour label	red, orange	orange
2	Colour label	brown, green	green
2	Colour label	red, orange	red
2	Colour label	purple, grey	grey
2	Colour label	brown, green	brown
2	Colour label	pink, yellow	pink
2	Colour label	pink, yellow	yellow
3	Target	shoe, crocodile	crocodile
3	Target	green glasses, chocolate	chocolate
3	Target	monkey, pink bottle	monkey
3	Target	tomato, blue hat	tomato
3	Unrelated distractor	green truck, red plane	soap
3	Unrelated distractor	pink boot, fish	telephone
3	Unrelated distractor	blue bike, yellow t-shirt	table
3	Unrelated distractor	cookies, blue chair	house
3	Related distractor (CF)	orange couch, toothbrush	orange (the fruit)
3	Related distractor (SA)	turtle, aqua trousers	pig

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Appendix (*Continued.*)

List	*Trial condition*	*Pictured objects*	*Named target*[a]
3	Related distractor (SF)	flower, grapes	chips
3	Related distractor (CA)	blue ball, brown bag	deer
3	Colour label	orange, pink	pink
3	Colour label	red, grey	red
3	Colour label	orange, pink	orange
3	Colour label	red, grey	grey
3	Colour label	yellow, green	green
3	Colour label	yellow, green	yellow
3	Colour label	purple, brown	brown
4	Target	chocolate, green glasses	chocolate
4	Target	blue hat, tomato	tomato
4	Target	pink bottle, monkey	monkey
4	Target	crocodile, shoe	crocodile
4	Unrelated distractor	blue chair, red cup	soap
4	Unrelated distractor	cookies, blue bike	house
4	Unrelated distractor	grey truck, pink boot	table
4	Unrelated distractor	red plane, bird	telephone
4	Related distractor	turtle, aqua trousers	deer
4	Related distractor	yellow couch, flower	chips
4	Related distractor	blue ball, pink bag	pig
4	Related distractor	toothbrush, sandwich	orange (the fruit)
4	Colour label	brown, yellow	brown
4	Colour label	pink, red	red
4	Colour label	grey, green	grey
4	Colour label	pink, red	pink
4	Colour label	grey, green	green
4	Colour label	brown, yellow	yellow
4	Colour label	orange, purple	orange
5	Target	pig, aqua trousers	pig
5	Target	ball, deer	deer
5	Target	orange, toothbrush	orange (the fruit)
5	Target	flower, chips	chips
5	Unrelated distractor	shoe, dog	table
5	Unrelated distractor	green glasses, brown sock	soap
5	Unrelated distractor	brown mitten, pink bottle	house
5	Unrelated distractor	loaf of bread, blue hat	telephone
5	Related distractor (CA)	green truck, yellow plane	frog
5	Related distractor (SF)	cookies, blue chair	strawberry
5	Related distractor (SA)	pink boot, fish	elephant
5	Related distractor (CF)	blue bike, yellow t-shirt	banana
5	Colour label	pink, green	pink
5	Colour label	red, yellow	yellow
5	Colour label	pink, green	green
5	Colour label	brown, orange	brown
5	Colour label	grey, purple	grey
5	Colour label	brown, orange	orange
5	Colour label	red, yellow	red

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Appendix (*Continued.*)

List	*Trial condition*	*Pictured objects*	*Named target*[a]
6	Target	chips, flower	chips
6	Target	deer, aqua trousers	deer
6	Target	toothbrush, orange	orange (the fruit)
6	Target	blue ball, pig	pig
6	Unrelated distractor	pink bottle, dog	table
6	Unrelated distractor	blue hat, red mitten	soap
6	Unrelated distractor	green sock, shoe	telephone
6	Unrelated distractor	apple, green glasses	house
6	Related distractor (CA)	grey truck, pink boot	elephant
6	Related distractor (SA)	red plane, bird	frog
6	Related distractor (CF)	blue chair, red cup	strawberry
6	Related distractor (SF)	cookies, blue bike	banana
6	Colour label	purple, red	red
6	Colour label	orange, yellow	orange
6	Colour label	green, grey	green
6	Colour label	pink, brown	brown
6	Colour label	pink, brown	pink
6	Colour label	orange, yellow	yellow
6	Colour label	green, grey	grey

Note: CA = colour-matched animal distractor. SA = semantically matched animal distractor. CF = colour-matched food distractor. SF = semantically matched food distractor.
[a]Named targets translated into English.