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PAPER

Young children's use of features to reorient is more than just associative: further evidence against a modular view of spatial processing

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Abstract

Proponents of a geometric module have argued that instances of young children's use of features as well as geometry to reorient can be explained by a two-stage process. In this model, only the first stage is a true reorientation, accomplished by using geometric information alone; features are considered in a second stage using association (Lee, Shusterman & Spelke, 2006). This account is contradicted by the data from two experiments. Experiment 1a sets the stage for Experiment 1b by showing that young children use geometric information to reorient in a complex geometric figure without a single principal axis of symmetry (an octagon). In such a figure, there are two sets of geometrically congruent corners, with four corners in each set. The addition of a colored wall leads to the existence of three geometrically congruent but, crucially, all unmarked corners; using the colored wall to distinguish among them could not be done associatively. In Experiment 1b, both 3- and 5-year-old children showed true non-associative reorientation using features by performing at above-chance levels on all-white trials. Experiment 2 used a paradigm without distinctive geometry, modeled on Lee et al. *(2006), involving an equilateral triangle of hiding places located within a circular enclosure, but with a large stable feature rather than a small moveable one. Four-year-olds (the age group studied by Lee* et al.*) used features at above-chance levels. Thus, features can be used to reorient, in a way not dependent on association, in contradiction to the two-stage version of the modular view.*

Introduction

All mobile animals face the challenge of establishing and maintaining spatial orientation. Recently, there has been a debate concerning whether reorientation, following disorientation that eliminates the usually ongoing sense of orientation based on internal tracking of movement, depends on a *geometric module* (e.g. Hermer & Spelke, 1996; see Cheng & Newcombe, 2005, for an overview). Evidence in favor of modularity in non-human animals and young children has come from findings that show that geometric information regarding the shape of a surrounding enclosure is used to reorient, but that featural (i.e. nongeometric) information, such as the color of surfaces, is not used even when it would be helpful. However, more recent studies have shown that use of features is evident in situations that increase their salience or diagnostic value, such as larger enclosure size (e.g. Chiandetti, Regolin, Sovrano & Vallortigara, 2007; Learmonth, Nadel & Newcombe, 2002; Vallortigara, Feruglio & Sovrano, 2005), and an adaptive combination model has been proposed in which geometry and features are flexibly combined as appropriate to achieve reorientation (Newcombe & Ratliff, 2007). Such combinatory models are common in thinking about spatial cognition (Cheng, Shettleworth, Huttenlocher & Rieser, 2007).

There is, however, a recent article that attempts to rescue the geometric modularity proposal. Lee, Shusterman and Spelke (2006) suggest that there are two separable systems of spatial processing, and that only the geometric system is used for reorientation *per se*. In their view, features are used only associatively. To support this argument, they disoriented 4-year-old children in an all-white circular space containing three hiding containers arranged as an equilateral triangle. One of the containers had a distinctive color and shape. However, although children could find objects hidden in the distinctive container, they failed to use it to choose between the two other identical containers. Based on this finding, Lee *et al*. argue that 'search behavior following disorientation depends on two distinct processes: a modular reorientation process … and an associative process that directly links landmarks to locations' (p. 581). The ultimate claim here is two-fold: true reorientation, defined as re-establishing one's location

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and directional bearings in order to navigate to several new points, is only possible using geometric properties of the surroundings and *cannot* be accomplished using features. A second process allows features to be directly associated with a response (e.g. the cookies are in the cookie jar); however, this is not reorientation because only one specific location is learned and no directional headings or sense relations can be established from this process. Essentially, feature use during reorientation is *not* possible according to the modular view, and features are utilized only in the secondary process of directly associating an unambiguous cue with a response.

It might be argued that prior data already contradict the two-stage associative account. Specifically, Learmonth, Newcombe and Huttenlocher (2001) showed that children's search for an object hidden in an all-white corner of a rectangle with one blue wall was as good as their search for an object hidden in the blue-and-white corner; it may seem initially that the all-white corner provides no associative cue for such performance. However, that characterization is not correct. In a rectangular room, there is only *one* all-white corner that is geometrically correct, so 'all whiteness' marks the corner as distinct from the geometrically correct alternative as much as 'blue and whiteness' marks the other geometrically congruent corner as correct. In fact, 'all white' is used as one of the pieces of encoded information in a recent associative model of the reorientation task (Miller & Shettleworth, 2007).

More recently, studies using square rooms have shown that toddlers, 18 to 24 months old, do use features in the absence of geometric information when features are relational, as with size of circles on the wall (Huttenlocher & Lourenco, 2007). Even when features are categorically distinct, as with different colored walls, features may be used; Nardini, Atkinson and Burgess (2008) found that 18- to 24-month-olds do use color to reorient in a square enclosure, in addition to symmetric and asymmetric patterns on the wall. However, these cases of feature use among young children are still susceptible to a rebuttal of the Lee *et al.* sort, because the four corners are equally 'marked' in these symmetric spatial layouts. Thus, there is a distinct cue to associate with the target location.

Lee *et al.*'s failure to find that 4-year-olds use features to reorient may, however, reflect the fact that the feature they used was extremely proximal to the layout (in fact, was part of it) and that the feature was obviously moveable. Distal landmarks are known to be more useful than proximal ones for spatial functioning in general and reorientation in particular (Learmonth, Newcombe, Sheridan & Jones, 2008; Nadel & Hupbach, 2006). Moveable landmarks are less likely to be used to guide spatial search than landmarks that are larger and apparently unlikely to move (Gouteux, Thinus-Blanc & Vauclair, 2001; Presson & Montello, 1988). In this paper, we address the issue of whether larger and more distal features can be used for true reorientation, in a non-associative fashion, using two methods. First, in Experiment 1b, we assessed whether a colored wall in an octagonal enclosure facilitates choice among the three all-white geometrically congruent corners. Such a finding would suggest that features are *not* simply used in a second stage of choice in a search task. Rather, the feature must be serving to disambiguate corners that are not directly marked; hence, the feature can be inferred to organize the whole space rather than just local aspects of it. Second, in Experiment 2, we examined performance in a situation more closely comparable to that used by Lee *et al.* in which there was no distinctive geometry at all; hiding places were laid out to form an equilateral triangle within a circular enclosure. However, we used a larger and more stable-appearing feature than their moveable container.

In order to pave the way for Experiment 1b, we began by examining performance in an all-white octagon in Experiment 1a, in order to be sure that children can use geometry in such a space. An octagon has more sides and more angles than any enclosure previously used in this literature to date. The angles are all obtuse, rather than the right angles of rectangles or squares, the acute angles of the triangles used so far (e.g. Lourenco & Huttenlocher, 2006), or the mixture of acute and obtuse angles in a rhombic environment (Hupbach & Nadel, 2005).

Experiment 1a

This experiment was designed to investigate whether young children would be sensitive to the complex geometry of an octagonal enclosure. In addition, Cheng and Gallistel (2005) have proposed that a shape parameter defined around a principal axis may underlie geometric coding rather than exact local information. An octagon is radially symmetric and hence has no single axis of principal symmetry. Thus, Experiment 1a also evaluated this claim.

Method

Participants

There were 26 2-year-old children (13 females, mean age 31 months, range 25–36 months) and 29 3-year-old children (19 females, mean age 40 months, range 36–47 months) in this experiment. All participants were obtained from a commercially available list. Four additional participants were discarded from data analyses because they refused to complete the task (n = 3) or as a result of non-compliance with experimental procedures (n = 1).

Apparatus

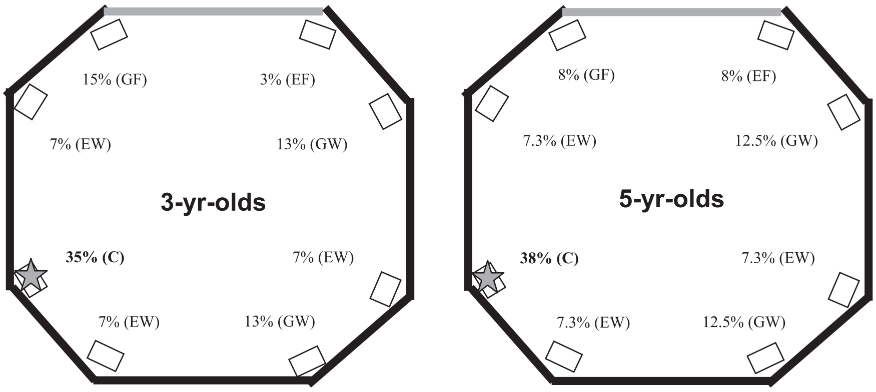
The experiment was conducted in a room defined by sheets suspended from the ceiling, creating four wide panels (4.83 ft) alternating with four narrow panels

(3 ft). The suspended panels created a 74.9 square foot enclosed octagonal-shaped space that was 9 ft in diameter and 6 ft tall. All walls were white and the ceiling was covered by navy fabric. The sheet panels were stapled to the floor and fastened together so they held taut. Identical clip lamps hung from the frame in each corner and four radios tuned to the same station and set at the same volume were placed in each corner of the actual room behind the walls. The floor was covered with uniform industrial carpet without any distinctive markings. Eight opaque grey plastic boxes were placed in the eight corners of the enclosure to serve as hide boxes. They were positioned at a 45 degree angle from the wall such that the front faced the center of the room. A small toy duck was used as the search object.

Procedure

The children came into the playroom waiting area and played with toys provided while the parent signed the consent forms and the experimenter explained the experimental procedure. When the child was ready, the experimenter led the child into the octagonal room. The long fabric wall at the bottom of the octagon in Figure 1 opened to allow entry into the search arena. Once inside the space, the experimenter sealed the wall shut so that the walls were uniform. If a child was apprehensive, the parent was asked to come with the child into the experimental room until the child was comfortable and then returned to the waiting area. In a very small number of cases (two children), the parents remained with the child during the session. In this rare situation, the parent stood behind the experimenter and both adults rotated in tandem to prevent the parents from assisting their child. The experimenter explained to the child that the toy duck would be hidden in only one box and that all other boxes were empty. Then the child was asked to hide the toy in a randomly predetermined box and shut the lid. The experimenter then explained that the child would close his or her eyes while she turned him or her in a circle, and then the child would be asked to indicate which box contained the duck. Once the experimenter received oral consent from the child, she began the disorientation procedure. The experimenter ensured the child's eyes were closed and turned him or

(A) *Target hidden in white corner*



(B) *Target hidden in red corner*

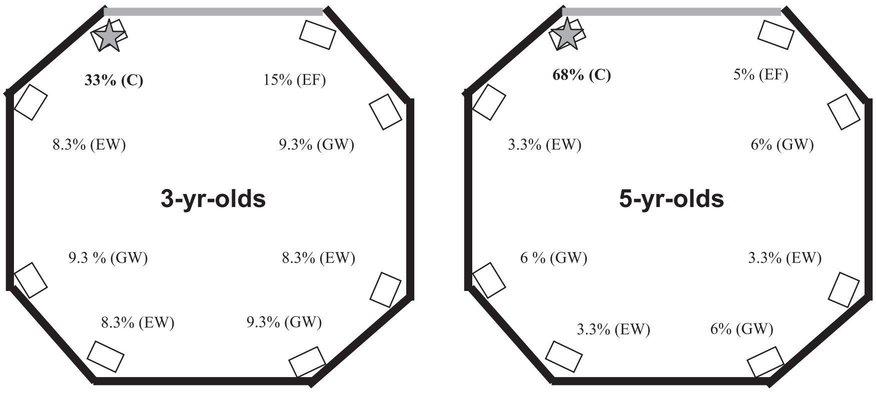


Figure 1 *Mean percentage of searches at each corner (correct search indicated by the star) for 3- and 5-year-olds in Experiment 1b when (A) the hiding box was in an all-white corner and (B) the hiding box was in a red corner. Corners were coded as correct (C), geometrically correct in a white corner (GW) or in a featured corner (GF), or error in an all-white corner (EW) or in a featured corner (EF). Percentages other than the correct percentage represent averaged searches to boxes within a category (e.g. for white corner hide box, GW for 3 yrs = 26%/2 = 13%; for red corner hide box, GW for 5 yrs = 18%/3 = 6%).*

her by the shoulders until the child had made a minimum of four full rotations. The experimenter stood behind the child at the end of the disorientation procedure and stopped the child's rotation such that the child faced a different wall (e.g. counterbalanced for order) on each of the four trials. The child was then immediately encouraged to search for the toy duck. The child was either congratulated if he/she succeeded or immediately shown which box was correct if he/she did not succeed on the first attempt. The process was then repeated three more times.

Results and discussion

The four search trials for each child were coded as correct (C) when children searched at the box with the duck, geometrically correct (GC) when they searched at the other three geometrically equivalent corners, or as errors (E). For 2-year-olds, C, GC and E choices occurred at the following rates: 22% (*SD* = 23%), 45% (*SD* = 26%), and 33% (*SD* = 25%). For 3-year-olds, the rates were similar: 23% (*SD* = 24%), 48% (*SD* = 27%), and 28% (*SD* = 26%).

To assess whether children can use geometry to reorient in a complex and radially symmetric space, we compared the sum of children's correct and geometrically correct searches to chance performance (50%). Both ages performed at levels reliably greater than chance, 67% vs. 50% for 2-year-olds and 72% vs. 50% for 3-year-olds, $t(25) = 3.49$, $p = .002$, and $t(28) = 4.53$, $p < .0005$, respectively. The difference between the age groups was not significant. Thus, both age groups did use geometry.

An additional analysis of methodological importance was performed to assure that children were disoriented. Children's correct searches were compared to the average of the geometrically correct searches (GC/3). Disoriented children should not be able to choose the correct box in a featureless room at greater than chance levels. C choices were not significantly greater than GC averages at either age (2-year-olds: 22% vs. 15%, $t(25) = 1.59$, $p = .123$; 3-year-olds: 23% vs. 16%, $t(28) = 1.63$, $p = .114$).

Thus, this experiment shows that very young children can reorient using the geometry of a many sided space with obtuse angles, and disputes the notion that a single axis of principal symmetry is the means by which geometry has an effect. It is interesting that children as young as 2 years succeed, given that Hupbach and Nadel (2005) found that it was not until 4 years that children could use the distinctive angular information in a rhombus; overall, the available data on use of geometry suggest that wall length is a more distinctive feature than size of angle, which is the only source of information in the rhombus (Hupbach & Nadel, 2005). Most crucially, however, the results of Experiment 1a lay a foundation for Experiment 1b, whose aim was to investigate children's use of features to reorient in a non-associative fashion.

Experiment 1b

Experiment 1b was conducted to investigate whether children use a stable feature to distinguish a correct hiding box in a white corner from the two other all-white and geometrically correct corners. As a comparison, we also assessed their ability to find the correct hide box when it was adjacent to the colored wall. We used 3- and 5-year-old children in order to span the age range used by Lee *et al.* (2006) and obtain a developmental perspective.

Method

Participants

There were 27 3-year-old children (16 females, mean age 43 months, range 36–47 months) and 26 5-year-old children (11 females, mean age 65 months, range 60–71 months) in this experiment. Data from two additional children had to be discarded due to failure to complete the task or experimenter error.

Procedure

The apparatus and procedure were the same as in Experiment 1a, except that one wide wall panel was covered with a red sheet. Again, there were a small number of cases (three children) for whom the parents remained with the child during the session.

Results and discussion

Responses were coded as correct (C), geometrically correct (in a white corner = GW or in a featured corner = GF), or error (in an all-white corner = EW or in a featured corner = EF). See Table 1 for descriptive statistics and Figure 1 for 3- and 5-year-olds' search patterns.

To assess whether the geometric sensitivity found in Experiment 1a was replicated, we compared the sum of the C and GC choices to chance performance (50%). Both 3- and 5-year-olds performed better than chance (70% vs. 50%, $t(26) = 3.50$, $p = .002$, and 76% vs. 50%, $t(25) = 4.92$, $p < .0005$).

To assess the crucial question of whether children are able to use a feature to reorient, we examined whether participants in the white corner conditions searched in the correct box at higher rates than chance performance. We compared C searches to the average of the two GW searches. Both age groups were successful at finding the correct box: 3-year-olds: 35% C vs. 13%, $t(16) = 3.66$, $p = .002$; 5-year-olds: 38% C vs. 12.5%, $t(15) = 4.90$, $p < .0005$. There was no age-related difference.

To evaluate performance when the hiding location was in one of the two boxes adjacent to the red wall, we compared children's correct searches to the average of searches to the three all-white corners (C vs. GW/3). Both

Table 1 *Mean (standard deviation) percentage of responses as a function of hiding corner type and age in Experiment 1b*

Hiding corner	Response (# Corners)	3-year-olds	5-year-olds
White	Correct (1)	35% (25)	38% (20)
	Geometrically correct	41% (26)	33% (31)
	in a white corner (2)	26% (24)	25% (27)
	in a featured corner (1)	15% (18)	8% (18)
	Error	24% (24)	30% (29)
	in a white corner (3)	21% (24)	22% (27)
	in a featured corner (1)	3% (8)	8% (12)
Red	Correct (1)	33% (26)	68% (31)
	Geometrically correct	28% (28)	18% (17)
	in a white corner (3)	28% (28)	18% (17)
	in a featured corner (0)	–	–
	Error	40% (38)	15% (21)
	in a white corner (3)	25% (26)	10% (17)
	in a featured corner (1)	15% (32)	5% (11)

age groups searched in the correct box more often than chance (3-year-olds: 33% C vs. 9.3%, $t(9) = 2.77$, $p = .022$; 5-year-olds: 68% C vs. 6%, $t(9) = 6.22$, $p < .0001$). In addition, comparing the white corner and the red corner conditions showed that the close proximity of the red wall to the hiding box provided the 5-year-olds with a significant boost in correct searching, 68% compared to 38% when the toy was hidden in an all-white corner, $t(18) = 2.70$, $p = .015$. However, this advantage for searching for a toy hidden adjacent to a colored wall was not evident for the 3-year-olds. There was a significant overall interaction between age and marked/unmarked hiding place, $F(1, 49) = 5.22$, $p = .027$.

These results confirm the data of Experiment 1a, showing that 3- and 5-year-olds use the geometry of a complex space without a single principal axis. In addition, and most importantly, they demonstrate the crucial theoretical point that young children do in fact rely on feature information to reorient, in a fashion that cannot depend on direct association, using the colored wall to choose among the three all-white geometrically congruent corners.

One aspect of the data that may initially seem somewhat puzzling is that 3-year-olds did not show enhanced performance when search could be directly marked by association with a colored wall. However, this finding replicates the analysis from Learmonth *et al.* (2001) that we discussed initially, and actually reinforces the case against the two-stage associative process proposed by Lee *et al.* (2006). It appears that, just as Learmonth *et al.* (2001) found no difference for 18- to 24-month-olds between all-white and partly colored corners in a rectangle, there is no analogous difference in the octagon for 3-year-olds. These data show that, if there is a contributory associative process at work at all in this paradigm, it may only appear at a later age.

Experiment 2

One potential limitation of Experiment 1b in rebutting the two-stage features-as-associative-cues proposal is that Lee *et al.* might argue that the data do not show that features can be used to reorient in the *absence* of geometry. It might be that geometry provides the crucial initial step, and that features are used in a second stage, which could not be purely associative given the data of Experiment 1b, but which might be dependent on the initial use of a first-stage reorientation using geometry. In potential support of this argument, children were unable to use a red feature wall to reorient in a square room with no unique geometry (Wang, Hermer & Spelke, 1999). Similarly, Gouteux and Spelke (2001, Experiment 6) found that a red curtain hung over one portion of a circular enclosure did not help 3-year-old children to distinguish among three identical boxes arranged to form a right angle triangle. (In this case, the arrangement of the three boxes potentially provides geometric information, but other experiments reported by Gouteux and Spelke showed that their children did not use geometric information that could be gained from the arrangement of separated objects.)

Experiment 2 was modeled on the Lee *et al.* work and used the same 4-year-old age range, but with a larger and more stable-appearing feature. There were two kinds of conditions. First, the equilateral triangle conditions (see Figure 2) were nearly identical to the arrays of Experiments 1, 4, and 5 from Lee *et al.*: same size, number of hiding locations, and position of the child in the array, The crucial difference was that, instead of the tip of the triangle serving both as a hiding location *and* as a potential reorientation cue, we hung a blanket on the circle wall to serve as the landmark. All of the search locations were identical, serving as only hiding locations. Second, the dyad condition (see Figure 2) corresponded to the Lee *et al.* paradigm if one considered that the blanket replaced the distinctive container. The boxes were located at the same distance from the landmark, and hence each search position is equated for associative strength with the landmark.

Method

Participants

Participants were 18 girls and 15 boys, ranging from 48 to 59 months and on average 53.2 months of age. The data from two boys and two girls were discarded due to experimental error (1), a failure to complete the trials (2) or discomfort during spinning (1). All of the participants were comfortable in the search space without their parents.

Apparatus and procedure

Children were led into an all-white circular chamber (diameter = 12¼ feet) through a hidden seam in the fabric. Once in the chamber, the door was sealed so that

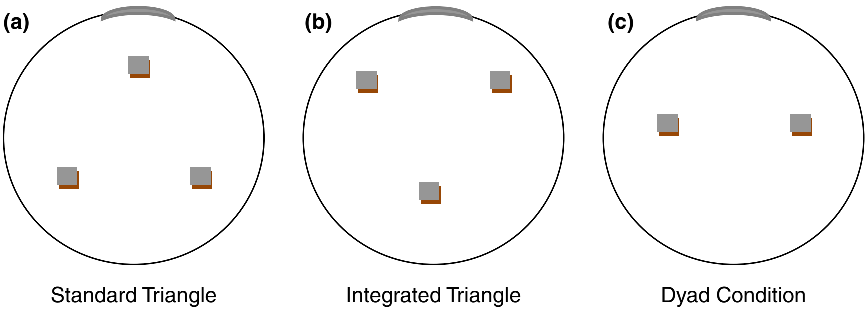


Figure 2 *Search array for Experiment 2. Within the circular search space, discrete hiding locations were placed in relation to the animal blanket affixed to the white fabric. The hiding locations form a 2 meter equilateral triangle, either with each other as in the first two conditions or with the center of the blanket as in the last condition. The experimenter and the child were always positioned in the center of the array for disorientation.*

the entire circle was uniform. The room was lit by four external 150 watt lights and four radios were placed outside of the circle, all tuned to the same classical music station. A camera was centrally mounted in the ceiling of the chamber. The experimenter led the child over to the blanket (40 w × 50 in h) and pointed out the different animals on the blanket (monkey, duck, lamb, frog, cat, and dog). The hiding toy was a duck (3½ × 2½ in) and the experimenter showed the child that there was also a duck on the blanket and that they were going to play a game of hide and seek with each other. The experimenter led the child to the center of the room and then hid the toy in one of the boxes (4½ h × 6¼ w × 7½ in) and asked the child to point to the duck and remember where it was hiding. Then the child was asked to close his or her eyes and turn in a circle. The experimenter walked in the opposite direction of the child and asked the child to stop after at least four complete revolutions. The child was stopped in between two of the boxes and was asked to make one choice. If the child made an incorrect choice, the duck was revealed.

There were either two or three potential hiding locations per condition, and the arrays are displayed in Figure 2. In the first two conditions, A and B, each container served as a hiding location once. In the last condition, where there were only two hiding boxes, the first two hiding locations were in both boxes and the last search trial was randomly assigned to either the left or right box. Thus, there were a total of nine trials per child. The presentation order of the three conditions was counterbalanced and the facing direction was randomized.

Disorientation check

To ensure that there were no external cues that could allow for reorientation, four additional children searched in a plain, all-white circle. Only the first two conditions were examined, so six trials were collected from each child. Overall accuracy was 25% and did not differ from chance levels of 33%, $t(3) = 0.55$, $p = .62$. Thus, we were confident that the disorientation process was effective and that there were no external cues available for reorientation.

Results

Conditions A and B

Overall on the triangle trials, children searched at the correct container at above chance (33%) levels (mean = 49.5%, $SD = 18.86$), $t(32) = 5.03$, $p < .001$. Proximity to the landmark did not have an effect on search accuracy, regardless of triangle part. Search did not differ when the tip of the triangle was facing either toward or away from the landmark, either for positions at the tip (where the difference was 3.03%, $SD = 72.82$), $t(32) = 0.24$, $p = .813$, or for positions at the base of the triangle (where the difference was 7.58%, $SD = 48.61$), $t(32) = 0.895$, $p = .377$. Search was marginally more accurate when the duck was hidden at a single box location (the point) rather than when there were two boxes at the same distance (the base), mean difference = 14.4%, $SD = 43.32$, $t(32) = 1.91$, $p = .065$. However, average accuracy at bases (44.7%, $SD = 24.01$) was still significantly above chance levels of 33%, $t(32) = 2.799$, $p = .009$.

Condition C

Children were able to select the correct hiding location 64% ($SD = 33.8$) of the time, and this was significantly above 50% chance, $t(32) = 2.317$, $p = .027$.

General discussion

While Experiment 1a was primarily designed to set the stage for Experiment 1b, its findings are of autonomous interest. They show that children as young as 2 years of age are sensitive to geometric relations in a complex enclosure in which corners are less salient and geometric regularities are less apparent than in the enclosures used in prior research. In addition, the data show that a single axis of principal symmetry is not the only way that geometric information can be processed, although of course such an axis may be useful when it is present.

The data from Experiment 1b show clearly that children as young as 3 years can use a colored wall to distinguish among three all-white corners that are geometrically congruent. In order to succeed in this task, children must take into account the geometric configuration of the layout in addition to the placement of the colored wall using left/right sense relationship to distinguish among the three all-white corners. Children search using features in a non-associative way, beginning to contradict the two-stage theory advanced by Lee *et al.* (2006) in which there is an initial modular reorientation process followed by associatively based decision making. However, Experiment 1b leaves open whether features *alone* can be used in a non-associative way following disorientation, i.e. in the absence of geometry.

Experiment 2 adds to the case for features' use in true reorientation by showing that 4-year-olds can succeed in two tasks based on Lee *et al*. but using a larger and more stable landmark. It might be argued that performance, while above chance, is not impressively high. However, the likely cause is that, in order to model the study as closely on that of Lee *et al*. as possible, we could not make the feature very distal. Landmarks are more likely to be used during navigation when they are more distal (Nadel & Hupbach, 2006). Distal features can be encoded with more certainty than proximal landmarks, because movement around a local area creates only small variations in the location of the distal feature but very large variations in the location of a local feature (Newcombe & Ratliff, 2007). Evidence from the animal literature also suggests that landmarks placed further at the periphery of enclosures accurately control hippocampal place cell firing as compared to the same landmark configurations placed more centrally, which do not exert stimulus control (Cressant, Muller & Poucet, 1997, 1999; Zugaro, Berthoz & Wiener, 2001). Furthermore, a natural environment would contain many more features than just a single one, as was used in this experiment for comparability with Lee *et al*. (2006).

The contrast between our findings and those of Lee *et al.* may be due to any one of several factors. We suspect that the reason Lee *et al*. failed to find feature use is that their feature was extremely proximal (in fact, part of the array) and obviously moveable. However, future work will be needed to directly assess this and other possibilities. Additional work will also be needed to address the contrast between our results and those of Gouteux and Spelke (2001). We found that children could in fact use a feature blanket suspended from a circular curtain in a non-associative way. There are several possible reasons for this contrast. First, our children are on average almost a year older, and thus there may be development in the use of features as landmarks. Second, the feature was perhaps more salient and connected to the task in our experiment. Our feature had animal faces and we connected the hiding toy, a small duck, to the bigger duck on the blanket. Third, since our array was an equilateral triangle, there was no competition between the feature and geometric information for control of learning. Although the children in Gouteux and Spelke's study did not seem to use the geometric information that was available, it is still possible that this information may have made the feature cue less noticeable.

Future work can also determine why 5-year-old children but not 3-year-olds in Experiment 1b make additional use of direct marking of hiding information, as well as why, in a sample of nine adults we asked to perform the Experiment 1b task, we found 100% success in finding a hidden toy. Clearly, there is age-related change in both use of featural information and in use of geometric information to reorient.

Nevertheless, the present data constitute an existence proof: young children use featural information to reorient, both in situations including geometry and situations lacking it, and they do not simply use features associatively. Hence, early reorientation is not modular, at least not in the sense of Fodor (1983), in contradiction to the arguments of Lee *et al*. (2006).

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