

The Effect of Visual Minority on Children's Choice Behavior

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ABSTRACT

We study how changing the relative frequencies of options in a choice set affects young children's decision making. In food and non-food choice tasks, we asked four- to five-year-old children to choose from a set in which each option appeared multiple times. When options were visually different from each other, children were more likely to choose the minority option, that is, the option that appeared the fewest number of times in the choice set. In particular, children chose a fruit over crackers when the fruit became the minority option, even though they had a strong preference for crackers when neither option was in minority. Adults did not tend to choose the minority option in similar tasks, suggesting this effect is due to developmental sources.

Convincing children to eat fruits and vegetables is a constant battle parents and caregivers face on a daily basis. Given children's resistance to explicit persuasion attempts (Maimaran and Fishbach 2014; Miller et al., 2011; Wardle and Huon, 2000), it is important to find other ways to encourage them to eat healthy. In this research, we ask how the composition of choice sets children face influences their choice behavior, and whether it is possible to change the choice-set composition in ways that trigger children to make healthier food choices.

We study how young children choose from sets in which each option appears multiple times. Such choice sets are abundant in real life, for example, when choosing from a bowl with several fruit types or when choosing a product from among several varieties. We propose that when options in the set are visually different from one another, the option that appears the fewest number of times in the set, called the minority option, stands out visually relative to other options. Because young children are guided by perception (e.g., Ginsburg and Opper 1988), they will tend to choose this minority option even if they prefer another option in the set. We call this tendency to choose the minority option when options are visually different *the visual minority effect*. Our first contribution is to demonstrate the visual minority effect in various choice contexts.

Motivated by concerns about the increasing rate of childhood obesity (Ebbeling, Pawlak, and Ludwig 2002; Hedley et al. 2004; Troiano and Flegal 1998), we proceed to study whether the visual minority effect also operates in environments in which children have relatively strong preferences for one food item (e.g. crackers) over another (e.g. fruits). Our second contribution is to show the effect does indeed operate in such environments in the sense that the proportion of children choosing a fruit over crackers increases significantly when the fruit is positioned as the minority option. The visual minority effect may therefore have implications for encouraging

children to make healthier food choices without changing the availability of options in the choice set.

THE VISUAL MINORITY EFFECT

When young children make judgments, they often rely on visual and other perceptual features more than on abstract thought (Flavel 1963; Ginsburg and Opper 1988; John 1999). For example, preschoolers are more likely to group a tomato with a fire engine than with a cucumber, because the former two are red (Tversky 1985), and to evaluate personality traits based on visual appearance rather than on behavior (Hoffner and Cantor 1985). They are also very sensitive to changes in visual features of commercials (Wartella and Ettema 1974).

Similar reliance on visual features also emerges when young children make choices. According to John (1999), three- to seven-year-old children tend to rely on a single perceptual salient dimension when making choices. For example, when asked to choose a hypothetical snack for a friend who likes a certain snack type, say, chocolate, kindergartners tend to choose the snack that contains the largest number of pieces, ignoring how many pieces of chocolate the snack contains (Wartella et al. 1979). That is, they choose based on overall size, which is visually salient, rather than their friend's preference, which is more abstract.

Our paper identifies a visual feature of choice sets that guides preschoolers' choice behavior. We propose that in choice sets in which options are visually different from one another and each of them appears multiple times, the option that appears the fewest number of times in the set, called the minority option, stands out visually relative to other options. Because young children are guided by perception, they will tend to choose this minority option even if they

prefer another option in the set. On the other hand, when options are visually similar, the minority option does not stand out, and children will choose based on their preferences. We call this tendency to choose the minority option when options are visually different *the visual minority effect*. We expect this visual minority effect to be weaker among adults because adults rely on preferences more—and on visual features less—than children.

POLICY RELEVANCE OF VISUAL MINORITY

Children often choose from sets with visually different options that appear multiple times, for example, when choosing among snacks, when choosing among entrees in a cafeteria, or when shopping with their parents in the supermarket. The options in such choice sets may differ in how healthy they are, and children may have a strong preference for a less healthy option. For the visual minority effect to be policy relevant, it has to operate in such environments. We conjecture that the effect indeed operates in environments in which children have a strong preference for a less healthy option (e.g. crackers) over a healthier one (e.g. fruit) in the sense that the proportion of children choosing a fruit over crackers will increase when the fruit becomes the minority option.

By studying whether the visual minority effect can trigger healthier food choices, we contribute to the growing literature on factors affecting children's food choices. One relevant factor is branding. For example, children prefer McDonalds-branded food and rate McDonalds-branded carrots as better tasting (Robinson et al. 2007)). Another relevant factor is the usage of characters children like. For example, children prefer food that is associated with familiar cartoons (de Droog, Valkenburg and Buijzen 2012; Roberto et al. 2010; Wansink, Just and

Payne, 2012) or that is presented as potentially consumed by admirable super-heroes (Wansink, Shimizu, and Camps 2012). A third relevant factor is the type of message children receive when offered something to eat. For example, serving carrots without mentioning any benefits the carrots might have increases their consumption (Maimaran and Fishbach 2014), and serving food without presenting it as a contingency to receive future rewards increases liking of that food (Birch, Marlin, and Kramer 1982). Our paper adds to this literature by identifying a visual cue that may influence the food choices of children without changing the availability of options in the choice set.

OVERVIEW OF STUDIES

We conducted five studies to test for the visual minority effect and its potential policy implications. Study 1 tests for the visual minority effect in four food and non-food choice tasks. In three tasks, the options are visually different from one another, and in the fourth, they are visually similar yet participants recognize them as different options. Study 2 further examines the importance of visual differences between the options in driving the visual minority effect by recording children's choices in two additional settings, one in which the options are visually different and another in which the options are visually similar. Study 3 tests whether the visual minority effect can be policy relevant by examining if it can trigger preschoolers to choose grapes over crackers even though they have a strong preference for crackers over grapes.

Studies 1-3 were conducted in a local pre-school facility, and they involved individual sessions in which children interacted with an experimenter who was blind to the research

hypotheses. All children in the relevant age group whose parents signed consent forms were invited to participate.

To provide additional indirect support for the developmental sources of the visual minority effect, studies 4 and 5 test whether the effect is also present among adults. Specifically, these studies examine how undergraduate students choose from sets that are similar to those of study 1. Studies 4 and 5 were conducted at the end of an unrelated lab session in a local university by an experimenter who was blind to the research hypotheses.

STUDY 1

To test for the visual minority effect, we invited preschoolers to choose from four food and non-food choice sets. Each set included two distinct options, and we manipulated the number of times each option appeared in the set. We also manipulated the intensity of the visual difference between options across sets.

Method

Sixty-one children (mean age = 59.6 months, $SD = 3.7$ months) were invited to participate in a shopping-trip simulation in which they received a shopping cart and visited two stations. In station 1, children chose among visually different options. About half the children chose an apple from a plate with two Red Delicious apples, which are red, and five Granny Smith apples, which are green (i.e., Red Delicious was the minority option). The rest chose from a plate with two Granny Smith apples and five Red Delicious apples (i.e., Granny Smith was the minority option). See Figure 1 for photos of the choice sets used in all studies.

In station 2, children chose among visually similar options. About half the children chose a bag of crackers from a plate with two Wheat Thin bags and five Cheez-It bags, and the rest chose from a plate with two Cheez-It bags and five Wheat Thin bags. All bags were clear plastic bags. Seven children did not visit the second station because of allergies.

A pretest with a separate group of 42 children (mean age = 62.7 months, STD = 5.5 months) established that the two bags of crackers are perceived as more similar to each other than the two apples. Specifically, we presented children with the two bags of crackers and the two apples (Granny Smith and Red Delicious) and asked them to indicate which two options look more like each other. Twenty-eight children (66%) indicated the two bags of crackers look more like each other ($t(41) = 2.26, p = .029$, t-test against 50%).

Children in the main experiment then proceeded to choose a shopping bag (in which to put the apple and crackers' bag) from a set with yellow and red bags. After completing unrelated tasks, they were offered a gift of a magnifying glass from a set with green and blue magnifying glasses. A total of seven items were presented in the shopping bags and the magnifying glasses tasks, and we manipulated the relative frequencies as in stations 1 and 2.

At the end of the session, children put the shopping bag with the chosen products (the apple, the bag of crackers, and the magnifying glass) in their individual lockers so that other children could not observe their choices, and returned to the classroom.

Results and Discussion

Children chose the minority option when options were visually different. In station 1, the proportion of children who chose a particular apple type increased by 31 percentage points when

this apple type became the minority option. For the Red Delicious apple, the proportion increased from 50% to 81%, and for the Granny Smith apple, from 19% to 50% ($\chi^2(1, N = 61) = 6.34, p = .012$). Put differently, despite the overall preference for Red Delicious apples among children (it was chosen by 65% of the children across conditions), about half the children chose a Granny Smith apple when it became the minority option. See Table 1 for a summary of the results and test statistics of all studies.

Similarly, when a particular magnifying glass became the minority option, the likelihood of choosing it increased by 35 percentage points ($\chi^2(1, N = 61) = 7.47, p = .006$), and when a particular shopping bag became the minority option, the likelihood of choosing it increased by 22 percentage points ($\chi^2(1, N = 61) = 2.9, p = .088$). Thus, when options were visually different from one another, children favored the minority option.

By contrast, children did not tend to choose the minority option when items were visually similar. In station 2, about 60% of the children chose the Cheez-It crackers independently of the experimental manipulation. Clearly, children recognized the different types of crackers and made deliberate rather than random choices in this station. If the children had chosen randomly, the proportion of children choosing the minority option would have been $2/7 \approx 29\%$ in each condition. Instead, about 57% chose Cheez-It crackers when they were the minority option, which is significantly different from 29% ($t(20) = 2.54, p = .019$).

STUDY 2

Study 1 showed that when options are visually different, children tend to choose the minority option, and when options are visually similar, they tend to choose based on their

preferences. Study 2 further demonstrates the importance of visual differences between the options in driving the visual minority effect by examining children's choices in two additional settings, one in which the visual difference is strong (a choice of a zebra or a giraffe finger puppet) and another in which the visual difference is weak (a choice of a photo featuring a light brown puppy or a photo featuring a white puppy).

A pretest with a separate group of 42 children (mean age = 62.7 months, STD = 5.5 months) established the two puppies are perceived as more similar to each other than the zebra and the giraffe. Specifically, we presented children with the giraffe and the zebra and with the two photos of the puppies and asked them to indicate which two options look more like each other. Thirty-two children (76%) indicated the puppies look more like each other ($t(41) = 3.94, p < .001$, t-test against 50%).

Method

After completing an unrelated task, 40 children (mean age = 62.8 months, SD = 3.9) were offered a gift of a photo featuring a puppy from a set with photos of white puppies and light brown puppies. About half the children chose from a set with two photos of a white puppy and five photos of a light brown puppy, and the rest from a set with two photos of a light brown puppy and five photos of a white puppy.

After completing another unrelated task, children were offered a gift of a finger puppet—either a zebra or a giraffe. About half the children chose from a set with two zebras and five giraffes, and the rest from a set with two giraffes and five zebras. After making their choices, children put their chosen gifts in their individual lockers and returned to the classroom.

Results and Discussion

The results of the puppy task re-enforced the results of study 1 regarding visually similar options. About 62% of the children chose the white puppy photo independently of the experimental manipulation. As in study 1, children clearly recognized the photos as different and made deliberate rather than random choices. If they had chosen randomly, the proportion of children choosing the minority option would be about 29%, which is very different from the 61% of children choosing the white puppy photo when it was the minority option ($t(17) = 2.72, p = .015$).

The results in the finger-puppet task re-enforced the results of study 1 regarding visually different options. When a particular finger puppet became the minority option, the likelihood of choosing it increased by 35 percentage points ($\chi^2(1, N = 40) = 5.23, p = .022$).

STUDY 3

Studies 1 and 2 established the visual minority effect by showing children choose the minority option when options are visually different (as in the apples, magnifying-glasses, shopping-bags, and finger-puppets tasks), but not when they are visually similar (as in the cracker-bags and puppy-photos tasks). Study 3 builds on these findings and tests whether the visual minority effect can be policy relevant. We do so by testing whether the visual minority

effect can trigger children to choose fruits over crackers even though they prefer crackers over fruits.

Method

Fifty-six children (mean age = 56.9 months, SD = 4.0) were offered a choice between grapes and crackers. About half the children chose from a set with four containers of grapes and four containers of crackers. This control condition aims to identify children's baseline preference among crackers and grapes. The rest of the children chose from a set with two containers of grapes and six containers of crackers. This visual minority condition aims to examine whether turning grapes into the minority option increases the proportion of children choosing grapes.

We used 5.5-ounce clear plastic containers. Given the different density of crackers and grapes, a grape container had about 90 grams of grapes, and a cracker container had about 30 grams of crackers. After making a choice, children completed unrelated tasks. They then put their chosen container in their individual lockers, and returned to the classroom. Three children were excluded from this study because of allergies.

Results and Discussion

Children expressed a strong preference for crackers over grapes when facing an equal number of cracker and grape containers. Specifically, about 74% of the children chose crackers in this condition. But when grapes became the minority option, children's behavior changed

dramatically, and the proportion of children choosing grapes doubled from 26% to 52% ($\chi^2 (N = 56, 1) = 3.90, p = .048$).

STUDY 4

Studies 1-3 established that when options are visually different, young children tend to choose the minority option even if they have a strong preference for another option as in the grapes-crackers task. Studies 1 and 2 also established that when options are visually similar and children clearly distinguish them, the minority manipulation has no effect on children's choice behavior. These findings indicate the importance of children's reliance on visual cues in driving the visual minority effect.

Study 4 further tests the role of sensitivity to visual cues in driving the visual minority effect by examining whether adults show this effect. Unlike children, adults are guided more by abstract thought and less by perception. Therefore, their choices are expected to be driven more by their preferences and less by the visual minority manipulation. To test this prediction, we repeated the apples task from study 1 with undergraduate students.

Method

At the end of an unrelated lab study, undergraduate students ($N = 70$, mean age = 20.0 years, $STD = .9$) in a local university were offered a choice of a Red Delicious or a Granny Smith apple from a plate with seven apples. As in study 1, about half the students chose from a

plate with two Red Delicious apples and five Granny Smith apples, and the rest from a plate with two Granny Smith apples and five Red Delicious apples.

Results and Discussion

Students displayed two choice patterns. The first is that, similar to children, they had a relatively strong preference for one type of apple over the other: about 60% of the students chose a Granny Smith apple, whereas about 65% of the children chose a Red Delicious apple in study 1.

The second pattern is that in contrast to children, no visual minority effect arose among students: becoming the minority option led to a non-significant decrease of 15 percentage points in the share of the particular apple ($p > .2$). Put differently, only 43% of the students chose the minority option in comparison to 66% of the children ($\chi^2(1, N = 131) = 6.76, p = .009$).

STUDY 5

Study 5 aims to replicate the results of study 4 in a different choice context. We offered undergraduate students a choice between yellow and green highlighters, and we manipulated whether the yellow or the green highlighter was the minority option.

Method

At the end of an unrelated lab study, we offered a different group of students from the same university ($N = 51$, mean age = 20.2 years, $STD = 1.1$) a choice of a yellow or a green highlighter, where either the yellow or the green highlighter was the minority option. We presented a total of seven highlighters, and we manipulated the relative frequencies as in studies 1, 2, and 4.

Results and Discussion

The results are very similar to those in study 4. First, students had a relatively strong preference for one type of highlighter over the other: about 65% of the students chose the yellow highlighter. Second, no visual minority effect arose in this task: about 67% chose the yellow highlighter when it was the minority option, and about 63% chose the yellow highlighter when the green highlighter was the minority option.

Studies 4 and 5 identify two settings in which adults do not tend to choose the minority option. Of course, there are other settings in which they choose the minority option, possibly because they wish to be unique in their choices (e.g., Chen, Berger, and Van Boven 2012; Kim and Markus 1999; Lynn and Snyder 2002; Snyder and Fromkin 1980). Most notably, Kim and Markus (1999) report that compared to East Asians, European Americans tend to choose the minority option when asked to choose among five black-ink pens that varied in the color of their barrel (such that some had a green barrel and the rest had an orange barrel). Although Kim and Markus's pens task is similar to our highlighters task, their results are different from ours. First, participants in our experiment did not tend to choose the minority option. Second, there was no interaction between ethnicity and choice in our experiment.

A possible reason for the different results is that people's preferences over actual painting color (which differ in our highlighters task but were identical in Kim and Markus's pens task) are stronger than their desire to be unique, which in turn is stronger than their preference over the color of the barrel. In this case, people will choose their preferred highlighter in our setting but the pen with the unique barrel color in Kim and Markus's setting.

GENERAL DISCUSSION

This paper establishes that preschoolers choose the minority option when options are visually different. They do so when choosing between Granny Smith and Red Delicious apples, green and blue magnifying glasses, red and yellow shopping bags, giraffe and zebra finger-puppets, and crackers and grapes.

This tendency to choose the minority option holds even when children have strong preferences over the available options. This is illustrated most clearly in the grapes-crackers task in study 3. In this task, only 26% of the children chose grapes when an equal number of crackers and grapes containers were present, reflecting a strong inherent preference for crackers over grapes. Positioning grapes as the minority option doubled this proportion to 52%. The apples task provides another, perhaps weaker, illustration. In this task, children seemed to have an overall preference for the Red Delicious apple (about 65% of them chose it across conditions). But positioning the Granny Smith apple as the minority option more than doubled its share from 19% to 50% relative to the case in which we positioned the Red Delicious apple as the minority option.

The mechanism underlying the visual minority effect relates to children's tendency to rely on visual cues when making choices. The main evidence supporting this assertion is the difference in children's choices between settings in which the visual cue was strong (apples, magnifying glasses, shopping bags, finger-puppets, and grapes-crackers) and settings in which the visual cue was weak (bags of crackers, puppy photos). In the former case, positioning an option as a minority option significantly increased children's tendency to choose this option, whereas in the latter case, such positioning had no effect on children's behavior.

Why children are attracted to the minority option when options are visually different remains an open question. One possibility is *perceived* scarcity. Although no real scarcity existed in our choice tasks, because both options were available for choice, children might have perceived the minority option as scarce because it appeared fewer times in the choice set. Adults are well known to assign higher values to scarce options, possibly because they interpret shortage as a signal of higher quality (Brock 1968; Cialdini 2009; Inman, Peter, and Raghurir 1997), and the same reasoning may apply to children. A possible difficulty with this argument is that, as we showed in studies 4 and 5, adults do not choose the minority option in similar tasks. This pattern of choice among adults may be due to their ability to correct for the visual saliency of the minority option and choose according to their preferences over options.

One relevant direction for future research is to identify other visual and perceptual features of choice sets that influence children's choice behavior. Another relevant direction is to extend the visual minority effect to other settings such as consumption and to other age groups. Although school-age children, who are less sensitive to perceptual features (John 1999) and process information differently (Peracchio 1990), might be less sensitive to the visual minority effect, the effect might be present among younger children, even those who are one and two

years old. The potential to influence the choice and consumption patterns of these younger children, and hence their future habits, by simple changes to their choice sets cannot be underestimated.

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Table 1: Summary of results of all studies

	Minority	Other	Statistic Test
S1: Share of Red Delicious apple	81%	50%	$\chi^2 (1, N = 61) = 6.34, p = .012$
S1: Share of Granny Smith apple	50%	19%	
S1: Share of Cheez-It crackers	57%	64%	$p > .2$
S1: Share of Wheat Thins crackers	36%	43%	
S1: Share of green magnifying glass	64%	29%	$\chi^2 (1, N = 61) = 7.47, p = .006$
S1: Share of blue magnifying glass	71%	36%	
S1: Share of red bag	56%	34%	$\chi^2 (1, N = 61) = 2.9, p = .088$
S1: Share of yellow bag	66%	44%	
S2: Share of zebra	55%	20%	$\chi^2 (1, N = 40) = 5.23, p = .022$
S2: Share of giraffe	80%	45%	
S2: Share of white puppy	61%	64%	$p > .2$
S2: Share of light-brown puppy	36%	39%	
S3: Share of grapes	52%	26%	$\chi^2 (1, N = 56) = 3.90, p = .048$
S4: Share of Granny Smith apple	53%	68%	$p > .2$
S4: Share of Red Delicious apple	32%	47%	
S5: Share of yellow highlighter	67%	63%	$p > .2$
S5: Share of green highlighter	37%	33%	

Figure 1: Photos of choice sets

<p>Apples task (Studies 1 and 4)</p>	<p>Red Delicious apple minority</p> 	<p>Granny Smith apple minority</p> 
<p>Crackers task (Study 1)</p>	<p>Cheez-It minority</p> 	<p>Wheat Thins minority</p> 
<p>Shopping-bags task (Study 1)</p>	<p>Red minority</p> 	<p>Yellow minority</p> 
<p>Magnifying-glasses task (Study 1)</p>	<p>Blue minority</p> 	<p>Green minority</p> 
<p>Finger-puppets task (Study 2)</p>	<p>Zebra minority</p> 	<p>Giraffe minority</p> 
<p>Puppy-photo task (Study 2)</p>	<p>White puppy minority</p> 	<p>Light-brown puppy minority</p> 
<p>Grapes-crackers task (Study 3)</p>	<p>Grapes minority</p> 	<p>Control</p> 
<p>Highlighters task (Study 5)</p>	<p>Yellow minority</p> 	<p>Green minority</p> 