Children Are Price Sensitive Too:
The Immediate and Long-Term Effects of Price Promotions on Children’s Healthy Choices

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ABSTRACT

Prior research in consumer behavior has invested tremendous effort in isolating the negative impact of marketing, such as fast-food advertisements, on childhood obesity. The current research takes a different approach: instead of limiting marketing of unhealthy options, we leverage a classic marketing tool to encourage children’s choice of healthy options. We partnered with UNICEF to launch three field experiments at three elementary schools in Panamá to examine the effectiveness of price-promotion interventions (i.e., coupons to be redeemed at kiosks in the schools) in boosting children’s choice of healthy products. We found that children’s responses to coupons mirrored those of adults, with short-term boosts during the promotion period and long-term deficit after the incentives were removed. Furthermore, we varied the processing ease of coupon messages (i.e., directly communicated price versus derived price) and found a divergent impact of price promotions on children’s redemption rates based on (1) their age (i.e., developmental level) and (2) repeated exposure to the promotion. This research provides novel insights into the impact of economic incentives on children, and contributes to the bubbling research on children’s health behaviors and motivation, cognitive developmental models, and the positive and negative impact of marketing, pricing, and repetition.

Keywords: children, price promotion, health, economic incentives, field experiment, repetition
Over the past three decades, the problem of overweight and obesity has gained much attention from policy makers, organizations, companies, and consumers (Malik, Willet, and Hu 2013; Ng et. al 2014; WHO 2018). The prevalence of childhood and adolescent obesity is also rising around the world (de Onis, Blössner, and Borghi 2010), from 11 million children and adolescents ages 5 to 19 classified as obese in 1975 to a startling 124 million in 2016, in addition to 213 million children and adolescents classified as overweight in the same year. This translates to close to one in every five (18.4%) children and adolescents classified as overweight or obese globally (WHO 2018).

Obese youth are more likely to be obese as adults (Daniels 2006), and they face a variety of health risks (Freedman et al. 2007). In addition to health consequences, overweight and obesity in children are associated with significant reduction in quality of life (Williams et al. 2005) and a greater risk of teasing, bullying, and social isolation (Lobstein, Baur, and Uauy 2004). Due to the rapid increase in childhood obesity and its serious health and life consequences, childhood obesity is considered one of the most serious health challenges of the 21st century (Mann, Tomiyama, and Ward 2015; Ogden et al. 2006).

Importantly, childhood obesity is not just a problem for developed, high-income countries; it has been considered a pressing issue in low- and middle-income families and in developing countries as well, with the number of overweight children trebled in the past three decades (Ng et. al 2014; WHO 2018). The ultimate paradox in developing countries is that food insecurity leads not only to undernutrition but also to overnutrition (Tanumihardjo, Emenaker, and Stadler 2007). This paradoxical condition exists because foods that are high in fat, sugar, and carbohydrates are often less expensive than foods of high nutrient density, such as fruits, vegetables, and whole grains (Drewnowski 2004; Harrison et al. 2010). As a result, people living
in a developing economy can consume adequate kilocalories but at the same time lack the dietary quality needed to achieve optimal health and prevent chronic disease (Tanumihardjo et al. 2007). It is thus not surprising that developing countries such as Panamá express rapidly rising concerns about obesity and children’s health (Rivera et al. 2014).

In this research, we aim to address the grave challenge of childhood obesity from a unique angle: instead of limiting marketing of unhealthy options to children, we leverage a classic marketing tool—specifically, price promotion—to encourage children to choose healthy options. We theorize the immediate as well as long-term effects of price promotions on children, and further propose a divergent impact of price promotion messages, depending on their processing ease, children’s age (i.e., developmental level), and repeated exposure. Empirically, we conducted three field experiments at three elementary schools in Panamá—a developing country with increasing concerns for childhood obesity—and captured the effectiveness of price promotions by tracking children’s redemption rates of these coupons at kiosks in the schools. Below, we review literature in food marketing, children’s health behaviors and motivation, developmental models, and repetition in marketing/advertising to develop our conceptual framework.

The (Wicked) Role of Food Marketing

1 According to WHO estimates, childhood obesity rates in Panama range between 4.5% and 18.8% (https://www.who.int/gho/ncd/risk_factors/overweight_obesity/obesity_adolescents/en/). A survey conducted by the Ministry of Health in 2016 suggested that the rate could be as high as 30% (http://www.cadenagramonte.cu/english/show/articles/24954:high-incidence-of-obesity-in-panama), which is even higher than in the U.S. (16.9%–26.1%, https://www.who.int/gho/ncd/risk_factors/overweight_obesity/obesity_adolescents/en/).
As the awareness of childhood obesity increases, so does the public’s desire to remedy the situation, often by first pinpointing those who are responsible. Who, in fact, is to blame for childhood obesity? Researchers and government agencies have homed in on the impact of marketing—food advertisements—on childhood obesity (for a review, see Friestad and Wright 2005; Wright, Friestad, and Boush 2005). In 2006, for instance, the Institute of Medicine (IOM) reviewed 155 studies of food-marketing practices and noted a consistent relationship between the exposure to television advertising and body fatness in children ages 2 to 11, warning the general public of the irreversible impact of advertising on children’s food preferences and consumption. What makes matters worse is that with integrated marketing communications, children’s exposure to food advertisements has now extended beyond television to mobile advertising, product placements, in-school marketing, and even “advergames” on food marketers’ websites (Moore and Rideout 2007). These richer and more dynamic marketing materials allow for more elaborate usage of persuasive elements, such as chubby cartoon characters, which could lead not only to a preference for unhealthy food items but also to higher food intake (Campbell et al. 2016).

It is thus not surprising that many researchers and organizations have advocated for a complete ban on unhealthy product advertisements targeting children (e.g., Dhar and Baylis 2011). Eleven leading food and beverage companies (e.g., Coca-Cola, Kraft Foods, McDonald’s, and PepsiCo) have moved forward with voluntary restrictions, stopping the advertising to children under 12 years old of products that do not meet the nutritional standards (Barnes 2007; Better Business Bureau 2006; McKay and Adamy 2006). Importantly, the effect of these restrictions and bans on advertising unhealthy products is mixed so far. Because much of the television that children watch is at a time when adults are watching, children are likely to be
exposed to a considerable amount of food advertising targeted to adults (Institute of Medicine 2006); for instance, the Children’s Food and Beverage Advertising Initiative (CFBAI) failed to reduce households’ purchase of Hershey’s and Mars chocolate because children continued to see Hershey’s and Mars chocolate advertising on general programs (Huang and Yang 2013).

Instead of limiting marketing of unhealthy options to children, we respond to the call-for-action from Goldberg and Gunasti (2007) to take a different approach—to leverage marketing tools to encourage children to choose healthy options, specifically, by providing different price promotions on healthy options in elementary schools.

Promoting Healthy Choices among Children at School

Just as promoting unhealthy snacks can lead to a preference for high-sugar and fatty options, one way to increase the consumption of healthy options is to make them more salient and available to children through various marketing vehicles (de Droog, Valkenburg, and Buijzen 2010; Miller et al. 2015; Reicks et al. 2012; Roberto et al. 2010; Robinson et al. 2007). Importantly, children consume at least 19% of their total daily caloric intake from food available during school meal times (and this percentage can be as high as 50% for low-income children; Gleason and Suitor 2001). Subtle interventions at schools have been documented to influence children’s consumption choices, such as drinking water (Huang et al. 2019). The school environment thus constitutes a critical location for promoting healthy options to combat childhood obesity. For instance, the Global Panel on Agriculture and Food Systems for Nutrition outlines specific recommendations for how schools can foster healthy consumption, including avoiding the provision of foods and beverages that are high in sugar, trans fat, and salt (Global
Panel 2015). A study in India (Singh, Park, and Dercon 2014) further shows that schools’ midday meal schemes could even offset the deficiency of nutrition at home. Supporting this mission, we explore the possibility of leveraging price promotions—a key instrument in marketing—at schools to increase children’s choice of healthy products.

We chose price promotions for two reasons. First, healthier foods such as good protein, fresh vegetables, and fruit can cost considerably more than calorie-dense foods (those high in refined grains, sugar, and fat; Drewnowski 2004; Harrison et al. 2010). In a U.S. study, fruit and vegetable consumption was thus lower in zip codes where prices were higher or where the price of fast food was lower (Powell et al. 2007). A review of five quasi-experimental studies further showed that adults respond positively to lowered prices for fruits, vegetables, and low-fat snacks (Faith et al. 2007). Therefore, providing price promotions for healthy options could be a key driver for increasing the choice of (and gradually building a preference for) these items. Importantly, these prior studies explored adolescents and adults, but not children. As children and adults often respond differently to persuasion attempts (Boush, Friestad, and Rose 1994; Roedder, Sternthal, and Calder 1983; Ward, Wackman, and Wartella 1977), important theoretical and practical insights are gained by investigating whether children’s responses to price promotions would mirror those of adults, as well as by studying the potential moderators and boundaries of this effect.

Second, directly motivating children to choose healthy options could be just as (or even more) effective in changing children’s food choices, compared to educating them about nutrition and health. Goldberg and Gunasti (2007) argued that children are affected by taste and presentation (the “product”), accessibility (the “place”), and also by simple cues (the “promotion”), rather than by reading and learning nutrition information. For instance, when a
healthy product is framed as limited in availability, children consume more of it and are more likely to choose it (Maimaran and Salant 2019). Furthermore, both children and adults tend to believe that the taste and the health value of foods are inversely related (Baranowski et al. 1993; Raghunathan, Naylor, and Hoyer 2006). Emphasizing the food’s health benefits can therefore backfire and reduce children’s consumption of healthy items (Maimaran and Fishbach 2014; Miller et al. 2011).

Drawing from these critical insights, we set out to test whether providing price promotions to children at elementary schools can motivate their choice of healthy options. Importantly, we explore both immediate and long-term effects (i.e., both during and after the promotion period), and theorize how the ease of processing of the coupon message may determine its effectiveness based on children’s age and the repetition of the coupons.

Temporal Impact of Price Promotions on Children

There has been very little research on children’s reactions to price promotions. Yet, as young participants in the marketplace, children can regularly be exposed to many price-related messages. Prior research has shown that children often do not include prices when thinking about shopping or searching for purchase-related information (McNeal 1992; Ward et al. 1977). This relative lack of attention to price information could be explained by the fact that price is usually less salient than other features such as size or color, and children tend to focus on salient, immediate cues (Collins, Wellman, Keniston, and Westby 1978; Flavell, Miller, and Miller 2002; John and Sujan 1990; Mischel and Ebbesen 1970). If so, price promotions through
coupons could increase the salience of price and provide an immediate cue to powerfully affect children’s purchase behavior.

Even if price promotions successfully gain children’s attention and increase their choice of the promoted healthy product, will this effect last beyond the promotion period? There is reason to believe that the effect of price promotions might be short-lived because consumers may attribute their purchase behavior to the extrinsic incentive and not to their intrinsic preferences (e.g., self-perception theory, Bem 1972; see also the overjustification effect, Lepper, Greene, and Nisbett 1973). Subsequently, the removal of the incentive could result in the reduction of the purchase behavior. For instance, Scott (1976) found that a bigger economic incentive (e.g., half price or completely free) increased consumers’ likelihood of accepting a two-week trial offer but undermined their likelihood of actually subscribing to the product after the trial period. Making a purchase on steep discounts, therefore, can lead consumers to attribute their purchase to the incentive and not their preference, resulting in a lower likelihood of repurchase and a higher likelihood of brand switching (Dodson, Tybout, and Sternthal 1978; Pauwels, Hanssens, and Siddarth 2002). Based on these findings on adults, we conjecture that children’s responses to coupons may mirror those of adults, showing significant short-term boosts during the promotion period but a deficit effect after the incentives are removed (hypothesis 1; H1).

Divergent Effects of Promotion Message and Children’s Age

In addition to theorizing the temporal effect of price promotion, we also explore how different types of messages may affect children’s responses to the promotion of healthy products. We base our hypotheses on child development theories and the processing ease literature.
At age two or three, children start to verbally communicate amounts and sizes (e.g., a lot, a little) and develop counting strategies; these basic conceptualization abilities occur rather spontaneously regardless of whether children are formally taught or not (Flavell et al. 2002; Gelman and Meck 1983; Gelman and Williams 1998; Wynn 1998). While basic abilities like counting can be acquired spontaneously, higher order conceptualization and operations such as deduction and multiplication (i.e., abilities required to understand quantity or percentage discounts of products; Boland, Connell, and Erickson 2012) typically need to be formally taught and learned (Gauvain 2001; Saxe, Guberman, and Gearhart 1987).

For elementary school children, this learning process is gradual and can span over six years (John 1999). At ages 6 to 7 (i.e., first and second grade), children tend to rely on a single and observable dimension, such as size or shape, when making decisions; in contrast, older children of ages 8 to 11 (i.e., third to sixth grade) have been documented to have the ability to consider multiple dimensions and to conduct logical thinking and abstract thinking (Moses and Baldwin 2005; Ward et al. 1977). Similarly, children’s information-processing strategies also develop over the elementary school years, such that children tend to use simpler strategies at the ages of 6 to 7 and more complex strategies at ages 8 to 11 (Bereby-Meyer, Assor, and Katz 2004; Davidson 1991; Gregan-Paxton and John 1997); older children are able to select more appropriate and efficient strategies for the task at hand, which indicates that strategy change is a distinctive characteristic of child development (Siegler 1988, 1996; Siegler and Jenkins 1989). Even the speed with which information is processed improves steadily across the elementary school years, such that older children can move through a line of reasoning more quickly than younger children (Hale 1990; Kail 2000).
In addition to the development of cognitive ability, children also acquire market knowledge as they grow from 6 to 11 years old. Although children have a good understanding of what money means and what it does starting at the age of 3 (Gasiorowska et al. 2016), their economic reasoning, including an understanding of supply and demand forces, significantly develops between the ages of 6 and 11 (Siegler and Thompson 1998; Thompson and Siegler 2000; Webley 2005). Importantly, ample evidence has shown that children perform better on tasks when they have domain-specific experience and knowledge about the task (Carraher, Carraher, and Schliemann 1985; Flavell et al. 2002; Nunes, Carraher, and Schliemann 1993; Saxe 1999). As a result, younger children, compared to older children, would have more difficulty explaining shopping-related concepts outside of the shopping context, because they lack everyday hands-on experience of shopping (Peracchio 1992).

Put together, these findings suggest that (1) there are two critical dimensions that jointly determine a child’s response to price promotions—the ability to conceptualize, make connections, and compute to derive value, and the domain-specific market experience/knowledge of price promotions; and (2) the development and impact of these two dimensions would depend on a child’s developmental age, with a clear distinction between ages 6 to 7 versus ages 8 to 11 (i.e., the classic age group classification for children, Bereby-Meyer et al. 2004; Davidson 1991; Gregan-Paxton and John 1997; John 1999; Moses and Baldwin 2005; Ward et al. 1977). Compared to older children, younger children ages 6 to 7 may not be able to process coupon messages that would require computation or making abstract connections to derive the final price, such as “15 cents less,” “10% off,” “buy A get B,” or “buy A, pay the price of B.” In contrast, easy-to-process coupon messages that directly communicate the final price (e.g., “pay
45 cents”) should be more effective in driving the younger children to redeem coupons (hypothesis 2; H2).

Following this logic, one could expect that this hypothesized difference in redemption rates based on the messages’ processing ease would disappear among older children (ages 8 to 11), as they would have the ability to compute and make connections to derive the promotion price. While we believe that older children should have the cognitive ability to process both types of coupons, we further suspect that the derived (vs. direct) message of price promotion might conversely be more effective for this group. This is because price promotions in the marketplace often involve connection-making derivations through price, percentage, or quantity discount (e.g., 10 cents less, 20% off, buy one get one free); older children’s domain-specific experience and knowledge about the marketplace thus may render these coupon messages more familiar, as these messages match their daily observation and hands-on experience. We thus hypothesize that older children ages 8 to 11 may respond more positively to hard-to-process coupon messages that invite them to derive the final price, compared to easy coupon messages that directly communicate the final price (hypothesis 3; H3).

What Happens with Repeated Exposure?

In the real world, price promotions are rarely used just once; instead, promotions of the same or similar messages are often used repeatedly to motivate the same segment of consumers to act. A price discount may be available for customers for three days, and then for another weekend in the month that follows. Therefore, in addition to our key hypotheses above regarding
the temporal and divergent impact of price promotions on children, we further explore whether
the effect of these promotions may change through repetition.

Classic research has shown that repetition of stimuli can prompt both habituation and
tedium (the two-factor theory, Berlyne 1970), leading to a curvilinear effect on liking: with
repeated exposure, liking would first increase with positive habituation and then decrease with
tedium (an inverse U curve). Importantly, the complexity of the initial stimuli moderates this
effect (Smith and Dorfman 1975); while highly complex stimuli mainly benefit from the
habituation mechanism as repetition brings the stimuli’s initially high arousal down to an optimal
level (i.e., repetition increases liking; the first half of the inverse U curve), low-complexity
stimuli mainly suffer from the tedium mechanism because boredom, decreased learning, and
reactance kicks in quickly (i.e., repetition decreases liking; the second half of the inverse U
curve). Applying these insights to the marketing domain, Anand and Sternthal (1990)
demonstrated that, similarly, the effect of repeated advertising exposure on brand evaluation was
moderated by the processing ease of the advertising messages.

We believe that these repetition effects could also occur when children are exposed to the
same price promotions the second time around. One way that young children invoke incidental
mnemonics is by listening to repetitions of the same message (e.g., Bishop, North, and Donlan
Although children do not deliberately employ learning strategies while attending to the message,
repeated exposures to the same message, story, or event sequence act as an environmentally
supplied organizational strategy, allowing children to learn and increase their comprehension.
Accordingly, we suspect that upon repeated/second exposure of the same coupon message,
young children of ages 6 to 7 may become better able to process the originally hard-to-process
(derived price) promotion message, increasing their likelihood of using these coupons through positive habituation; in contrast, these young children might experience tedium with the easy coupon (directly communicated price), decreasing the likelihood of using these coupons (hypothesis 4; H4). Among the older children who can comprehend both types of coupons already, repeated exposure would allow the tedium mechanism to kick in, rendering both types of coupons ineffective the second time around (hypothesis 5; H5).² That is, tedium may lead to a loss of interest for both types of coupons in all age groups, except for the potential positive habituation that could occur with the hard-to-process message among young children.

OVERVIEW OF CURRENT RESEARCH

Overall, this research contributes to classic work on childhood obesity, child development theories, pricing, and repetition in marketing/advertising. First, in contrast to previous findings showing that marketing instruments can backfire and decrease consumption of healthy products by promoting the consumption of unhealthy products, our research tests the possibility that marketing tools such as price promotions can produce a short-term positive effect on children’s choice of healthy products in a noisy real world. Marketing thus can be both the cause of the global crisis in children’s health and a potential solution. Second, our research suggests that price promotions can generate a significant impact on children of young ages; this finding importantly extends prior research that documents the effect of price promotion among

² Of note, the exact threshold for incurring a change in children’s experience of processing ease, habituation, and tedium may depend on the initial difficulty of the message, the incentive amount, and the environmental/social context. Hence, this research modestly serves as the first empirical test of the potential effect of repeated price promotions on children’s behavior. In the General Discussion section, we encourage future research to explore other possible effects of repeated exposure for different types of messages, as well as the exact threshold of repetition for the observed effects to occur among children around the world.
older adolescents and adults (Faith et al. 2007; Powell et al. 2007) and critically adds to theories suggesting that children pay less attention to price as an aspect of the marketplace, compared to their greater attention paid to product design, packaging, brand symbol, and retail environment (Chaplin and John 2005; Chaplin and Lowery 2010; John 1999). Third, our research further documents that children’s responses to coupons mirror those of adults, with significant short-term boosts during the promotion period and a deficit after the incentives are removed. Fourth, our research also adds to the growing work on children’s developmental phases by demonstrating that the processing ease of the promotion message needs to match the cognitive ability and knowledge of the target population. Fifth, our findings shed light on the critical role that repetition plays in determining the effectiveness of promotional messages on children. Marketers of healthy products thus should be aware of not only what (i.e., the product message) and to whom (i.e., the consumer) they promote, but also how often they promote this message to a specific segment of children.

By testing our predictions in a developing country currently facing increasing rates of childhood obesity—Panamá—this work also responds to the call for research questions that describe substantive phenomena using appropriate and difficult-to-access samples (e.g., Inman et al. 2018; Lynch et al. 2012; Pham 2013; Wertenbroch 2015), while addressing also the critical problem of the WEIRD phenomenon, in which the majority of social science studies to date have focused on adult participants who were Western, educated, and from industrialized, rich, and democratic countries (Arnett 2008; Henrich, Heine, and Norenzayan 2010; Rad, Martingano, and Ginges 2018). Below, we discuss the three field experiments conducted in collaboration with UNICEF at three elementary schools to test our hypotheses. We discuss the generalizability and implications of our findings to different markets and populations in the General Discussion.
School Selection

To test our hypotheses, we distributed different coupons to promote healthy products to children and then tracked the effectiveness of these messages by recording the actual redemption rate of these coupons. To enhance the external validity and experimental realism of our research (e.g., Inman et al. 2018; Morales, Amir, and Lee 2017), we did so in a context in which children actually purchase food by themselves, i.e., at school kiosks.

In collaboration with UNICEF, we recruited three elementary schools in the Republic of Panamá to participate in three field experiments. Because our experimental design required that the target schools had a pre-existing kiosk that sold healthy options (such as natural fruit juice and cereal), we focused our consideration set on private schools; unlike public schools, most private schools had kiosks, and children at these schools were in the habit of purchasing drinks, snacks, and meals at the kiosks during school hours. During the school screening and recruitment in 2016, Panamá had 274 private schools, enrolling 50,353 students.

To ensure the representativeness of the sample, we limited the final consideration set to schools whose annual tuition and elementary school enrollment (i.e., enrollment in grades one to six) matched the average in the country’s private schools (approximately USD $1,700 per student, and approximately 100 students in each grade). Three schools were selected based on these criteria, enrolling 80 to 140 students from grades one to six at each school. The schools were located in residential neighborhoods in urban areas (all in the district of Panamá City). See Appendix A for the details regarding these schools’ enrollment in each grade.

IRB and Panamá Government Approval
In preparation for these field experiments, we sent a formal letter and conducted a presentation to the authorities of the Ministry of Education of the Republic of Panamá (MEDUCA), including to the Minister of Education, Mrs. Marcela Paredes. We also sent the same letter to the Directorate of Private Schools for their approval.

The principals of each of the three selected schools received a letter detailing the objective and procedures of the field experiment. The managers at the school kiosks were informed of the forthcoming coupons and were trained by the research assistants on (1) how to accurately track sales of the promoted products using the sheets prepared by the research team, and (2) how to ensure sufficient inventory for the promoted products for the duration of the experiment. Last, the detailed research protocols for these three schools were submitted to and approved by the IRB of the National Secretariat of Science, Technology, and Innovation (SENACYT) in Panamá. The negotiation, preparation, and approval process from all interested parties took about two years in total. After receiving approval from the IRB and the Ministry of Education, we hired two local research teams to execute the field experiments in 2017.

Product Selection

Based on initial interviews with the local research teams and the teachers at these schools, we selected one healthy product to promote at each school. The criteria for these products included having obtained the official approval from UNICEF as a healthy option for children, being considered among the popular products that children purchased at their respective kiosks, and being consistently stocked in large quantities at the kiosks. The final products
selected were a cereal shake for School A (study 1) and a natural fruit beverage for schools B and C (studies 2 and 3, respectively). These products were freshly made every day using local ingredients; while the specific nutrition information was unavailable (as these products were not massively manufactured in a standardized way), they were recognized by UNICEF’s local team as healthy for the target population. The full list of products available at each school and their prices are summarized in Appendix B.

**Design of Price Promotion Messages**

We then designed price promotion messages for each of the three schools. Drawing from child development theories, we manipulated the processing ease of messages (easy to process vs. hard to process) by changing whether the coupon *directly communicated* the final price or would require computation or abstract connection making to *derive* the price (e.g., Moses and Baldwin 2005; Ward et al. 1977). In studies 1 and 2, the hard-to-process coupons required children to deduct the discount amount from the original price to derive a final price; for generalizability, in study 3, the hard-to-process coupon required children to make connections between products of different sizes in order to derive a final price.

For instance, to manipulate whether the coupon would require children to deduct the discount amount from the original price to derive the final price, the hard-to-process message stated “A cereal shake usually costs 1 dollar. **Only Tuesday to Thursday! Pay 20 cents less for the cereal shake!**” In contrast, the easy-to-process message would state “A cereal shake usually costs 1 dollar. **Only Tuesday to Thursday! Pay 80 cents for the cereal shake!**” While the easy-to-process message directly informed children of the final price of the beverage, the hard-
To-process message required them to make a connection between two numbers in order to derive the (same) final price of 80 cents, which is a more typical practice in the marketplace.

To ensure that our manipulations of coupon message were indeed successful and appropriate for elementary school children in Panamá, we additionally recruited 50 elementary school teachers in Panamá for a pretest. In this pretest, 50 teachers assessed how easy or difficult each coupon message was for children of ages 6 to 11 in Panamá to understand, as well as how each coupon message would match the cognitive capability of younger children (6 to 7) and older children (8 to 11). See Appendix C for details of the pretest procedure and results.

Upon successful pretesting, we hired an illustrator at a West Coast university in the United States to design the visual for the coupons, using the promotion messages pretested in Appendix C and the products approved by UNICEF, as described above. Each coupon was 3.5 by 2 inches in size (close to a regular-size business card, for ease of carrying in a pocket or wallet). We used the same color and design for coupons of different processing ease, to keep the visual impact constant across the two conditions at each school; the only difference between the two conditions was whether the price was directly communicated on the coupon or needed to be derived by the children themselves. For quality control and accuracy, we produced the coupons in the United States and then shipped the coupons in clearly labeled individual packages (by school and by class) to the teams in Panamá, who distributed them at each school based on the timeline and procedures detailed in the IRB procedure. We report below the specific coupon design, distribution procedure, and findings in each field experiment at each of the three schools.

**Study 1: Leveraging Coupons of Different Processing Ease** to Promote a Healthy Cereal Shake
Method

With the IRB approval from the government and printed coupons in hand, we proceeded with the main field experiment at School A in 2017. As it was crucial for our experimental purpose that children could not easily compare their coupons across conditions, we assigned one type of coupon to each class, and randomly assigned two types of coupons across classes within each grade. As a result, about half of the classes in the first grade received the easy-to-process message while the other half received the hard-to-process message, and half of the classes in the second grade received the easy-to-process message while the other half received the hard-to-process message, and so on. Since classes within each grade are created based only on numbers (to have approximately the same number of children per class) and not on any demographic variables (e.g., gender, age, income, prior academic performance), the randomization across classes within each grade ensured the internal validity of our experimental design while minimizing the possibility of suspicion or cross-condition comparison. See table 1 for the assignment of classrooms to coupon type at School A.

<table>
<thead>
<tr>
<th>Easy-to-process coupon</th>
<th>1st grade</th>
<th>2nd grade</th>
<th>3rd grade</th>
<th>4th grade</th>
<th>5th grade</th>
<th>6th grade</th>
<th>Total</th>
</tr>
</thead>
</table>

Each coupon was marked with a serial number to indicate the grade and class it was distributed to, followed by a unique count number, such that the coupons could not be duplicated or shared with other children. These coupons were distributed on a Tuesday in June 2017, in the
morning by a group of research assistants blind to the hypotheses. The research assistants were accompanied by the teacher of the class to ensure credibility. The teachers were not involved in the communication regarding the coupons and were informed not to talk about these coupons in their class; in addition, teachers were not aware of the different conditions of the coupons. The teachers were simply present when the research assistants distributed the coupons, to reduce children’s anxiety (or confusion) about having a stranger in their class.

All coupons in all classes were distributed on the same morning to keep the starting time consistent across classes and across grades. After the coupons were distributed on that Tuesday, research assistants visited the school every day that week, to validate that there was no issue with redeeming the coupons, and that the sales record of the focal product was tracked accurately and closely by the kiosk manager. Children in private schools in Panamá tended to carry a small amount of cash with them as there were no official lunch programs at the schools, and they either brought lunch/snacks from home or would have to purchase lunch/snacks at the school kiosks. Children had multiple breaks during school days; they could drop by the kiosks to purchase anything they would like by themselves, autonomously and unsupervised by adults. If they wished to use the coupon they received, they had until Thursday of that week to redeem it. The promotion period was specified on the coupon.

A month after the distribution of the first-phase coupons, on a Tuesday in July 2017, the research assistants visited the school again, and this time distributed the second-phase coupons to children. Children could redeem these coupons until Thursday of that week. These second-phase coupons were identical in messages and visuals to the ones distributed in the first phase, allowing us to examine the effect of repeated exposure; children who received the easy-to-process (directly communicated price) message in the first phase would again receive the easy message
in the second phase, and those who received the hard-to-process (derived price) message in the first phase would again receive the hard-to-process message in the second phase. To ensure that all coupons redeemed in the second phase were indeed the ones freshly distributed (and not the unused coupons from the first phase), we created a different set of serial numbers for second-phase coupons, and alerted the kiosk managers to pay additional attention to the serial number when redeeming coupons. All the reported redemption rates were cross-checked with the coupons actually collected at each kiosk to further ensure the accuracy of the dependent measure.³

In this school we promoted the cereal shake, and we manipulated the processing ease of the promotion message by changing whether or not the coupon would require children to deduct the discount amount from the original price to derive a final price. As mentioned earlier, the easy message directly communicated the discounted price and did not require children to make additional connections. The message read “A cereal shake usually costs 1 dollar. Only Tuesday to Thursday! Pay only 80 cents when you buy the cereal shake!” In contrast, the hard-to-process message required children to make a connection between two numbers to derive the final price and read “A cereal shake usually costs 1 dollar. Only Tuesday to Thursday! Pay 20 cents less when you buy the cereal shake!” (see figure 1 for coupon visuals). The coupons were in Spanish (the official language in Panamá); we have translated the text below into English for ease of comprehension.

³ Due to students’ absence and class activities, about 5% of the coupons were not distributed, such that 529 coupons were distributed in phase 1 and 530 in phase 2.
Thus, this study constituted a 2 (Processing Ease: Easy vs. Hard) × 2 (Age: Young = 1st and 2nd grades, ages 6 to 7 vs. Old = 3rd through 6th grades, ages 8 to 11) × 2 (Phase: One vs. Two) design. The between-class manipulation of incentive processing ease ensured that children’s exposure to each message would not be contaminated by exposure to another message (which would have been a likely consequence of a within-class manipulation of promotion message, posing a risk to the internal validity of the study). In addition, the within-class variable of two phases enabled us to isolate the unique consequence of second exposure (e.g., habituation and tedium), while controlling for any baseline variance across class and grade. Lastly, the grade variable allowed us to isolate the impact of price promotions on children across two major developmental phases.

Results and Discussion
Temporal effect on sales. First, as shown in figure 2, the distribution of coupons led to an immediate increase in the sales of the promoted cereal shake. The average daily sales significantly increased from 23.75 (SD = 7.13) shakes per day during the five-week baseline period to 32.5 (SD = 3.53) shakes per day during the first promotion period, \( t(56) = 1.97, p = .054 \). The first promotion thus was effective in increasing children’s purchase of healthy product. We observe a similar, though nonsignificant spike when coupons were introduced the second time around. The average daily sales during the rest period (between the two promotions) was 20.00 (SD = 5.83) shakes per day, compared to the (nonsignificantly) higher sales of 24.33 (SD = 4.51) shakes per day during the second promotion period, \( p = .25 \).

What happened after coupons were removed? We observed a decline in sales once coupons were removed. After the first promotion period, sales significantly declined from 32.5 (SD = 3.53) shakes per day to 20.00 (SD = 5.83) shakes per day, \( t(56) = 2.76, p = .008 \). We also observed a similar decline in sales after the second intervention, such that sales declined from 24.33 (SD = 4.51) shakes per day to 14.88 (SD = 4.51) shakes per day after the second promotion, \( t(56) = 2.49, p = .016 \). Of note, sales after the second promotion were lower than in the baseline, \( t(56) = 4.56, p < .001 \). In this study, price promotion led to a long-term deficit, mirroring the patterns documented among adult populations in pricing research (e.g., Doob et al. 1969; Dodson et al. 1978; Pauwels et al. 2002; Scott 1976). These findings provided supportive evidence for hypothesis 1.

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4 Due to an error, the kiosk manager did not record sales on the second day after the coupons were distributed, so the average sales reported here were calculated based on the first day (30 shakes sold) and third day (35 shakes sold). This error did not occur for the second coupon phase, nor at the other two schools.
Divergent effect based on age and repetition. To explore how different types of coupons generate divergent effects on children based on processing ease, age group, and repetition, we then conducted a logistic regression with processing ease (easy vs. hard), age (young vs. old), phase (1 vs. 2), and all 2-way and 3-way interactions as the independent variables, and redemption rate as the dependent variable. Based on the experimental design and the procedures in prior literature (e.g., Ginsburg and Opper 1988; John 1999), we collapsed children in grades 1 and 2 into the young age group, as they are in the same early developmental stage, and the children in grades 3 to 6 into the old age group, as they are in the same later developmental stage. Analyzing the data at the respective grade levels revealed consistent results for all analyses in all three experiments. In addition, analyzing the data using only extreme age groups (grades 1 and 2 versus grades 5 and 6) revealed consistent results across all studies; see Appendix D for these additional robustness checks.

The logistic regression revealed a 2-way interaction between age and phase ($Wald \chi^2 = 4.24, p = .04$), such that in phase 1, young and old children were equally likely to redeem
coupons (14.2% vs. 14.4%), whereas in phase 2, young children were more likely to redeem coupons than old children (13.1% vs. 8.1%). There were no main effects.

Importantly, we observed the hypothesized 3-way interaction between processing ease, age, and phase ($Wald \chi^2 = 17.19, p < .001$; see figure 3). Decomposing the 3-way interaction by phase, in phase 1, we observed a main effect of processing ease ($Wald \chi^2 = 5.19, p = .023$) and a main effect of age ($Wald \chi^2 = 9.78, p = .002$), qualified by a significant 2-way interaction between processing ease and age ($Wald \chi^2 = 17.96, p < .001$). Simple effect analyses further revealed that in this phase, young children were more likely to redeem the easy-to-process coupon than the hard-to-process coupon (26% vs. 5.1%, $\chi^2 = 15.56, p = .001$), providing supportive evidence for hypothesis 2. In contrast, old children were more likely to redeem the hard-to-process coupon that required them to derive the final price than the easy coupon (19.1% vs. 10.5%, $\chi^2 = 5.32, p = .021$), providing supportive evidence for hypothesis 3.

In phase 2, when the same coupons were distributed again at the school, we observed a marginal interaction between processing ease and age ($Wald \chi^2 = 2.97, p = .085$), with no main effects. Importantly, this interaction revealed a different pattern compared to phase 1: young children became significantly more likely to redeem the hard-to-process coupon the second time around—a behavioral change consistent with prior research on positive habituation of repeating complex stimuli (e.g., Anand and Sternthal 1990; Berlyne 1970; Smith and Dorfman 1975)—compared to the easy coupon (20% vs. 5.7%, $\chi^2 = 8.22, p = .004$). This provided supportive evidence for hypothesis 4. In contrast, old children showed low interest in redeeming both types of coupons in the second phase (7.1% vs. 9.2%, $\chi^2 < 1$), possibly because of tedium that kicked in during repetition (e.g., Anand and Sternthal 1990; Berlyne 1970; Smith and Dorfman 1975); this provided supportive evidence for hypothesis 5.
These findings suggest that the effectiveness of price promotions among children depended on their age and repeated exposure to the coupons. While easy-to-process coupons were more effective among children 6 to 7 years old than hard-to-process coupons, this pattern significantly reversed upon repeated exposure, rendering the coupon that required derivation more effective among children 6 to 7 years old. In contrast, the hard-to-process coupons were more effective among children 8 to 11 years old than easy coupons in phase 1, but the effectiveness of both types of coupons in this age segment was significantly reduced upon repeated exposure. Overall, there were immediate boosts on the purchase of the promoted healthy product during the promotion phase, but the sales quickly dropped once the incentives were removed.

We conducted the next field study at School B to provide a critical robustness check for the patterns documented in study 1 at School A. We tested the effect of manipulating the processing ease of coupon messages at School B (a different population of children) on a different healthy product.
Study 2: Leveraging Coupons of Different Processing Ease to Promote a Healthy Fruit Beverage

Method

The procedure and design of this experiment were identical to those in study 1, with the exception of the product promoted, the coupon value, and the student sample (from a different elementary school), to provide a robustness check for the findings in study 1. In this field experiment, we promoted the fruit beverage, another healthy drink approved by UNICEF. We used a similar manipulation of processing ease as in study 1, altering the extent to which children had to make connections to derive the final price. Specifically, the easy-to-process message for School B directly communicated the final price and did not require children to make connections or computations. The message read “A 12-ounce natural fruit beverage usually costs 50 cents. Only Tuesday to Thursday! Pay only 35 cents when you buy the 12-ounce natural fruit beverage!” As in study 1, the hard-to-process message required children to make a connection between two numbers to derive the final price themselves and read “A 12-ounce natural fruit beverage usually costs 50 cents. Only Tuesday to Thursday! Pay 15 cents less when you buy the 12-ounce natural fruit beverage!” (see figure 4 for coupon visuals, and table 2 for the assignment of classrooms to coupon type at School B). The coupons were again in Spanish; we have translated the text below into English for ease of comprehension.

Figure 4: Coupons for School B

<table>
<thead>
<tr>
<th>Easy-to-Process Message</th>
<th>Hard-to-Process Message</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A 12-ounce natural fruit beverage usually costs 50 cents. Only Tuesday to Thursday! Pay only 35 cents when you buy the 12-ounce natural fruit beverage!

Table 2: Assignment of Classrooms to Coupons at School B

<table>
<thead>
<tr>
<th>Easy-to-process coupon</th>
<th>1st grade</th>
<th>2nd grade</th>
<th>3rd grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A (N=34)</td>
<td>Class B (N=35)</td>
<td>Class D (N=36)</td>
<td>Class E (N=37)</td>
</tr>
<tr>
<td>Class C (N=32)</td>
<td>---</td>
<td>Class A (N=35)</td>
<td>Class F (N=37)</td>
</tr>
<tr>
<td>Class B (N=35)</td>
<td>Class D (N=36)</td>
<td>Class E (N=39)</td>
<td>Class B (N=38)</td>
</tr>
<tr>
<td>Class C (N=33)</td>
<td>Class E (N=37)</td>
<td>Class C (N=36)</td>
<td>Class C (N=39)</td>
</tr>
<tr>
<td>Class D (N=35)</td>
<td>Class F (N=37)</td>
<td>Class B (N=27)</td>
<td>---</td>
</tr>
<tr>
<td>Class E (N=36)</td>
<td>Class D (N=36)</td>
<td>Class C (N=27)</td>
<td>---</td>
</tr>
<tr>
<td>Class F (N=37)</td>
<td>Class A (N=27)</td>
<td>Class C (N=35)</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hard-to-process coupon</th>
<th>4th grade</th>
<th>5th grade</th>
<th>6th grade</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class E (N=36)</td>
<td>Class F (N=30)</td>
<td>Class G (N=34)</td>
<td>---</td>
<td>Class A (N=33)</td>
</tr>
<tr>
<td>Class A (N=32)</td>
<td>Class B (N=34)</td>
<td>Class C (N=33)</td>
<td>Class D (N=31)</td>
<td>Class D (N=36)</td>
</tr>
<tr>
<td>Class B (N=34)</td>
<td>Class C (N=33)</td>
<td>Class D (N=35)</td>
<td>Class E (N=34)</td>
<td>Class E (N=36)</td>
</tr>
<tr>
<td>Class C (N=33)</td>
<td>Class D (N=35)</td>
<td>Class E (N=34)</td>
<td>Class G (N=32)</td>
<td>Class F (N=36)</td>
</tr>
<tr>
<td>Class D (N=35)</td>
<td>Class E (N=34)</td>
<td>Class F (N=38)</td>
<td>Class A (N=38)</td>
<td>Class B (N=35)</td>
</tr>
<tr>
<td>Class E (N=36)</td>
<td>Class F (N=36)</td>
<td>Class C (N=35)</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

These coupons were distributed on a Tuesday in June 2017, in the morning by a group of research assistants blind to the hypotheses. The research assistants were again accompanied by the teacher of the class to ensure credibility. Consistent with study 1, all coupons in all classes were distributed on the same morning to keep the starting time consistent across classes and across grades. After the coupons were distributed on that Tuesday, research assistants visited this school every day that week as well, to validate that there was no issue with redeeming the coupons, and that the sales record of the focal product was tracked closely by the kiosk manager. A month after the distribution of the first-phase coupons, on a Tuesday in July 2017, the research
assistants visited the school again, and this time distributed the second-phase coupons to children; consistent with study 1, these second-phase coupons were identical in messages and visuals to the ones distributed in the first phase (but with unique identification numbers), allowing us to track the effect of repeated exposure.5

Results and Discussion

Temporal effect on sales. First, as shown in figure 5, the distribution of coupons led to an immediate increase of the sales of the promoted fruit beverage. The average daily sales significantly increased from 0.27 (SD = .88) cups per day during the five-week baseline period to 34.33 (SD = 12.34) cups per day during the first promotion period, \( t(3.7) = 17.22, p < .001 \).6 The first promotion thus was effective in increasing children’s purchase of healthy item. We observed another spike when coupons were introduced the second time around. The average daily sales during the rest period (between the two promotions) was 4.93 (SD = 10.57) cups per day, compared to the significantly higher sales of 18.00 (SD = 12.12) cups per day during the second promotion period, \( t(4.08) = 3.22, p = .031 \).

What happened after coupons were removed? We again observed a decline in sales once coupons were removed. After the first promotion period, sales significantly declined from 34.33 (SD = 12.34) cups per day to 4.93 (SD = 10.57) cups per day, \( t(14.99) = 7.12, p < .001 \). We also observed a similar decline in sales after the second promotion, such that sales declined from

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5 Due to students’ absence and class activities, about 8% of the coupons were not distributed, resulting in a total of 1,116 coupons distributed in phase 1 and 1,028 in phase 2.

6 Since data in this study were not normally distributed (skewness = 2.65, Std. Error = .322, Z = 8.23, Kolmogorov-Smirnov (55) = .365, \( p < .001 \)), we log-transformed the sales data before conducting the analysis. We obtained consistent results when using the raw data. Additionally, the reported t-tests in this section did not assume equal variances (Levene’s statistic (4, 50) = 6.79, \( p < .001 \)).
18.00 (SD = 12.12) cups per day to 2.08 (SD = 1.97) cups per day, \( t(3.29) = 3.26, p = .041 \).

These findings provided supportive evidence for hypothesis 1. Of note, different from study 1, sales after the second promotion were higher than in the baseline period, \( t(3.07) = 14.43, p = .008 \).

Figure 5: Average Daily Sales in Study 2

**Dynamic effect based on age and repetition.** To compare the redemption rate across processing ease, age, and phase, we followed the same procedures as in study 1 and conducted a logistic regression. The analysis revealed a 2-way interaction between processing ease and age (\( Wald \chi^2 = 15.84, p = .000 \)), such that the difference in redemption rate between the hard-to-process and easy-to-process messages was larger among young children (15.3% vs. 10.7%) than among old children (10.2% vs. 7.9%). We observed also a 2-way interaction between age and phase (\( Wald \chi^2 = 3.85, p = .05 \)), such that in phase 1, there was no difference in redemption rates between young and old children (12.4% vs. 12.0%), whereas in phase 2, young children were more likely to redeem coupons than old children (12.9% vs. 6%). Finally, we observed a 2-way
interaction between processing ease and phase (Wald $\chi^2 = 4.15$, $p = .042$), such that in phase 1, the difference in redemption rate between hard-to-process and easy-to-process messages was slightly smaller than in phase 2 (13% and 11.2% vs. 9.5% and 6.1%).

Importantly, these effects were again moderated by the hypothesized 3-way interaction between processing ease, age, and phase (Wald $\chi^2 = 25.89$, $p < .001$; see figure 6). Decomposing the 3-way interaction by phase, in phase 1, we observed a main effect of processing ease (Wald $\chi^2 = 6.21$, $p = .013$) and a main effect of age (Wald $\chi^2 = 6.03$, $p = .014$), qualified by a significant 2-way interaction between processing ease and age (Wald $\chi^2 = 10.08$, $p = .002$). Simple effect analyses further revealed that in phase 1, the young children were again more likely to redeem the easy-to-process coupon than the hard-to-process coupon (16.3% vs. 7.5%, $\chi^2 = 5.21$, $p = .022$), supporting hypothesis 2 and replicating the findings in study 1 through a different school, a different promotional value, and a different promoted product. In contrast, old children were more likely to redeem the hard-to-process coupon than the easy-to-process coupon (14.7% vs. 9%, $\chi^2 = 6.32$, $p = .012$), supporting hypothesis 3 and again replicating study 1.

When coupons were distributed the second time around, the interaction between processing ease and age was also significant (Wald $\chi^2 = 15.84$, $p = .000$), with no main effects. This interaction in phase 2 again revealed a different pattern compared to phase 1: consistent with the findings in study 1, young children became more likely to redeem the hard-to-process coupon the second time around, compared to the easy-to-process coupon (25.5% vs. 5%, $\chi^2 = 23.36$, $p = .000$), providing supportive evidence for hypothesis 4. In contrast, old children were equally likely to redeem the easy-to-process and the hard-to-process coupon in this phase (6.6% vs. 5.4%, $\chi^2 < 1$; hypothesis 5).
These results replicated and provided important robustness checks for the patterns observed in study 1. The easy-to-process (vs. hard-to-process) coupon message was more effective among young children, and the hard-to-process (vs. easy-to-process) coupon message led to greater redemption rates among old children; importantly, repetition changed these effects, such that the hard-to-process (vs. easy-to-process) coupons became more effective for the young children during the second phase, whereas both types of coupons were equally ineffective among the old children the second time around. While we again observed immediate boosts on the purchase of the promoted healthy product, the sales quickly dropped once the incentives were removed.

The results so far highlight the importance of tailoring promotion messages based on children’s age and the number of exposures. In our third and final field experiment, we manipulated message processing ease in a different way: instead of altering the need for computation, our manipulation in this study required students to make connections between products of different sizes to derive a final price. This additional treatment helped to enhance the
generalizability of our findings so far and provided convergent evidence for the proposed parsimonious construct of processing ease (directly communicated price vs. derived price) on children. Importantly, it also ruled out potential alternative accounts such as highlighting the feeling of gain/saving when using the math-based discount messages and specifying the amount saved (e.g., “pay 15 cents less” in the derived price conditions in previous studies could have unintentionally highlighted the amount of savings). Furthermore, we distributed the coupons at yet another school to promote a healthy fruit beverage among a different sample of children.

**Study 3: Manipulating Processing Ease through Connection Making**

Method

In study 3, we further tested the generalizability of our findings by conducting a field experiment in yet another elementary school to promote a healthy fruit beverage. To expand the scope of our empirical test, we manipulated message processing ease by changing the extent to which children had to make connections between products of different sizes to derive a final price. As in previous studies, the easy-to-process message did not require making a connection between products but instead directly communicated the final price. The message read “A large natural fruit beverage usually costs 65 cents and a small natural fruit beverage usually costs 40 cents. Only Tuesday to Thursday! Buy the large natural fruit beverage and pay only 40 cents!” The hard-to-process message required children to make a connection between the large and small sizes of the fruit beverage to derive the final price, and read “A large natural fruit beverage usually costs 65 cents and a small natural fruit beverage usually costs 40 cents. Only
Tuesday to Thursday! Buy the large natural fruit beverage and pay for the small one!”

While the easy-to-process message directly informed children of the final price of the beverage, the hard-to-process message required them to make a connection between two sizes of the beverage in order to derive the (same) final price of 40 cents. Unlike studies 1 and 2, deriving the final price did not require any math-based computations nor did the hard-to-process message highlight the amount saved. See figure 7 for the visual of the coupons, and table 3 for the assignment of classrooms to coupon type.

Figure 7: Coupons for School C

Table 3: Assignment of Classrooms to Coupons at School C

<table>
<thead>
<tr>
<th>Easy-to-Process Message</th>
<th>Hard-to-Process Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>A large natural fruit beverage usually costs 65 cents and a small natural fruit beverage usually costs 40 cents. <strong>Only Tuesday to Thursday! Buy the large natural fruit beverage and pay only 40 cents!</strong></td>
<td>A large natural fruit beverage usually costs 65 cents and a small natural fruit beverage usually costs 40 cents. <strong>Only Tuesday to Thursday! Buy the large natural fruit beverage and pay for the small one!</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Easy-to-process coupon</th>
<th>Hard-to-process coupon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A (N=24)</td>
<td>Class C (N=21)</td>
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<tr>
<td>Class B (N=21)</td>
<td>Class D (N=25)</td>
</tr>
<tr>
<td>Class C (N=23)</td>
<td>Class A (N=26)</td>
</tr>
<tr>
<td>Class D (N=25)</td>
<td>Class B (N=26)</td>
</tr>
<tr>
<td>Class A (N=25)</td>
<td>Class C (N=21)</td>
</tr>
<tr>
<td>Class B (N=25)</td>
<td>Class D (N=21)</td>
</tr>
<tr>
<td>Class C (N=25)</td>
<td>Class E (N=21)</td>
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<tr>
<td>Class D (N=21)</td>
<td>Class A (N=22)</td>
</tr>
<tr>
<td>Class E (N=22)</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5th grade</th>
<th>6th grade</th>
<th>Total</th>
</tr>
</thead>
</table>
These coupons were distributed on a Tuesday in June 2017, in the morning by a group of research assistants blind to the hypotheses. The research assistants were again accompanied by the teacher of the class to ensure credibility. Consistent with previous studies, all coupons in all classes were distributed on the same morning to keep the starting time consistent across classes and across grades. Research assistants again visited this school every day that week, to validate that there was no issue with redeeming the coupons, and that the sales record of the focal product was tracked accurately by the kiosk manager. A month after the distribution of the first-phase coupons, on a Tuesday in July 2017, the research assistants visited the school again, and this time distributed the second-phase coupons that were identical in messages and visuals as the ones distributed in the first phase but with unique identification numbers.7

Results and Discussion

*Temporal effect on sales.* First, as shown in figure 8, the distribution of coupons led to an immediate increase of the sales of the promoted fruit beverage. The average daily sales significantly increased from 4.00 (SD = .41) cups per day during the five-week baseline period to 33.67 (SD = 13.50) cups per day during the first promotion period, *t*(2.6) = 7.89, *p* = .007.8 The first promotion thus was effective in increasing children’s purchase of healthy item. We observed another spike when coupons were introduced the second time. The average daily sales during the

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7 Due to students’ absence and class activities, about 5% of the coupons were not distributed, such that 597 coupons were distributed in phase 1 and 556 in phase 2.

8 Since data in this study were not normally distributed (skewness = 3.78, Std. Error = .333, Z = 11.35, Kolmogorov-Smirnov (51) = .356, *p* < .001), we log-transformed the sales data before conducting the analysis. We obtained consistent results when using the raw data. Additionally, the reported *t*-tests in this section did not assume equal variances (Levene’s statistic (4,46) = 21.188, *p* < .001).
rest period (between the two promotions) was 2.33 (SD = 2.79) cups per day, compared to the higher sales of 8.00 (SD = 7.00) cups per day during the second promotion period, \( t(4.24) = 2.7 \), \( p = .051 \).

Similar to the first two field experiments, we again observed a decline in sales once coupons were removed. After the first promotion period, sales significantly declined from 33.67 (SD = 13.50) cups per day to 2.33 (SD = 2.79) cups per day, \( t(10.29) = 7.63 \), \( p < .001 \). We also observed a similar, though nonsignificant, decline in sales after the second intervention, such that sales declined from 8.00 (SD = 7.00) cups per day to 2.00 (SD = 1.09) cups per day after the second promotion, \( p = .11 \).\(^9\) Of note, sales after the second promotion were marginally lower than in the baseline, \( t(5.99) = 2.08 \), \( p = .083 \). These findings provided supportive evidence for hypothesis 1.

Figure 8: Average Daily Sales in Study 3

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\(^9\) There was an unexpected change in personnel and the new kiosk manager did not track sales after 7/31/2017, therefore there were only 6 days recorded in rest phase 2.
Coupon redemption. To compare the redemption rate across processing ease, age, and phase, we followed the same procedures as in prior studies to conduct a logistic regression analysis. The analysis revealed a main effect of processing ease (Wald $\chi^2 = 4.86$, $p = .027$), such that children redeemed more hard-to-process coupons than easy-to-process coupons (19% vs. 11.2%). The regression revealed also a main effect of phase (Wald $\chi^2 = 5.14$, $p = .023$), such that children redeemed more coupons in phase 1 than in phase 2 (22.5% vs. 7.2%). We observed a 2-way interaction between processing ease and age (Wald $\chi^2 = 10.09$, $p = .001$), such that across phases, old children redeemed more hard-to-process coupons than easy-to-process coupons (22.3% vs. 10.2%), whereas there was no significant difference among young children (easy-to-process vs. hard-to-process = 13.4% vs. 11.9%). There was also a 2-way interaction between processing ease and phase (Wald $\chi^2 = 17.53$, $p = .000$), such that across ages, children redeemed more hard-to-process coupons than easy-to-process coupons in phase 1 (29.8% vs. 15.3%), whereas there was no difference in redemption rate in phase 2 (7.6% vs. 6.8%).

Most importantly, these effects were again moderated by the hypothesized 3-way interaction between processing ease, age, and phase (Wald $\chi^2 = 31.46$, $p < .001$; see figure 9). Decomposing the 3-way interaction by phase, in phase 1, we observed a main effect of processing ease (Wald $\chi^2 = 36.07$, $p < .001$), qualified by a significant 2-way interaction between processing ease and age (Wald $\chi^2 = 24.19$, $p < .001$). Simple effect analyses revealed that young children were more likely to redeem the easy-to-process coupon than the hard-to-process coupon (19.4% vs. 3.4%, $\chi^2 =11.04$, $p = .001$), consistent with studies 1 and 2 and providing final evidence for hypothesis 2. In contrast, old children were more likely to redeem the hard-to-process coupon than the easy-to-process coupon (40.9% vs. 13.5%, $\chi^2 = 39.13$, $p < .001$), again supportive of hypothesis 3.
In phase 2, when the same coupons were distributed again among children at this school, we observed a main effect of processing ease \((Wald \chi^2 = 4.86, p = .027)\), qualified by a 2-way interaction between processing ease and age \((Wald \chi^2 = 10.09, p = .001)\). Consistent with studies 1 and 2, this interaction in phase 2 revealed a different pattern compared to phase 1: the young children were more likely to redeem the hard-to-process coupon the second time around, compared to the easy-to-process coupon \((20.0\% vs. 7.5\%, \chi^2 = 6.03, p = .014)\), providing final evidence for hypothesis 4. Interestingly, in this experiment, old children were even less likely to redeem the hard-to-process coupon than the easy-to-process coupon in phase 2 \((1.6\% vs. 6.5\%, \chi^2 = 5.68, p = .017)\). We suspect that this difference may have reached significance due to the unusually low redemption rate of hard-to-process coupons in phase 2 among old children (i.e., 1.6%). It is also possible that making connections between products of different sizes affected old children differently, compared to making math computations to derive price, as documented in studies 1 and 2. We discuss this interesting pattern in greater depth in the General Discussion to motivate future research.

Figure 9: Redemption Rate as a Function of Processing Ease, Age, and Phase (Study 3)
General Discussion

Three school-wide field experiments, each having two 3-day interventions (with three months of sales tracking), demonstrated that price promotions can be employed to increase children’s choice of healthy products in the short run. This finding is in itself valuable, as prior literature had not documented the effect of price promotions among children, only among adults and adolescents (Faith et al. 2007; Powell et al. 2007). In addition, we documented this effect in the noisy real world, in which children were exposed to a variety of educational and marketing materials every day. Importantly, much like with adults, the effectiveness of price promotions on children might be short-lived once the incentives were removed.

The effectiveness of price promotions depended on the processing ease of the message and on the children’s ages, such that easy and direct messages were more effective among young children but hard-to-process messages that required derivation to infer the final price were more effective among old children. Also important, we uncovered an interesting effect of repetition;
upon second exposure to the same promotion message, young children responded better to the derived message, whereas old children were equally unmotivated by both types of messages (with the exception of School C, where the derived message was even less effective when distributed the second time).

As an exploratory analysis, we were also curious to see if our attempt to promote healthy products—specifically, healthy beverages—created a substitution effect, such that children’s purchase of unhealthy beverages decreased during the promotion period. Or alternatively, children may have used the money they saved to purchase indulgent drinks at the kiosks during the promotion or rest phases. We found that the sales of unhealthy beverages slightly declined during promotion periods and increased once the promotions of healthy drinks were removed, though the effects were not always statistically significant (see Appendix E for complete results). These preliminary findings provide exciting possibilities for future research and policy development, to increase the choice of healthy options as a way to reduce unhealthy consumption. Similar to the patterns observed in price promotions, however, the reduction of unhealthy consumption could also be short lived; a more permanent pricing change may be required to induce long-term behavioral change.

Theoretical Implications and Future Research

Marketing to children. Our findings add to the understanding of children’s responses to, and engagement with, marketing communications of healthy products. Attempts to completely ban advertising of unhealthy products to children may be ineffective, as children may still be exposed to similar advertisements targeting adults (Huang and Yang 2013; Institute of Medicine
At the same time, direct attempts to convince children to consume healthy products can backfire and decrease consumption of these items (Maimaran and Fishbach 2014; Wardle and Huon 2000), unless it is subtly communicated in the background (e.g., Huang et al. 2019). Our studies demonstrate that leveraging price promotions—a classic marketing tool—can aid in increasing children’s immediate choice of healthy products at school. Future research can build on these findings to explore how a combination of different marketing tools (e.g., price promotions and product design) can jointly encourage healthy consumption among children, and how these treatments potentially counteract the marketing of unhealthy options to produce net positive effects.

In addition, the present research leveraged price promotions to encourage purchase of healthy products such as cereal shakes and fruit juice, which are relatively pleasant and flavorful for children. An important empirical question is whether the observed short-term increase in sales would be generalizable to other healthy options that have a duller flavor profile, such as raw vegetables (Birch 1999; Nicklaus 2009). In these situations, perhaps other marketing tools (e.g., location/proximity, packaging, endorsement) would be critical. We encourage future research to explore the boundary of price promotions and the relative effectiveness of different marketing tools in encouraging children to consume a variety of healthy items.

The lack of long-term effect. Why would the sales of the promoted healthy products drop once the promotion was removed? It is possible that using price promotions to encourage healthy consumption is similar to directly rewarding children for healthy consumption (e.g., “eat your vegetables and you will get a toy”). While rewards can be effective in promoting consumption of fruit and vegetables (Cooke et al. 2011; Wardle et al. 2003), research has shown that using rewards may lead to decreased liking of the promoted healthy products, as these items would be
viewed merely as means to get the reward (Birch et al. 1982; Birch, Marlin, and Rotter 1984; Newman and Taylor 1992). In addition, price promotion research on adults has revealed that consumers may attribute their purchase behavior to the extrinsic incentive and not to their intrinsic preferences (Dodson et al. 1978; Pauwels et al. 2002; Scott 1976); subsequently, the removal of the incentive resulted in the reduction of the purchase behavior. Our findings suggested that a similar attribution may have occurred among children as well. Additionally, it is possible that when the promoted healthy product was not especially tasty, children would not develop a preference for it and thus would reduce consumption once the external incentives were removed. Of note, this possibility is less likely in our case, since the promotion did increase sales when distributed the second time around. We encourage future research to explore other ways to provide incentives to children that can help to boost not only their immediate choice but also their long-term preference for healthy options.

Developmental models. Our findings contribute to the growing research on child development theories by demonstrating the divergent impact of price promotion messages on children. We isolate two determining variables: children’s age and repetition. Our findings provide suggestive evidence that the processing ease literature and the repetition literature, which mainly tested adult populations, could be employed to understand what motivates children to engage with a promotional message. The results of three field experiments suggest that if a message is hard to process, it will not be received well by a young population who still process information in a relatively concrete, simple manner; however, if a price promotion message is too easy to process and too direct, it does not evoke sufficient engagement among old children, who are capable of processing complex information and who also have domain-specific market knowledge and experience about how price promotions are usually communicated.
Interestingly, the proposed effects of age and of message processing ease could change upon second exposure. This finding complements and adds to the classic work on children’s repeated exposure to food commercials (Galst and White 1976; Taras et al. 1989). For instance, Gorn and Goldberg (1982) found that repeated exposure to televised food and beverage messages at a summer camp could alter children’s snack choices, such that children who viewed candy commercials chose significantly more candy over fruit as afternoon snacks. While these papers focused on television communication and identified an amplifying effect through repeated exposure, we isolated a temporally divergent effect of price promotion on children, such that the patterns of choice either reversed (for young children) or reduced (for old children) upon second exposure. These findings are consistent with the two-factor model of repetition in marketing (Anand and Sternthal 1990; Berlyne 1970; Smith and Dorfman 1975), and suggest that both positive habituation and tedium could be at work when children were exposed to a stimulus repeatedly. Future research is encouraged to further explore these interesting and important dynamics, such as: (1) When would repeated exposure affect behavior (i.e., the frequency and density of repetition to reach the threshold), (2) How does repeated exposure affect behavior (habituation, tedium, and the meta-cognitive ability required for these mechanisms to produce an effect), and (3) What types of materials would show the amplifying effect versus a divergent effect through repetition?

Relatedly, in our studies, the divergent effects of repeated exposure seem to vary depending on how we manipulated the messages’ processing ease. When the hard-to-process message asked children to make connections between (and computations of) two numbers in studies 1 and 2, the hard- and easy-to-process messages were equally ineffective among old children the second time around; in contrast, when the hard-to-process message asked children to
make connections between products of two sizes in study 3, the hard-to-process message became significantly less effective than the easy-to-process message during phase 2. While this could be due to a floor effect, as less than 2% of the old children redeemed the hard-to-process coupon, it is also possible that making connections between products (versus numbers) follows a different learning pattern; exploring this possibility can further add to our understanding of how children learn different types of skills (e.g., computation, language, and logical derivation), and how different types of cognitive skills may affect the effectiveness of different types of marketing messages.

Cultural Specificity, Generalizability, and Practical Implications

Because of the collaboration with UNICEF (which focuses on the welfare of children in developing countries), the present research focuses on studying the behaviors of children in Panamá. This approach nicely responds to the call-for-action to move beyond WEIRD populations (i.e., Western, educated adults from industrialized, rich, and democratic countries) and study difficult-to-access samples. This call-for-action is gaining attention across fields, including food science (Birch 1999), consumer behavior research (Inman et al. 2018; Lynch et al. 2012; Pham 2013; Wertenbroch 2015), and social psychology and social science in general (Arnett 2008; Henrich et al. 2010; Rad et al. 2018). This approach additionally allows the testing of solutions for obesity in developing countries that may suffer from food insecurity. As Tanumihardjo et al. (2007) rightfully pointed out, food insecurity is complex, and the paradox is that it leads not only to undernutrition but also overnutrition, which can result in overweight and obesity. Our research thus fills an important gap in the sampling approach of prior work, while
addressing a critical concern that both developed and developing countries are facing.

Nonetheless, just like any research that studies a specific population, the generalizability of present findings to populations of different cultures and different socioeconomic statuses would require additional testing.

Importantly, Vygotsky-inspired sociocultural approach to cognitive development emphasizes the role of social context, both the distal context provided by the general culture and the proximal context of interactions with significant others such as the child’s parents. As a result, children’s development of cognitive abilities may be significantly different across cultures, such that social experiences can either hinder or nurture the development of cognitive skills. For instance, Saxe (1981, 1982) found that numerical-reasoning skills tended to be slower to develop among New Guinean children than among Western children because of the reliance on concrete (i.e., physical, nonabstract) counting methods in New Guinea. In contrast, research on 9-year-old to 15-year-old candy vendors in Brazil demonstrated that these children were able to quickly perform complex and difficult mathematical computations to conduct transactions on the street, even in the absence of formal education (Nunes et al. 1993; Saxe 1991, 1999). Therefore, children in certain socioeconomic levels in developing countries may have less formal training but more advanced market experience and knowledge because of the need to engage in market-related activities, such as purchasing and selling, on a daily basis. In addition, there is evidence suggesting that certain learning effects (e.g., repetition to learn a new song) could be stronger among Panamanian children than US children (Moore et al. 1997). Hence, we enthusiastically encourage future research to explore how children around the world may respond to different price promotions of healthy options, and the specific cultural and socioeconomic environments in which the present findings would replicate versus diverge.
In closing, our findings are highly relevant for devising practical strategies to encourage children to choose healthy products. By using price promotions, children are choosing whether to purchase the promoted product or not, thereby giving children control, compared to forcing children to consume healthy products or banning the unhealthy products from their environment altogether. Also, price promotions can be used easily at an institutional level, such as at schools, in supermarkets, and at restaurants that cater to children and families. Our studies show that price promotions can be quite effective in motivating healthy choices in the short run, but that the messages need to match the developmental level and knowledge of the specific target segments that the government, organizations, and marketers are trying to influence.

As exposure to marketing messages during childhood can lead to resilient changes in product evaluations that persist into adulthood (e.g., Albuquerque et al. 2018; Connell, Brucks, and Nielsen 2014), and given the inherent complexity of making healthy choices (Bublitz, Peracchio, and Block 2010; Block et al. 2011), it is of critical importance for scholars to expand the present inquiry and examine the long-term effects of employing price promotions to increase healthy consumption among children across different socioeconomic environments (developing versus developed countries), cultures (collective versus individualistic), and climates (tropical, subtropical, temperate, and polar). Valuable insights can be obtained that would enhance our understanding of the positive and negative effects of marketing on young, vulnerable consumers, as well as for policy development and for effective marketing practices.
APPENDIX A

Demographics of the Three Schools

<table>
<thead>
<tr>
<th>Name of the School</th>
<th>Total Number of Students</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
</tr>
</thead>
<tbody>
<tr>
<td>School A</td>
<td>Gran Bretaña</td>
<td>565</td>
<td>107</td>
<td>93</td>
<td>80</td>
<td>83</td>
<td>85</td>
</tr>
<tr>
<td>School B</td>
<td>La Siesta</td>
<td>1219</td>
<td>101</td>
<td>219</td>
<td>214</td>
<td>230</td>
<td>237</td>
</tr>
<tr>
<td>School C</td>
<td>Estado de Israel</td>
<td>633</td>
<td>87</td>
<td>98</td>
<td>98</td>
<td>107</td>
<td>118</td>
</tr>
</tbody>
</table>
## APPENDIX B

### Kiosk Inventory by School and Product Type

#### School A: Gran Bretaña

<table>
<thead>
<tr>
<th>Beverages and cold products</th>
<th>Snacks</th>
<th>Prepared foods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product details</strong></td>
<td><strong>Price</strong></td>
<td><strong>Product details</strong></td>
</tr>
<tr>
<td>Bottled water, Cielo 625 mL</td>
<td>0.75</td>
<td>Curly french fries, package</td>
</tr>
<tr>
<td>Malta Vigor, can 355 mL</td>
<td>1.00</td>
<td>Doritos</td>
</tr>
<tr>
<td>Iced tea, Duran, can 355 mL</td>
<td>1.00</td>
<td>Potato chips, Lays</td>
</tr>
<tr>
<td>Del Monte juice, can 330 mL</td>
<td>1.00</td>
<td>Salty cookies, Pascual</td>
</tr>
<tr>
<td>Bonlac juice, Tetra Pak 200 mL</td>
<td>0.50</td>
<td>Raisins cookies, Pascual</td>
</tr>
<tr>
<td>Power, bottle 600 mL</td>
<td>1.00</td>
<td>Coconut cookies, Pascual</td>
</tr>
<tr>
<td>V8 Splash juice, Tetra Pak, 200 mL</td>
<td>0.65</td>
<td>Maria cookies, Pascual</td>
</tr>
<tr>
<td>Liquid oat, Nevada, Tetra Pak 236 mL</td>
<td>0.75</td>
<td>Sandwich cookies, Pascual</td>
</tr>
<tr>
<td>Whole milk, Chiricana, Tetra Pak, 236 mL</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>Natural fruit beverage, 16 oz</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Natural fruit beverage, 10 oz</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Cereal shake, 16 oz</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Cantaloupe, pineapple shake, 16 oz</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>Dos Pinos yogurt</td>
<td>0.85</td>
<td></td>
</tr>
</tbody>
</table>

**Fruits**

<table>
<thead>
<tr>
<th>Fruits</th>
<th><strong>Combo</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal fruit slices</td>
<td>0.25</td>
</tr>
<tr>
<td>Fruit salad, 10 oz</td>
<td>0.75</td>
</tr>
</tbody>
</table>

All prices are in USD. The kiosk offers a total of 31 products, which may vary, depending on the prepared food available.
<table>
<thead>
<tr>
<th>School B: La Siesta</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beverage and cold products</strong></td>
</tr>
<tr>
<td><strong>Product details</strong></td>
</tr>
<tr>
<td>Bottled water, Cielo 625 mL</td>
</tr>
<tr>
<td>Bottled water, Nestlé 500 mL</td>
</tr>
<tr>
<td>Del Monte juice, can 330 mL</td>
</tr>
<tr>
<td>Del Monte juice, Tetra Pak 200 mL</td>
</tr>
<tr>
<td>Liquid oatmeal, Nevada Tetra Pak, 236 mL</td>
</tr>
<tr>
<td>Regular juice in a bottle, 355 mL</td>
</tr>
<tr>
<td>Natural fruit beverage, 8 oz</td>
</tr>
<tr>
<td>Natural fruit beverage, 12 oz</td>
</tr>
<tr>
<td>Natural fruit beverage, 16 oz</td>
</tr>
<tr>
<td>Rice pudding dessert 6 oz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Fruits</strong></th>
<th><strong>Club social salad cookies</strong></th>
<th><strong>Slice of cake</strong></th>
<th><strong>Price</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Slices of pineapple (2)</td>
<td>0.50</td>
<td>Whole wheat cookies</td>
<td>0.25</td>
</tr>
<tr>
<td>Watermelon slices (2)</td>
<td>0.50</td>
<td>Emperador chocolate cookies</td>
<td>0.75</td>
</tr>
<tr>
<td>Small slices of cantaloupe</td>
<td>0.25</td>
<td>Halls sweets</td>
<td>3x0.10</td>
</tr>
<tr>
<td>Big slices of cantaloupe</td>
<td>0.50</td>
<td>Coffee candies</td>
<td>3x0.10</td>
</tr>
<tr>
<td>Fruit salad, 8 oz</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit salad, 16 oz</td>
<td>1.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pear</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grapes in a plastic container</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kiwi</td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All prices are in USD. The kiosk offers a total of 44 products, which may vary, depending on the prepared food available.
## School C: Estado de Israel

<table>
<thead>
<tr>
<th>Beverages and cold products</th>
<th>Snacks</th>
<th>Prepared foods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product details</strong></td>
<td><strong>Price</strong></td>
<td><strong>Product details</strong></td>
</tr>
<tr>
<td>Bottled water, Cielo</td>
<td>1.00</td>
<td>Yellow cheese crackers</td>
</tr>
<tr>
<td>625 mL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottled water, Bon fresh</td>
<td>0.65</td>
<td>Salty cookies, Pascual</td>
</tr>
<tr>
<td>500 mL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Del Monte juice, can</td>
<td>1.00</td>
<td>Raisin cookies, Pascual</td>
</tr>
<tr>
<td>330 mL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit juice, bottle 360 mL</td>
<td>0.60</td>
<td>Sorbeto cookies, Pascual</td>
</tr>
<tr>
<td>Del Monte juice, can</td>
<td>1.00</td>
<td>Raisin cookies, Pascual</td>
</tr>
<tr>
<td>330 mL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural fruit beverage,</td>
<td>0.40</td>
<td>Sandwich cookies, Pascual</td>
</tr>
<tr>
<td>8 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural fruit beverage,</td>
<td>0.65</td>
<td>Peanuts</td>
</tr>
<tr>
<td>12 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jelly, 8 oz</td>
<td>0.25</td>
<td>Chocolate cookies, mini choqui</td>
</tr>
<tr>
<td>Natural fruit ices</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Ice cream served in 6 oz</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>glass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice pudding dessert, 8 oz</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td>Sweets</td>
</tr>
<tr>
<td>Slice of pineapple</td>
<td>0.50</td>
<td>Slice of cake</td>
</tr>
<tr>
<td>Fruit salad, 12 oz</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Slice of watermelon</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>Slice of cantaloupe</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>Two oranges</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Slice of papaya</td>
<td>0.40</td>
<td></td>
</tr>
</tbody>
</table>

All prices are in USD. The kiosk offers 37 products, which may vary, depending on the prepared food available and fruit of the season.
APPENDIX C
Pretest of Coupon Messages

Method. Based on interviews with the Panamanian research teams and the teachers at the three schools, we designed the price promotion messages to be easy-to-process (directly communicating the final price) or hard-to-process (requiring children to derive the final price). We tested the validity of these manipulations through a pretest among a randomly selected sample of 50 elementary school teachers in Panamá.

As it was challenging to recruit elementary school teachers in Panamá and to verify that they were indeed employed as teachers at their respective schools, we hired a local research company, IME (Inteligencia de Mercado Emocional), to assist us with the recruitment, verification, and execution of the pretest. The manager of this company (and his research assistants) remained blind to our hypotheses throughout the survey process. IME recruited 50 elementary school teachers in Panamá on our (and UNICEF’s) behalf (male = 15, female = 35; public school = 25, private school = 25; $M_{\text{age}} = 43.32$, $SD = 10.58$; $M_{\text{years as elementary-school teacher}} = 64.62$ months/5.39 years, $SD = 32.63$ months/2.72 years).

These teachers viewed the six coupons (three easy-to-process and three hard-to-process, for Schools A, B, and C, respectively) in a random order, and answered the following questions about how easy it was to process the coupon, and whether the coupon required abstract thinking and connection making (i.e., derived price) for children: “Overall, how difficult is it for elementary school children (6–11 years old) to understand this coupon? (1 = very easy, 7 = very difficult),” “How much abstract thinking is required for elementary school children (6–11 years old) to understand this coupon? (1 = not at all, 7 = a lot of abstract thinking),” “How much
connection making (across different concepts) is required for elementary school children (6–11 years old) to understand this coupon? (1 = not at all, 7 = a lot of connection making).” All questions were translated into the teachers’ native language (i.e., Spanish) by IME.10

Results. Paired sample t-tests verified that the manipulation of coupon messages was successful. Across all coupon pairs (one pair for each school), the hard-to-process message was perceived as significantly more difficult to understand, requiring more abstract thinking and more connection making than the easy-to-process message (see table below).

Table: Perceived Coupon Complexity for Three Schools

<table>
<thead>
<tr>
<th>School A</th>
<th>Easy-to-Process Message</th>
<th>Hard-to-Process Message</th>
<th>t(49)</th>
<th>p &lt; .001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to understand</td>
<td>M = 2.80, SD = 1.73</td>
<td>M = 5.40, SD = 1.65</td>
<td>t(49) = –8.49, p &lt; .001</td>
<td></td>
</tr>
<tr>
<td>Abstract thinking</td>
<td>M = 2.88, SD = 1.97</td>
<td>M = 5.48, SD = 1.64</td>
<td>t(49) = –8.01, p &lt; .001</td>
<td></td>
</tr>
<tr>
<td>Connection making</td>
<td>M = 2.86, SD = 1.78</td>
<td>M = 5.14, SD = 1.91</td>
<td>t(49) = –8.02, p &lt; .001</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>School B</th>
<th>Easy-to-Process Message</th>
<th>Hard-to-Process Message</th>
<th>t(49)</th>
<th>p &lt; .001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to understand</td>
<td>M = 2.90, SD = 1.80</td>
<td>M = 4.94, SD = 1.77</td>
<td>t(49) = –6.12, p &lt; .001</td>
<td></td>
</tr>
<tr>
<td>Abstract thinking</td>
<td>M = 2.92, SD = 2.02</td>
<td>M = 5.28, SD = 1.73</td>
<td>t(49) = –7.40, p &lt; .001</td>
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<tr>
<td>Connection making</td>
<td>M = 2.80, SD = 1.86</td>
<td>M = 5.22, SD = 1.56</td>
<td>t(49) = –7.70, p &lt; .001</td>
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</table>

<table>
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<th>School C</th>
<th>Easy-to-process Message</th>
<th>Hard-to-process Message</th>
<th>t(49)</th>
<th>p &lt; .001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to understand</td>
<td>M = 2.78, SD = 1.56</td>
<td>M = 4.50, SD = 2.05</td>
<td>t(49) = –5.54, p &lt; .001</td>
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</tr>
<tr>
<td>Abstract thinking</td>
<td>M = 3.14, SD = 1.71</td>
<td>M = 4.94, SD = 2.00</td>
<td>t(49) = –5.46, p &lt; .001</td>
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<tr>
<td>Connection making</td>
<td>M = 2.90, SD = 1.66</td>
<td>M = 4.60, SD = 2.06</td>
<td>t(49) = –5.57, p &lt; .001</td>
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</tr>
</tbody>
</table>

10 We initially conceptualized that the difference in coupon redemption can be explained by the level of fit between the message and the child’s cognitive developmental level. We therefore asked the teachers to indicate also for each message how well it matches the comprehension level of the young children (1st and 2nd grade) and the old children (3rd to 6th grade). While not relevant to our updated theorizing, we found that across all messages, the easy-to-process messages matched better with the comprehension level of young children, whereas the hard-to-process messages matched better with the comprehension level of old children (ps < .001). We reported these additional items and results here in a footnote for transparency and comprehensiveness.
APPENDIX D

Analyzing Redemption Rates for 1st–2nd and 5th–6th Grades Only

*Study 1.* The logistic regression revealed a 2-way interaction between age and phase ($Wald \chi^2 = 5.05, p = .025$), such that in phase 1, young and old children were equally likely to redeem coupons (14.2% vs. 15.2%), whereas in phase 2, young children were more likely to redeem coupons than old children (13.1% vs. 8.8%). There were no main effects.

Importantly, we again observed the hypothesized 3-way interaction between processing ease, age, and phase ($Wald \chi^2 = 17.69, p < .001$; see figure D1). Decomposing the 3-way interaction by phase, in phase 1, we observed a main effect of processing ease ($Wald \chi^2 = 5.60, p = .018$) and a main effect of age ($Wald \chi^2 = 8.13, p = .004$), qualified by a significant 2-way interaction between processing ease and age ($Wald \chi^2 = 18.29, p < .001$). Simple effect analyses further revealed that in this phase, young children were more likely to redeem the easy-to-process coupon than the hard-to-process coupon (26% vs. 5.1%, $\chi^2 = 15.56, p = .001$), providing supportive evidence for hypothesis 2. In contrast, old children were more likely to redeem the hard-to-process coupon than the easy-to-process coupon (22.4% vs. 9.9, $\chi^2 = 5.88, p = .015$), providing supportive evidence for hypothesis 3.

In phase 2, when the same coupons were distributed again at the school, we again observed a marginal interaction between processing ease and age ($Wald \chi^2 = 3.21, p = .073$), with no main effects. Similar to the results of all age groups reported in study 1, this interaction revealed a different pattern compared to phase 1: young children were significantly more likely to redeem the hard-to-process coupon the second time around, compared to the easy-to-process coupon (20% vs. 5.7%, $\chi^2 = 8.22, p = .004$), providing supportive evidence for hypothesis 4. In
contrast, old children were equally likely to redeem the easy-to-process and the hard-to-process coupon in this phase (8.4% vs. 9.3%, $\chi^2 < 1$), which was supportive of hypothesis 5.

Figure D1: Redemption Rate as a Function of Processing Ease, Age, and Phase (Study 1)

Study 2. The logistic regression revealed a 2-way interaction between processing ease and age ($Wald \chi^2 = 5.60, p = .018$), such that the difference in redemption rate between the hard-to-process and easy-to-process messages was larger among old children (10.7% vs. 5.4%; $\chi^2 = 7.8$, $p = .005$) than among young children (15.3% vs. 10.7%, $p > .1$). There were no main effects.

Importantly, we again observed the hypothesized 3-way interaction between processing ease, age, and phase ($Wald \chi^2 = 16.422, p < .001$; see figure D2). Decomposing the 3-way interaction by phase, in phase 1, we observed a main effect of processing ease ($Wald \chi^2 = 7.61, p = .006$) and a main effect of age ($Wald \chi^2 = 7.81, p = .005$), qualified by a significant 2-way interaction between processing ease and age ($Wald \chi^2 = 12.23, p < .001$). Consistent with the results of all age groups reported in study 2, simple effect analyses further revealed that the young children at this school were more likely to redeem the easy-to-process coupon than the
hard-to-process coupon (16.3% vs. 7.5%, $\chi^2 = 5.21, p = .022$). In contrast, old children were more likely to redeem the hard-to-process coupon than the easy-to-process coupon (15.6% vs. 6.7%, $\chi^2 = 8.04, p = .005$).

Figure D2: Redemption Rate as a Function of Processing Ease, Age, and Phase (Study 2)

In phase 2, the interaction between processing ease and age was also significant ($Wald \chi^2 = 5.60, p = .018$), with no main effects. This interaction in phase 2 again revealed a different pattern compared to phase 1: young children were more likely to redeem the hard-to-process coupon the second time around, compared to the easy-to-process coupon (25.5% vs. 5%, $\chi^2 = 23.36, p = .000$), providing supportive evidence for hypothesis 4. In contrast, old children were equally likely to redeem the easy-to-process and the hard-to-process coupon in this phase (4.0% vs. 5.9%, $\chi^2 < 1$; hypothesis 5).
Study 3. The logistic regression\textsuperscript{11} revealed a main effect of processing ease ($Wald \chi^2 = 4.77, p = .029$), such that children redeemed more hard-to-process coupons than easy-to-process coupons (14.7% vs. 12.3%). We observed a 2-way interaction between processing ease and age ($Wald \chi^2 = 8.71, p = .003$), such that across phases, old children redeemed more hard-to-process coupons than easy-to-process coupons (17.1% vs. 11.0%), whereas there was no significant difference among young children (easy-to-process vs. hard-to-process = 13.4% vs. 11.9%). There was also a 2-way interaction between processing ease and phase ($Wald \chi^2 = 9.46, p = .002$), such that across ages, children redeemed more hard-to-process coupons than easy-to-process coupons in phase 1 (18.9% vs. 15.3%), whereas the difference was smaller in phase 2 (10.1% vs. 8.5%).

Most importantly, these effects were again moderated by the hypothesized 3-way interaction between processing ease, age, and phase ($Wald \chi^2 = 22.003, p < .001$; see figure D3). Decomposing the 3-way interaction by phase, in phase 1, we observed a main effect of processing ease ($Wald \chi^2 = 9.42, p = .002$), qualified by a significant 2-way interaction between processing ease and age ($Wald \chi^2 = 16.87, p < .001$). Simple effect analyses revealed that young children were more likely to redeem the easy-to-process coupon than the hard-to-process coupon (19.4% vs. 3.4%, $\chi^2 = 11.04, p = .001$), providing converging evidence for hypothesis 2. In contrast, old children were more likely to redeem the hard-to-process coupon than the easy-to-process coupon (30.0% vs. 12.0%, $\chi^2 = 10.03, p = .002$), again supportive of hypothesis 3.

In phase 2, when the same coupons were distributed again among children at this school, we observed a main effect of processing ease ($Wald \chi^2 = 4.77, p = .029$), qualified by a 2-way interaction between processing ease and age ($Wald \chi^2 = 8.71, p = .003$). This interaction in phase

\textsuperscript{11} There was zero redemption in the “old children, hard-to-process, phase 2” cell; to conduct regression analysis and estimation, we added one observation (redemption = 1) to this cell.
2 again revealed a different pattern compared to phase 1: the young children were more likely to redeem the hard-to-process coupon the second time around, compared to the easy-to-process coupon (20.0% vs. 7.5%, $\chi^2 = 6.03, p = .014$), providing final evidence for hypothesis 4.

Interestingly, at this school, old children were more likely to redeem the easy-to-process coupon than the hard-to-process coupon in phase 2 (9.9% vs. 1.0%, $\chi^2 = 7.13, p = .008$), similar to the patterns observed in the analyses of all age groups reported in study 3.

Figure D3: Redemption Rate as a Function of Processing Ease, Age, and Phase (Study 3)
APPENDIX E

Sales of Unhealthy Beverages

Two independent coders coded all products sold in schools into four categories: unhealthy beverages, healthy beverages, unhealthy snacks, and healthy snacks. To ensure that the comparison across the different periods would be meaningful, only products that were sold at least 50% of the days of the entire experimental period were included in this exploratory analysis. Of most interest to us was how the promotion of a healthy shake or juice affected sales of unhealthy beverages, as substitution of unhealthy beverages with healthier ones could have important policy implications.12

Study 1. We observed a nonsignificant substitution in School A (figure E1). Sales of unhealthy beverages (which included Del Monte juice, Bonlac juice, and Power at this school) declined from 17.47 (SD = 12.08) in the baseline period to 13.67 (SD = 16.09, \( p = .33 \)) during the first promotion period, and from 16.39 (SD = 9.39) during the first rest period (between the two promotions) to 13.44 (SD = 6.91; \( p = .48 \)) during the second promotion period. We also observed a nonsignificant increase in sales after the promotion of healthy beverage was removed, such that sales of unhealthy beverages increased from 13.67 (SD = 16.09) in phase 1 to 16.39 (SD = 9.39; \( p = .51 \)) in the first rest period, and from 13.44 (SD = 6.91) in phase 2 to 17.24 (SD = 10.54; \( p = .34 \)) in the second rest period.

12 Analysis of the other categories (healthy beverages, healthy snacks, and unhealthy snacks) produced mixed and inconsistent results across studies, as there was large variance in terms of which products were tracked in each category at each school. In some cases, there were no products included in a category (e.g., no healthy snacks past the tracking threshold at School C), or no sales during promotion periods (e.g., zero sales of healthy snacks during the first promotion period at School B).
Study 2. We observed a nonsignificant substitution in School B (figure E2).\textsuperscript{13} Sales of unhealthy beverages (which included the Del Monte juice and a regular (i.e., not all natural) juice at this school) declined from 9.78 (SD = 8.40) in the baseline period to 6.22 (SD = 4.32; \( p = .38 \)) during the first promotion period, and from 4.02 (SD = 2.19) during the first rest period to 3.00 (SD = 2.19; \( p = .45 \)) during the second promotion period. Here we did not observe an increase in sales of unhealthy beverages once the coupons were removed.

\textsuperscript{13} Since data at this school were not normally distributed (skewness = 1.761, Std. Error = .196, \( Z = 8.98 \), Kolmogorov-Smirnov (153) = .29, \( p < .001 \)), we log-transformed the sales data before conducting the analysis. We obtained similar results when using the raw data. Additionally, the reported \( t \)-tests did not assume equal variances (Levene’s statistic (4, 148) = 5.54, \( p < .001 \)).
Study 3. In Study 3, we observed a significant pattern of substitution (figure E3). Sales of unhealthy beverages (which included Del Monte juice, fruit juice, and regular juice at this school) declined from 12.00 (SD = 6.74) in the baseline period to 4.33 (SD = 1.15) during the first promotion period, $t(58) = 2.97, p = .004$. We observed a similar significant decline from 7.56 (SD = 5.73) during the first rest period to 3.33 (SD = 1.53) during the second promotion period, $t(58) = 2.22, p = .03$.

We also observed nonsignificant increase in sales after the promotion of the healthy beverage was removed, such that sales of unhealthy beverages increased from 4.33 (SD = 1.15) in phase 1 to 7.56 (SD = 5.73) in the first rest period ($p > .19$), and from 3.33 (SD = 1.53) in phase 2 to 3.50 (SD = 1.09) in the second rest period. The increase in sales from phase 2 to the second rest period was not significant ($p > .8$).

14 Since data in this study were not normally distributed (skewness = 1.621, Std. Error = .302, Z = 5.37, Kolmogorov-Smirnov (.63) = .21, p < .001), we log-transformed the sales data before conducting the analysis. We obtained similar results when using the raw data.
Figure E3: Sales of Unhealthy Beverages* in School C

*Del Monte juice, can 330ml
Fruit juice, 360ml
Regular juice, 355 ml
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