

The Peak of Health: The Vertical Representation of Healthy Food

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Abstract

As expressed by the “Healthy is Up” metaphor, conceptual metaphor theory argues that the representation of health is commonly associated with high verticality because, typically, people stay upright when they are healthy whereas illness may force them to lie down. Along this line of argument, this research is the first to empirically explore the metaphorical representation of healthy food in terms of verticality. Across five experiments ($N = 714$), this article first demonstrates that people are faster to pair healthy food with up than down in an implicit association test (Study 1, supporting a metaphorical congruency effect). Then, it shows that people associate healthy food with high verticality and unhealthy food with low verticality by placing healthy food up high and unhealthy food low down along the vertical axis, and by preferring a food pyramid that depicts healthy food at the top rather than at the bottom (Studies 2a, 2b and 3, supporting an abstract-to-concrete effect). Last, this research finds that people judge a food product as healthier when it is pictured from an upward-looking angle than when it is pictured from a downward-looking angle (Study 4, supporting a concrete-to-abstract effect). Further analyses test the interaction between individual differences in self-control and the effects of the “Healthy is Up” metaphor in Studies 2a, 2b, 3 and 4. The article concludes with a discussion of the theoretical and practical implications of this research.

Keywords: communication, healthy food, metaphor, verticality

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1. Introduction

In the current obesogenic environment, increasing healthy food intake is one of the main public policy objectives (e.g., de Ridder, Kroese, Evers, Adriaanse & Gillebaart, 2017; Folkvord, 2020; Petit et al., 2016). Various solutions, ranging from behavioral interventions to education have been suggested thus far (e.g., Cadario & Chandon, 2020; Murimi et al., 2017; Robinson, Fleming & Higgs, 2014). Evidence shows that conceptual metaphors can be an efficient technique to improve public health communication (e.g., Hauser & Schwarz, 2015; Landau, Arndt, & Cameron, 2018; Landau et al., 2019) and healthy choice (e.g., Dong, Huang, & Labroo, 2020; Hung & Labroo, 2011). For instance, the bodily experience of firming muscles has the metaphoric benefit of strengthening willpower and self-regulation, and may increase the purchase of healthy food and drinks (Hung & Labroo, 2011). Research also showed that high-pitched music metaphorically evoked morality thoughts, which increased participants' likelihood to engage in healthy activities considered virtuous and moral (Dong et al., 2020).

However, whereas communicating with metaphors may help promote healthier choices, to our knowledge, the metaphorical representation of health in terms of verticality has never been empirically investigated. The purpose of this article is to document this metaphorical representation and its applications to healthy food consumption. Verticality, defined as the position of a physical object along the vertical dimension, is a primary embodied experience underlying many abstract mental constructs through metaphorical thinking (Cian, 2017; Lakoff & Johnson, 1999; Schnall, 2014). Past research in psychology has documented a wide range of abstract concepts (e.g., valence, concreteness, power) metaphorically associated with verticality in people's mind, and these vertical metaphors have been shown to shape thoughts and actions in various ways

(e.g., Aggarwal, & Zhao, 2015; Meier & Robinson, 2004; Schubert, 2005; Sundar & Noseworthy, 2014; van Rompay, van Hoof, Rorink & Folsche, 2019).

The present research investigates how the metaphorical (in)congruence between verticality and healthy food influences processing speed and consumer behavior, how vertical cues affect health-related judgments about food and vice versa, and how individual differences in self-control may change people's responsiveness to the same metaphor "Healthy is Up". In the next section, we will discuss the conceptual foundations of the metaphorical connection between healthy food and high verticality and posit our hypotheses. We will then present a series of five experimental studies testing them, and conclude by discussing the main contributions of this work and future research avenues.

2. Theoretical Background

2. 1. The Conceptual Metaphor "Healthy is Up"

In Western philosophy, metaphors are traditionally considered as rhetoric devices (Kirby, 1997). Inspired by an embodied approach of the mind, Lakoff and Johnson (1980) contest this traditional viewpoint and originally propose that metaphors are deeply embedded in our cognitive structure, allowing us to make sense of an abstract concept (i.e., the target domain) in terms of a seemingly unrelated concrete concept (i.e., the source domain) representing certain sensorimotor experience. Those cross-domain conceptual mappings in our cognitive systems emerge automatically from our direct interactions with the physical world, where non-sensorimotor experiences in the target domains regularly co-occur with the sensorimotor experiences in the source domains (Grady, 1997; Lakoff & Johnson 1999). Through the process of scaffolding (Williams, Huang, & Bargh, 2009), it is proposed that early pairings between a sensorimotor

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experience (e.g., up) and a subjective experience (e.g., health) are then used by adults to represent the concepts. For instance, as expressed by the “Healthy is Up” metaphor, Lakoff and Johnson (1980) argue that health is associated with up and sickness is associated with down in language (e.g., “*He is at the peak of health*”; “*They felt under the weather*”) because we share the physical experiences that healthy people typically stay upright while serious illness forces us to lie down.

This core claim of the conceptual metaphor theory, namely that people not only speak metaphorically but also think metaphorically, is supported by an accumulating body of empirical research in embodied cognition during the past two decades (Casasanto & Bottini, 2014; Landau, Meier, & Keefer, 2010). Embodied metaphors have been found to influence attention, memory, social judgment and other higher cognitive processes “even in contexts where linguistic expressions of the relevant metaphors are not made salient” (Landau et al., 2010, p.1048). The most common line of evidence is that people have better performance (e.g., shorter response time or a higher accuracy rate) in tasks where abstract and concrete concepts conveyed by the stimuli are metaphorically congruent (vs. incongruent). For example, as expected from the “Good is Up” metaphor, Meier and Robinson (2004) demonstrated in a Stroop-like task that participants categorized positive words faster when the words were in a higher rather than a lower position, whereas they categorized negative words faster when the words were in a lower rather than a higher position. Similarly, as expected from the “Power is Up” metaphor, Schubert (2005) showed that people spent less time responding and committed fewer errors in a categorization task when the powerful groups were placed up and the powerless groups were placed down, as compared to when the powerful groups were placed down and the powerless groups were placed up. Those findings attest that the metaphorically congruent stimuli are easier to process than the metaphorically incongruent ones, suggesting that people’s pre-existing expectations for the stimuli

are in line with the “Good is Up” metaphor and the “Power is Up” metaphor. Accordingly, we hypothesize a metaphorical congruency effect on processing speed for the metaphor “Healthy is Up”:

H₁: A match (vs. mismatch) between verticality and healthy food will lead to faster response speed.

The effects of metaphorical congruency on processing fluency are not only directly reflected in processing speed, but also in downstream attitudes and judgments. Because humans have limited cognitive capacity, stimuli demanding less mental effort, i.e., that can be processed more fluently, are usually preferred (Fiske & Taylor, 1984; Garbarino & Edell, 1997; Reber, Schwarz, & Winkielman, 2004). It has been found that the same statements were judged more positively when presented in colors that made them easier to read against a white background (Reber & Schwarz, 1999), and that repeated exposure to a stimulus facilitated fluent processing and fostered positive affective responses based on both self-reported and psychophysiological evidence (Harmon-Jones & Allen, 2001; Whittlesea, 1993; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Consistently, the metaphorical congruence between abstract and concrete concepts improves processing fluency and produces more favorable attitudes and behavioral intentions towards the stimuli. Applied to consumer research, Sundar and Noseworthy (2014) demonstrated with the vertical metaphor “Power is Up” that consumers were more willing to purchase from a powerful brand when its logo was located in a higher (vs. lower) visual field, but more willing to purchase from a less powerful brand when its logo was in a lower (vs. higher) visual field. Van Rompay and colleagues (2019) found that presenting consumers in a Dutch coffee house with an ad portraying verticality (vs. horizontality) cues metaphorically congruent (vs. incongruent) with

economic power enhanced luxury perceptions, evaluations of taste intensity as well as purchase intention. In the context of this research, it is therefore hypothesized that:

H₂: A match (vs. mismatch) between verticality and healthy food will generate more positive consumer behavioral intentions.

2.2. Bidirectionality of Metaphorical Associations

Originally, Lakoff and Johnson (1980) describe metaphorical thinking as a unidirectional process, from the concrete “source domain” (e.g., verticality) to the abstract “target domain” (e.g., health). Empirical evidence however suggests that the psychological consequences of metaphorical mappings are often bidirectional, and thus may encompass concrete-to-abstract but also abstract-to-concrete effects (Lee & Schwarz, 2012). Bidirectional effects have been observed in many studies testing various conceptual metaphors such as “Social Suspicion is Fishy Smell” (Lee & Schwarz, 2012), “Affection is Warmth” (Zhong and Leonardelli, 2008) or “Hope is Light” (Dong, Huang, & Zhong, 2015). In relation to vertical metaphors, when testing the “Power is Up” metaphor, prior research found that more powerful leaders were placed in higher locations on the chart representing the organizational structure (abstract-to-concrete effect), and, conversely, that leaders located higher in the organization chart were perceived as more powerful (concrete-to-abstract effect; Giessner & Schubert, 2007). Likewise, when testing the “Rationality is Up” / “Emotion is Down” metaphor, research showed that stimuli with rational connotations are placed higher on a screen than stimuli with emotional connotations (abstract-to-concrete effect) and, conversely, that ambiguous stimuli are perceived as having a more rational meaning when they are presented high rather than low on a website (concrete-to-abstract effect; Cian, Krishna, & Schwarz, 2015).

In light of this body of evidence, we investigate the bidirectionality of the “Healthy is Up” metaphor in the current research, and hypothesize that this metaphor has both abstract-to-concrete (H₃) and concrete-to-abstract (H₄) effects:

H₃: Healthy food is more likely to be placed in a higher position.

H₄: An upward-looking camera angle will increase the perceived healthiness of food.

2.3. Individual Differences in Self-Control: A Potential Predictor

Although relatively less examined, individual differences in personality traits have been shown to interact with the effects of conceptual metaphors on intentions, attitudes and behavior. Literature indicates that the accessibility of a metaphorical association between two concepts can be significantly influenced by individual predispositions (Landau et al., 2010). Some abstract concepts can be less relevant to certain individuals, who are thus less likely to think about those concepts, and to draw on concrete bodily experiences to understand them metaphorically (Meier, Sellbom, & Wygant, 2007b). For instance, Meier and colleagues (2007b) found that the metaphorical congruence between morality and verticality affected processing speed among participants low in psychopathy, but not among participants high in psychopathy. In other words, psychopaths, who were characterized by being amoral (Cleckley, 1941; O’Kane, Fawcett, & Blackburn, 1996), were less responsive to the “Moral is Up” metaphor. A similar effect of dispositional individual differences was observed for the metaphor “Divinity is Up”, such that people high (vs. low) in religious belief showed a stronger tendency to implicitly associate God-related words with up and Devil-related words with down (Meier, Hauser, Robinson, Friesen, & Schjeldahl, 2007a).

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Within the domain of health communication, prior research also found that muscle firming, which facilitated self-control by firming willpower, increased the purchase of healthy food and beverages, among health-oriented participants but not among indulgence-oriented participants (Hung & Labroo, 2011). In other words, the accessibility of the metaphorical association (between firming muscles and exerting willpower) was predicted by participants' (health) goals. Similarly, drinking products with a slim package shape (vs. a wide package shape), which simulated a slim body shape, and thus metaphorically cued healthiness, were evaluated more positively and got chosen more often by consumers who had a health-related shopping goal but not by consumers who had a hedonic shopping goal (van Ooijen, Fransen, Verlegh, & Smit, 2017).

Following this line of thought, the current research tests whether trait self-control differentiates sensitivity to the "Healthy is Up" metaphor. Trait self-control is defined as the ability "to override or change one's inner responses, as well as to interrupt undesired behavioral tendencies (such as impulses) and refrain from acting on them" (Tangney, Baumeister & Boone, 2004, p. 274). Accordingly, self-control positively predicts a wide-range of health-promoting behaviors, such as consuming less alcohol and junk food, exercising regularly and maintaining sufficient sleep, among a variety of populations (Frieze & Hofmann, 2009; Hagger, Gucciardi, Turrell, & Hamilton, 2019; Kroese, Evers, Adriaanse & de Ridder, 2016; McCullough & Willoughby, 2009; Crescioni et al., 2011). In the context of this research, people who are high in trait self-control should think about the concept of health through the embodiment of verticality more often and thereby endorse the "Healthy is Up" metaphor more strongly than those who are low in self-control and are less concerned about their health. Formally, we hypothesize that:

H₅: The mental association between verticality and healthy food will be stronger among people who are high in self-control.

2.4. Overview of the Studies

We test these five hypotheses across five experiments. Study 1 focuses on the basic effect of metaphorical congruency on processing speed (H_1), while Studies 2a, 2b and 3 investigate the abstract-to-concrete effect (H_3) and Study 4 examines the concrete-to-abstract effect (H_4). The relationship between self-control and endorsement of the health metaphor is explored in Studies 2a, 2b, 3 and 4 (H_5), and Study 4 further examines the metaphorical congruency effect on consumer behavioral intentions (H_2).

It should be noted that the effects of the “Healthy is Up” metaphor are usually compatible with another comprehensively studied vertical metaphor, “Good is Up”, since the concept of health is positive in nature (Gibbs, 2014). One may argue that any influence that the “Healthy is Up” metaphor exerts on processing fluency, perceptual judgments or consumer behavior, is just a reflection of the general associations between valence and verticality. Therefore, to rule out “Good is Up” as an alternative explanation and show that the “Healthy is Up” metaphor has distinct effects, we implement various strategies in each study.

2.5. Ethics statement and data availability

This series of studies received the approval of the Department of Psychological and Behavioural Science (DPBS) Ethics Committee of the London School of Economics (LSE). All participants gave informed consent before taking part in a study, and the privacy rights of human subjects has always been observed.

3. Study 1

Study 1 aimed to establish the mental association between health and verticality expected from H_1 in an implicit association test (IAT). The IAT is a reaction time task (Greenwald, McGhee, & Schwartz, 1998) that has been frequently used to determine “the automaticity of a metaphorical connection” in psychology (Cian et al., 2015, p.6). More specifically, we asked participants to perform an IAT with healthy/unhealthy food pictures and words referring to verticality on the web-based behavioral research platform *Gorilla*.

3.1. Methods

Participants. Prior to data collection, the required sample size was computed based on a power analysis (G*Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With $\alpha = 0.05$ and power = 0.80, the projected sample size needed to detect a medium effect size ($d = 0.50$) for a one-sample t -test difference from a constant was at least $N = 34$. We oversampled to enable a robust analysis of the order effect. One hundred participants from the United States were recruited online through Amazon’s Mechanical Turk (mTurk; Buhrmester, Kwang, & Gosling, 2016) and completed the study in exchange for monetary compensation. Of those, nine were excluded from the analysis because they produced more than 10% of trials with latencies less than 300 milliseconds, which indicated careless responding (Greenwald, Nosek, & Banaji, 2003). Thus, the final sample size for this study was 91 (female = 34, male = 56, other = 1; $M_{age} = 38$, $SD_{age} = 12$).

Procedure. Following the standard IAT procedure (Greenwald et al., 2003), participants were presented with a series of words or images to classify into one of four groups (see Figure 1), one pair of the groups comprising the target categories (healthy or unhealthy) and the other pair comprising the attribute categories (up or down). Each stimulus (i.e., a word or an image) belonged to only one of those categories.

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The stimuli for the attribute categories (up vs. down) were two sets of words matched on length and frequency drawn from previous research on vertical metaphors (Cian et al., 2015; Meier et al., 2007a): up (high, top, over, above, ascend), and down (low, bottom, under, below, descend).

The stimuli for the target categories (healthy vs. unhealthy) consisted of 10 food pictures from Food-Pics_Extended, an image database for eating and appetite research (Blechert, Lender, Polk, Busch, & Ohla, 2019). We selected the pictures #212 (veggie mix with dip), #213 (crisp bread with cottage cheese), #248 (blueberries), #325 (fruit salad) and #490 (potatoes and corn) for the healthy food category; and the pictures #46 (French fries), #150 (popcorn), #664 (ice cream in waffle bowl), #685 (pizza) and #880 (gummy bears) for the unhealthy food category, for two main reasons. First, because the pictures representing the healthy and unhealthy categories were deemed similar in terms of shape after visual inspection (see Figure 2 for all the stimuli). Second, because, on the basis of the normative rating data provided by Blechert and colleagues (2019), Mann-Whitney tests showed that both categories did not significantly differ in terms of valence “characterized by how negatively or positively” female and male omnivore participants “viewed the object; that is, whether they found it was repulsive or attractive” rated on 8-cm visual analog scales (VAS) ranging from “very negative” to “very positive” (unhealthy: $M = 56.18$, $SD = 11.06$; healthy: $M = 59.76$, $SD = 12.35$; $U = 10.00$, $Z = -0.52$, $p = 0.690$). Additional analyses also found that the total kcal value for the depicted portion was higher for the unhealthy food ($M = 422.64$, $SD = 266.85$) than for the healthy food category ($M = 118.36$, $SD = 167.21$; $U = 2.00$, $Z = -2.19$, $p = 0.032$).

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Unhealthy
or
Up

Healthy
or
Down



Press 'e' for the left category and 'i' for the right category.

Figure 1. IAT Screen (Incongruent Blocks 1 & 2) in Study 1.

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Target Categories		Attribute Categories	
Healthy	Unhealthy	Up	Down
		high	low
		top	bottom
		over	under
		above	below
		ascend	descend

Figure 2. IAT Stimuli for the Target Categories “Healthy” and “Unhealthy” and the Attribute Categories “Up” and “Down” in Study 1.

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As per the standard IAT procedure (Greenwald et al., 2003), participants were directed to complete 7 blocks, each of which was composed of 20 or 40 trials (see Table 1). Half of the participants received the training block 1 and the congruent blocks (3 & 4) first, while the other half received the training block 5 and the incongruent blocks (6 & 7) first. The position of the training block 2 was the same for all participants.

As depicted in Figure 1, throughout the experiment, category labels (“Healthy”-“Unhealthy” and/or “Up”-“Down”) were presented on the upper left and right corners of the computer screen. In each trial, participants saw a stimulus in the center of the screen and their task was to classify the given stimulus into the left or the right category by pressing “E” (left key) or “I” (right key) on their keyboard as quickly and accurately as possible.

Table 2. The Sequence of Trial Blocks for the IAT on the Association Between Health and Verticality.

Block n°	Block	N° of trials	Left key	Right Key
1	Training	20	Healthy	Unhealthy
2	Training	20	Up	Down
3	Congruent 1	20	Healthy or Up	Unhealthy or Down
4	Congruent 2	40	Healthy or Up	Unhealthy or Down
5	Training	20	Unhealthy	Healthy
6	Incongruent 1	20	Unhealthy or Up	Healthy or Down
7	Incongruent 2	40	Unhealthy or Up	Healthy or Down

Note. For half of the participants, the positions of blocks 1, 3, and 4 have been switched with those of blocks 5, 6, and 7, respectively.

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In the training block 1, participants were only asked to discriminate target images (left key for “Healthy”, right key for “Unhealthy”). In the training block 2, participants were only asked to discriminate attribute words (left key for “Up”, right key for “Down”). In two congruent blocks (3 & 4), target images (“Healthy” or “Unhealthy”) and attribute words (“Up” or “Down”) were randomly presented in each trial. Participants should press the same key “E” for “Healthy” images and “Up” words (left key), and the same key “I” for “Unhealthy” images and “Down” words (right key). A red cross would appear if participants pressed the wrong key, and they had to press the correct key to fix the error. The response mappings were congruent with the “Healthy is Up” metaphor in these two blocks. Blocks 5-7 were identical to blocks 1, 3, and 4, except that the locations of the target categories will be reversed (left key for “Unhealthy”, right key for “Healthy”). In this way, the response mappings became incongruent with the “Healthy is Up” metaphor in the last two blocks (6 & 7). All the stimuli were presented twice in each block and in a randomized order.

3.2. Results

Complying with Greenwald and colleagues’ (2003) improved scoring algorithm, the reaction time data (RT , measured in milliseconds) from the congruent blocks (3 & 4) and the incongruent blocks (6 & 7) were used to compute the IAT D score for each participant. The following formula was applied to calculate D scores = $[(RT_{\text{incongruent } 6} - RT_{\text{congruent } 3}) / SD1 + (RT_{\text{incongruent } 7} - RT_{\text{congruent } 4}) / SD2] / 2$.

We calculated RT for each block by averaging response latencies for all trials in that block. Trials with response latencies above 10,000 milliseconds and participants whose latencies were less than 300 milliseconds in more than 10% of trials were eliminated from the dataset.

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SD_1 was the pooled standard deviation for all trials in the congruent block 3 and the incongruent block 6. SD_2 was that for the congruent block 4 and the incongruent block 7.

A one-sample t -test showed that participants' average D score was significantly greater than zero ($M = 0.39$, $SD = 0.41$, $t(90) = 9.10$, $p < 0.001$, $d = 0.95$, $95\% CI = [0.31, 0.48]$), indicating, as expected from H_1 , that participants responded faster in the congruent blocks where Healthy is paired with Up than in the incongruent blocks where Healthy is paired with Down.

Further to this, we also tested the order effect by comparing the D scores of participants who received the congruent blocks first ($N = 46$) with those of participants who received the incongruent blocks first ($N = 45$). An independent sample t -test yielded a significant order effect ($t(89) = 5.39$, $p < 0.001$, $d = 1.13$, $M_{diff} = 0.41$, $95\% CI = [0.26, 0.55]$). The average D score was significantly higher among participants who received the congruent blocks first ($M = 0.59$, $SD = 0.36$, $95\% CI = [0.49, 0.70]$), but still positive for participants who received the incongruent blocks first ($M = 0.19$, $SD = 0.36$, $95\% CI = [0.08, 0.29]$), which indicated that, despite the order effect, results remained aligned with our hypothesis.

3.3. Discussion

The results of Study 1 confirmed that a metaphorical congruence (vs. incongruence) between verticality and healthy food stimuli accelerated processing speed (supporting H_1). However, the confounding effect of the “Good is Up” metaphor could not be completely ruled out as the category labels “Healthy” - “Unhealthy” still entailed valence (Lakens, 2012), even though the valence of healthy/unhealthy food stimuli was controlled. This limitation is addressed in the following studies.

4. Study 2a

Study 2a tested whether, as posited by H₃, healthy food was more likely than unhealthy food to be placed in a higher position, investigating the abstract-to-concrete effect of the “Healthy is Up” metaphor, and whether, as posited by H₅, this association was predicted by self-control. A web-based vertical placement task was adopted to achieve these goals.

4.1. Methods

Participants. Prior to data collection, the required sample size was computed based on a power analysis (G*Power 3.1; Faul et al., 2007). With $\alpha = 0.05$ and power = 0.80, the projected sample size needed to detect a medium effect size ($g = 0.30$) for a sign test was at least $N = 20$. We oversampled to allow an exploratory analysis of the association between trait self-control and the vertical placement test results of the metaphor “Healthy is Up”. One hundred participants from the United States were recruited online through mTurk and completed the study in exchange for monetary compensation. Unique Turker (<https://uniqueturker.myleott.com/>) was used to ensure that all participants were unique and different from those who took part in Study 1, and this study was collected via *Qualtrics*. Participants completed an attention check (“*For quality control purposes, please select ‘Not at all’.*”) which was randomly inserted among the questions measuring trait self-control, and a seriousness check question (Aust, Diedenhofen, Ullrich, & Musch, 2013) at the end of the survey (“*It would be very helpful if you could tell us at this point whether you have taken part in this study seriously, so that we can use your answers for our scientific analysis, or you were just clicking through without reading the instructions and survey questions? Please answer honestly - you will receive the payment regardless of your answer.*”). Overall, five participants were excluded for the following reasons: failed the attention check ($N = 1$), did not

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pass the seriousness check ($N = 4$); leaving 95 participants (female = 45, male = 49, other = 1; $M_{age} = 35$, $SD_{age} = 12$).

Procedure. We used a web-based adaptation of Casasanto's (2009) paper-and-pencil diagram task for vertical metaphors. The original task was developed to test the metaphor "Good is Up", where participants were given information about how a cartoon figure liked or disliked two animals, and then instructed to draw one animal in each of two boxes located either above or below the cartoon figure. In the present study, we asked participants to drag and drop the stimuli into the boxes instead of drawing them in order to make the task easier in the online setting (see Figure 3). The stimuli were a fruit salad picture and an ice cream picture similar in valence and visual characteristics from Study 1 and their presentation order was randomized and counterbalanced across participants. As in Casasanto (2009), participants were presented with two boxes with a cartoon figure in the middle and read the following instructions:

"The cartoon character depicted below loves fruit salad and ice cream. He thinks that fruit salad is healthier than ice cream but that ice cream is tastier than fruit salad.

Your task is to place the picture of fruit salad into the box that best represents healthy food, and the picture of ice cream into the box that best represents tasty food."

To ensure that participants' judgments were not confounded by the temporal order in which they read about the two stimuli, half of the participants were randomly assigned to another version of the instructions where all the descriptions about ice cream were mentioned before those about fruit salad. We also deliberately contrasted "healthy" with "tasty" to control for valence in the instructions, as the opposition between healthiness and tastiness of food was shown to be intuitive for Americans (Raghunathan, Naylor, & Hoyer, 2006).

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The cartoon character depicted below loves fruit salad and ice cream. He thinks that fruit salad is healthier than ice cream but that ice cream is tastier than fruit salad.

Your task is to place the picture of fruit salad into the box that best represents healthy food, and the picture of ice cream into the box that best represents tasty food.




Items	
	Box A
	
	Box B

Figure 3. The Task Structure in Study 2a.

After completing the vertical placement task, participants were asked to evaluate the healthiness and tastiness of the fruit salad picture and the ice cream picture on two 7-point scales (“How healthy do you think this dessert is?”; 1 = “Very unhealthy” / 4 = “Neutral” / 7 = “Very healthy”; “How tasty do you think this dessert is?”; 1 = “Not at all tasty” / 4 = “Neutral” / 7 = “Very tasty”).

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To control for the valence of the stimuli, participants were also asked to evaluate the valence of the fruit salad picture and the ice cream picture on the following 7-point scale adapted from prior literature (Gottwald, Elsner, & Pollatos, 2015; Sultson, Vainik, & Kreegipuu, 2019): “*How much do you like this dessert?*” (1 = “*Strongly dislike*” / 4 = “*Neutral*” / 7 = “*Strongly like*”). The presentation order of the two pictures was counterbalanced across participants and that of the three questions was randomized for each picture.

Eventually, before collecting the demographic data, the seriousness check question and comments, we required participants to fill in the 13-item Brief Self-Control Scale (BSCS; Tangney et al., 2004), in which they rated how much the given statements characterized themselves (e.g., “*I am good at resisting temptation*”, “*I have a hard time breaking bad habits*” “*Sometimes I can’t stop myself from doing something, even if I know it is wrong*”; 1 = “*Not at all*” / 5 = “*Very much*”). Following Tangney and colleagues’ (2004) initial proposal as well as Lindner, Nagy, and Retelsdorf’s (2015) suggestions, we treated the BSCS as a unidimensional measure and averaged the thirteen items to form a single composite score for trait self-control (Cronbach’s $\alpha = 0.85$).

4.2. Results

Manipulation check. Paired-samples *t*-tests demonstrated that the fruit salad (healthiness: $M = 6.23$, $SD = 1.31$; tastiness: $M = 5.82$, $SD = 1.13$) was perceived as significantly healthier ($t(94) = 20.23$, $p < 0.001$, $d = 2.08$, $M_{diff} = 3.93$, 95% $CI = [3.54, 4.31]$) but less tasty ($t(94) = -4.23$, $p < 0.001$, $d = -0.43$, $M_{diff} = -0.57$, 95% $CI = [-0.84, -0.30]$) than the ice cream (healthiness: $M = 2.31$, $SD = 1.34$; tastiness: $M = 6.39$, $SD = 0.96$), which was in line with our intended manipulations. There was no significant difference in how much participants liked the two desserts, $t(94) = -1.31$, $p = 0.193$, $d = -0.13$, $M_{diff} = -0.22$, 95% $CI = [-0.56, 0.11]$ (fruit salad: M

= 5.80, $SD = 1.06$; ice cream: $M = 6.02$, $SD = 1.22$), further suggesting a successful control of valence.

Vertical placement. As expected from H_3 , the majority of participants (71%) placed the fruit salad picture in the top box and the ice cream picture in the bottom box, associating healthy food rather than unhealthy food with a higher placement along the vertical axis. A sign test revealed a significant difference in the proportion of placements of the fruit salad picture up and placements of the ice cream picture up ($p < 0.001$).

Self-control. As expected from H_5 , a logistic regression with trait self-control as the independent variable and the placement of the fruit salad picture (0 = down, 1 = up; i.e., 1 = the vertical placement consistent with the “Healthy is Up” metaphor) as the dependent variable showed that higher self-control was associated with increased probability of placing the fruit salad picture up ($\beta = 0.86$, $SE = 0.38$, $z = 2.25$, $p = 0.024$, $OR = 2.37$, $95\% CI = [1.12, 5.01]$).

4.3. Discussion

As predicted, results from Study 2a showed that people were more likely to place healthy food, as compared to tasty but unhealthy food, in a higher position along the vertical dimension (supporting H_3). Moreover, in line with our expectations, results also revealed a significant effect of self-control on the “Healthy is Up” metaphor showing that the effect of the “Healthy is Up” metaphor was stronger among people who had better self-control (supporting H_5).

Besides, Study 2a complemented Study 1 by 1) detecting the mental association between healthy food and verticality in a task with visual vertical cues rather than linguistic vertical descriptions (Meier, et al., 2007a, 2007b), and 2) controlling for valence in both the stimuli and the instructions (Lakens, 2012). Nevertheless, as can be seen in Figure 3, due to technical reasons, the upper box was labeled “Box A” and the lower was labeled “Box B” in Study 2a, which could have

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confounded the effects of verticality. Therefore, we decided to replicate this study with those labels removed.

5. Study 2b

The aim of Study 2b was to eliminate the possible confounding effects of the “Box A” and “Box B” labels indicated on the top and bottom boxes. Apart from the absence of labels in this study (see Figure 4), the experimental design was identical to Study 2a.

The cartoon character depicted below loves ice cream and fruit salad. He thinks that ice cream is tastier than fruit salad but that fruit salad is healthier than ice cream.

Your task is to place the picture of ice cream into the box that best represents tasty food, and the picture of fruit salad into the box that best represents healthy food.

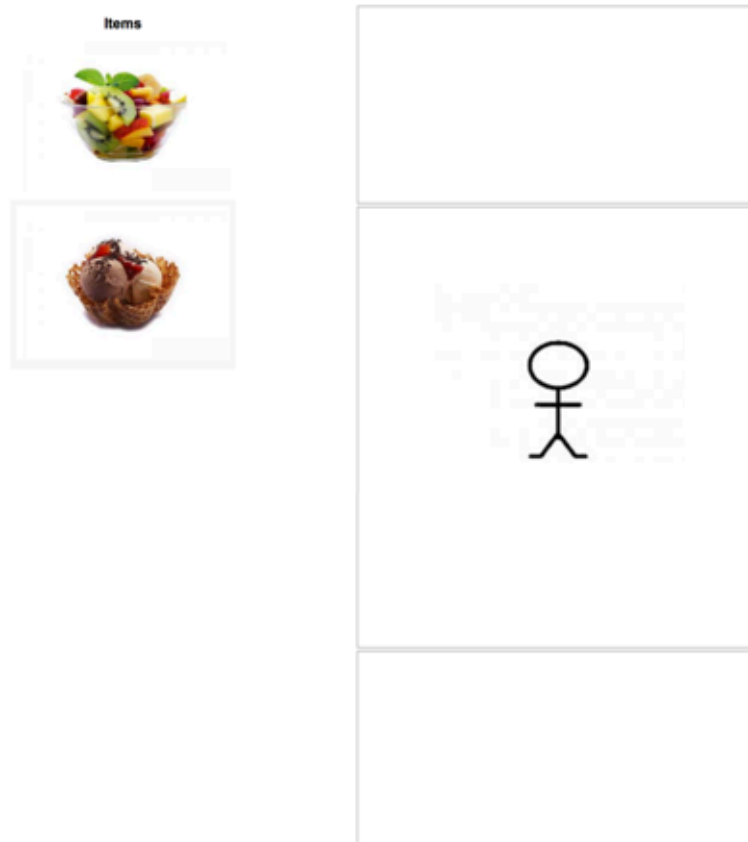


Figure 4. The Task Structure in Study 2b.

5.1. Methods

Participants. One hundred and forty-nine participants from the United States were recruited online through mTurk and completed the study in exchange for monetary compensation. Unique Turker (<https://uniqueturker.myleott.com/>) was used to ensure that all participants were unique and different from those who took part in other studies in this article. As in Study 2a, participants completed the measure of trait self-control (BSCS, Cronbach's $\alpha = 0.90$) as well as the attention and seriousness check questions. Seven participants were excluded for the following reasons: failed the attention check ($N = 3$), did not pass the seriousness check ($N = 4$); leaving 142 participants (female = 57, male = 84, other = 1; $M_{\text{age}} = 38$, $SD_{\text{age}} = 12$).

5.2. Results

Manipulation check. Paired-samples t-tests demonstrated that the fruit salad (healthiness: $M = 6.31$, $SD = 0.84$; tastiness: $M = 5.72$, $SD = 1.05$) was perceived as significantly healthier ($t(141) = 26.30$, $p < 0.001$, $d = 2.21$, $M_{\text{diff}} = 4.08$, 95% $CI = [3.78, 4.39]$) but less tasty ($t(141) = -6.06$, $p < 0.001$, $d = -0.51$, $M_{\text{diff}} = -0.68$, 95% $CI = [-0.90, -0.46]$) than the ice cream (healthiness: $M = 2.23$, $SD = 1.50$; tastiness: $M = 6.39$, $SD = 0.90$), which was in line with our intended manipulations. There was no significant difference in how much participants liked the two desserts, $t(141) = -1.43$, $p = 0.156$, $d = -0.12$, $M_{\text{diff}} = -0.22$, 95% $CI = [-0.52, 0.08]$ (fruit salad: $M = 5.70$, $SD = 1.27$; ice cream: $M = 5.92$, $SD = 1.27$), further suggesting a successful control of valence.

Vertical placement. As expected from H_3 , participants generally placed the fruit salad picture in the top box and the ice cream picture in the bottom box (66%), associating healthy food rather than unhealthy food with a higher placement along the vertical axis. A sign test revealed a significant

difference in the proportion of placements of the fruit salad picture up and placements of the ice cream picture up ($p < 0.001$).

Self-control. Contrary to H_5 , a logistic regression with trait self-control as the independent variable and the placement of the fruit salad picture (0 = down, 1 = up; i.e., 1 = the vertical placement consistent with the “Healthy is Up” metaphor) as the dependent variable revealed no significant effect of self-control ($\beta = 0.20$, $SE = 0.22$, $z = 0.88$, $p = 0.378$, $OR = 1.22$, $95\% CI = [0.79, 1.88]$).

5.3. Discussion

Study 2b addressed the limitations of Study 2a and provided additional support for the main effects of healthiness on the vertical placement of food, by showing that, when compared with tasty but unhealthy food, people placed healthy food in a higher position (H_3).

However, although the effect of self-control on the association between verticality and healthy food was observed, it did not reach significance, and, unlike Study 2a, Study 2b failed to support H_5 . The implications of this result for this research are further developed in the general discussion section.

6. Study 3

Previous studies showed a robust association between healthiness and up at the implicit (Study 1) and explicit levels (Studies 2a and 2b). The purpose of this study was to extend this analysis by considering the implications of the “Healthy is Up” metaphor in the context of healthy eating guidelines, and more specifically in relation to the food pyramid where foods that should be consumed in greater amounts (i.e., healthy foods) are located at the bottom of the pyramid, while those that should be eaten sparingly (i.e., unhealthy foods) are at the top (Fernandez et al., 2021). In this perspective, Study 3 tested whether, as predicted by H_3 , when compared to the standard

version of the food pyramid where “Unhealthy is Up”, participants would favor a revised version of the pyramid that depicts healthy food at the top, in line with the “Healthy is Up” metaphor. This study also tested whether the choice of the “Healthy is Up” (vs. “Unhealthy is Up”) pyramid was predicted by self-control, as expected from H₅.

6.1. Methods

Participants. Prior to data collection, the required sample size was computed based on a power analysis (G*Power 3.1; Faul et al., 2007). With $\alpha = 0.05$ and power = 0.80, the projected sample size needed to detect a medium effect size ($g = 0.30$) for a sign test was at least $N = 20$. We oversampled to allow an exploratory analysis of the association between trait self-control and the probability of choosing the “Healthy is Up” pyramid. Two hundred participants from the United States were recruited online through mTurk and completed the study in exchange for monetary compensation. Unique Turker (<https://uniqueturker.myleott.com/>) was used to ensure that all participants were unique and different from those who took part in other studies in this article. The study was collected via *Qualtrics*. Participants completed the trait self-control measure as in the previous studies (BSCS, Cronbach’s $\alpha = 0.91$), along with the attention check and the seriousness check question. Overall, nine participants were excluded for the following reasons: failed the attention check ($N = 2$), did not pass the seriousness check ($N = 7$); leaving 191 participants (female = 78, male = 113; $M_{\text{age}} = 40$, $SD_{\text{age}} = 11$).

Procedure. Participants reported their level of hunger on a 100-point scale (100 = “very hungry”) at the beginning of the survey (Loewenstein, 1996; Lozano et al., 1999), and were introduced to the task as follows: “*You will see a healthy eating pyramid on the next page. A healthy eating pyramid is a recognizable nutrition guide that provides dietary guidelines in a visual format. Please look carefully at the two versions reported below for 30 seconds. You will be required to*

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answer related questions afterwards.” Next, the two versions of the food pyramid were first presented in large size format, one above the other on the same webpage, for participants to be able to see that the food items displayed in each pyramid were identical. The two pyramids were adapted from the “food triangle” created by the Flemish Institute for Healthy Living in 2017¹. The “Unhealthy is Up” pyramid classically depicted unhealthy food at the top and healthy food at the bottom, whereas the “Healthy is Up” pyramid depicted healthy food at the top and unhealthy food at the bottom. The presentation of the two versions of the food pyramid was counterbalanced, so that half of the participants viewed the “Unhealthy is Up” pyramid above the “Healthy is Up” pyramid on their screen, and the other half viewed the “Healthy is Up” pyramid above the “Unhealthy is Up” pyramid.

Participants were then presented with the two food pyramids side by side in a smaller size format on the same screen (see Figure 5) and were asked to select one of them after reading the following instruction: *“In your opinion, which is the best version of the healthy eating pyramid to provide dietary guidelines?”*. The presentation of each pyramid on the left or on the right side of the screen was also counterbalanced across participants to avoid potential side biases in healthy food perception (Manippa, Giuliani & Brancucci, 2020; Romero & Biswas, 2016). Last, participants answered demographic questions, the seriousness check question, and a text box for comments, after completing the measure of trait self-control, which included the attention check question.

¹ <http://www.fao.org/nutrition/education/food-based-dietary-guidelines/regions/countries/belgium/en/>

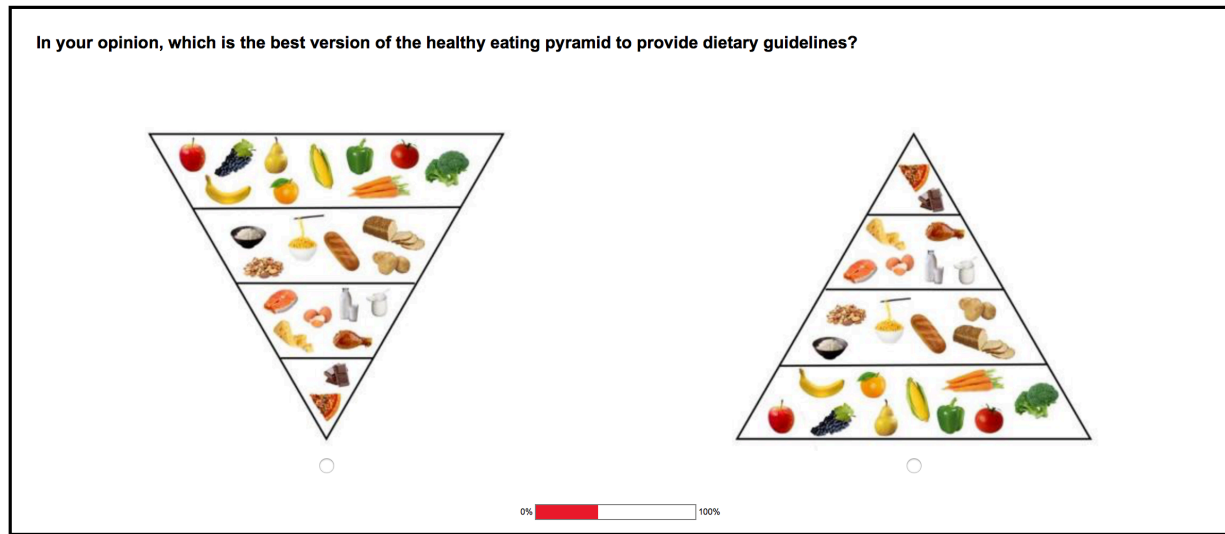


Figure 5. The Task Structure in Study 3.

6.2. Results

Pyramid preference. As expected from H₃, participants were more likely to select the “Healthy is Up” pyramid in which healthy food was depicted at the top (59%) than the “Unhealthy is Up” pyramid in which unhealthy food was depicted at the top. A sign test further confirmed a significant difference in choice between the pyramids ($p = 0.014$).

Self-control. Contrary to H₅, a logistic regression with trait self-control as the independent variable and pyramid preference (0 = “Unhealthy is Up”, 1 = “Healthy is Up”) as the dependent variable revealed no significant effect of self-control ($\beta = 0.03$, $SE = 0.18$, $z = 0.16$, $p = 0.874$, $OR = 1.03$, $95\% CI = [0.72, 1.46]$). Including levels of hunger as a covariate did not substantially change the results (self-control: $\beta = 0.06$, $SE = 0.18$, $z = 0.35$, $p = 0.874$, $OR = 1.06$, $95\% CI = [0.75, 1.52]$; levels of hunger: $\beta = 0.01$, $SE = 0.01$, $z = 1.16$, $p = 0.248$, $OR = 1.01$, $95\% CI = [1.00, 1.02]$).

6.3. Results

Study 3 tested the “Healthy is Up” metaphor in the context of healthy eating guidelines and further supported the association between health and verticality (H₃). Indeed, people indicated that the

“Healthy is Up” (vs. “Unhealthy is Up”) pyramid, where healthy (vs. unhealthy) food is depicted at the top, was the best version to provide dietary guidelines.

However, contrary to H₅, it is worthwhile to note that self-control did not significantly predict preference for the “Healthy is Up” pyramid. The implications of this result for this research are further developed in the general discussion section.

7. Study 4

Study 4 had three main purposes: 1) to examine whether a higher placement increased the perceived healthiness of food as posited by H₄, 2) to test whether the metaphorical association between health and verticality could impact behavioral intentions as posited by H₂, 3) and to investigate the interaction between trait self-control and the “Healthy is Up” metaphor (H₅). We employed a 2 (camera angle: upward vs. downward) * 2 (slogan: healthy vs. tasty) between-subject design where participants were required to evaluate the product (juice) featured in an advertisement.

5.1. Method

Participants. Prior to data collection, the required sample size was computed based on a power analysis (G*Power 3.1; Faul et al., 2007). With $\alpha = 0.05$ and power = 0.80, the projected sample size needed to detect a medium effect size ($f = 0.25$) for a two-way analysis of variance (ANOVA) with interaction was at least $N = 179$. We oversampled to allow an exploratory analysis of the effects of self-control. Two hundred and fifty-six participants from the United States were recruited online through mTurk and completed the study in exchange for monetary compensation. Unique Turker (<https://uniqueturker.myleott.com/>) was used to ensure that all participants were unique and different from those who took part in other studies reported in this article, and this

study was collected via *Qualtrics*. Participants completed an attention check inserted into the measure of trait self-control and a seriousness check question at the end of the survey as in previous studies. They also answered a manipulation check question about the content of the advertisement that they had been exposed to (“*What is the slogan of the fruit juice advertisement that you were presented with?*”; options: “*Your healthy start to the morning!*” “*Your tasty start to the morning!*” “*I do not remember.*”; those who answered “*I do not remember*” and those who chose the slogan from the other condition were deemed as failing this check). An additional question asked whether they were allergic to the main ingredients of the juice product. Overall, sixty-one participants were excluded for the following reasons: failed the attention check ($N = 4$), failed the manipulation check ($N = 39$), did not pass the seriousness check ($N = 10$), allergic to the ingredients of the given juice product ($N = 8$); leaving 195 participants (female = 110, male = 85; $M_{age} = 37$, $SD_{age} = 10$).

Procedure. Since we used fruit juices as stimuli, participants were asked to report their level of hunger and thirst on two 100-point scales (100 = “*very hungry*”/“*very thirsty*”) at the beginning of the survey (Loewenstein, 1996; Lozano, Crites, & Aikman, 1999).

Next, participants were randomly assigned to one of the four conditions, where they were exposed to an advertisement of a juice product for at least 10 seconds. In all conditions, the advertisement was made up of a fruit juice pictured on the left and a slogan on the right (see Figure 6). We manipulated verticality through the camera angle of the fruit juice picture (Van Rompay, De Vries, Bontekoe, & Tanja-Dijkstra, 2012). In the upward conditions ($N = 97$), the product looked as if it was shot from an upward-looking angle, making participants feel that the product was placed in a higher location. By contrast, the product was displayed from a downward-looking angle in the downward conditions ($N = 98$), and hence its location looked relatively lower for participants. Two versions of slogans emphasizing either health or taste were also manipulated. Participants read

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“Healthy Me!” on the product along with the slogan “Your healthy start to the morning!” in the healthy conditions ($N = 106$), whereas they read “Tasty Me!” on the product along with the slogan “Your tasty start to the morning!” in the tasty conditions ($N = 89$). This manipulation was combined with the vertical manipulation to investigate if the metaphorical congruence (vs. incongruence) between the visual verticality conveyed by camera angles and the abstract concepts highlighted in the slogan would promote intentions to purchase and consume the product.





	Healthy	Tasty
Upward	 Your healthy start to the morning!	 Your tasty start to the morning!
Downward	 Your healthy start to the morning!	 Your tasty start to the morning!

Figure 6. The Stimuli Used in Study 4.

Note. These stimuli are adapted from a free 3D model provided on the website sketchfab.com.

Participants were then asked to indicate their intentions to drink and purchase this product on two 7-point scales (“How likely would you be to drink this fruit juice if you had the opportunity?”, “How likely would you be to purchase this fruit juice?”; 1 = “Very unlikely” / 4 = “Neutral” / 7 = “Very likely”), after which they evaluated its healthiness and its tastiness (“How healthy do you

think this fruit juice is?”, 1 = “*Very unhealthy*” / 4 = “*Neutral*” / 7 = “*Very healthy*”; *How tasty do you think this fruit juice is?”*, 1 = “*Not at all tasty*” / 4 = “*Neutral*” / 7 = “*Very tasty*”). Drinking and purchase intentions were highly correlated (Spearman-Brown $\rho = 0.93$; Eisinga, Grotenhuis, & Pelzer, 2013) and were thus collapsed into one index capturing consumers’ behavioral intentions. Last, participants completed the measure of trait self-control (BSCS, Cronbach’s $\alpha = 0.88$), along with the manipulation check question, demographic questions, the seriousness check question, and a text box for comments.

5.2. Results

Perceived healthiness. A two-way ANOVA with camera angle (0 = downward, 1 = upward) and slogan (0 = tasty, 1 = healthy) as between-subject factors yielded a significant main effect of camera angle on perceived healthiness of the fruit juice ($F(1, 191) = 4.71, p = 0.031, \eta^2 = 0.024, \beta = 0.41, 95\% CI = [0.03, 0.80]$). As predicted by H₄, participants evaluated the fruit juice in the upward conditions ($M = 5.37, SD = 1.20$) as healthier than in the downward conditions ($M = 4.96, SD = 1.49$). Results indicated no significant main effect of slogan ($M_{\text{Tasty}} = 5.17, SD = 1.40; M_{\text{Healthy}} = 5.16, SD = 1.35; F(1, 191) < 0.01, p = 0.954, \eta^2 < 0.001, \beta = -0.01, 95\% CI = [-0.40, 0.40]$) nor any significant interaction between camera angle and slogan on perceived healthiness of the fruit juice ($F(1, 191) = 0.52, p = 0.471, \eta^2 = 0.003, \beta = -0.28, 95\% CI = [-1.05, 0.49]$). As a robustness check, additional analyses including levels of hunger and thirst as covariates found no substantial change in the results (see Table 2 for the regression model). Consistent with previous findings that hunger enhanced attitudes toward food (Lozano et al., 1999), level of hunger had a significant positive effect on perceived healthiness ($F(1, 189) = 4.11, p = 0.044, \eta^2 = 0.021, \beta = 0.008, 95\% CI = [0.0002, 0.0148]$). However, level of thirst did not impact how healthy

participants perceived the fruit juice ($F(1, 189) = 0.50, p = 0.481, \eta^2 = 0.003, \beta = 0.003, 95\% CI = [-0.005, 0.012]$).

Perceived tastiness. A two-way ANOVA with camera angle (0 = downward, 1 = upward) and slogan (0 = tasty, 1 = healthy) as between-subject factors revealed no significant main effects of camera angle ($M_{\text{Downward}} = 5.34, SD = 1.32; M_{\text{Upward}} = 5.20, SD = 1.69; F(1, 191) = 0.49, p = 0.485, \eta^2 = 0.003, \beta = -0.14, 95\% CI = [-0.57, 0.29]$) or slogan ($M_{\text{Tasty}} = 5.19, SD = 1.64; M_{\text{Healthy}} = 5.33, SD = 1.41; F(1, 191) = 0.41, p = 0.521, \eta^2 = 0.002, \beta = 0.14, 95\% CI = [-0.29, 0.57]$) on the perceived tastiness of fruit juice. As expected, the interaction between camera angle and slogan was not significant either ($F(1, 191) = 0.38, p = 0.540, \eta^2 = 0.002, \beta = 0.27, 95\% CI = [-0.60, 1.13]$). Additional analyses including levels of hunger and thirst as covariates did not make any substantial change to the results (see Table 2 for the regression model). The effect of hunger on perceived tastiness was not significant ($F(1, 189) = 0.05, p = 0.820, \eta^2 < 0.001, \beta = -0.001, 95\% CI = [-0.01, 0.01]$) and the effect of thirst on perceived tastiness was only marginally significant ($F(1, 189) = 3.27, p = 0.072, \eta^2 = 0.017, \beta = 0.01, 95\% CI = [-0.001, 0.018]$). These results further support H₄ as they show that, in contrast with healthiness perceptions, tastiness perceptions were not influenced by the vertical placement.

Behavioral intentions. A two-way ANOVA with camera angle (0 = downward, 1 = upward) and slogan (0 = tasty, 1 = healthy) as between-subject factors showed that neither camera angle ($M_{\text{Downward}} = 4.38, SD = 1.85; M_{\text{Upward}} = 4.59, SD = 1.94; F(1, 191) = 0.60, p = 0.438, \eta^2 = 0.003, \beta = 0.21, 95\% CI = [-0.33, 0.74]$) nor slogan ($M_{\text{Tasty}} = 4.33, SD = 1.98; M_{\text{Healthy}} = 4.62, SD = 1.82; F(1, 191) = 1.17, p = 0.281, \eta^2 = 0.006, \beta = 0.30, 95\% CI = [-0.24, 0.83]$) had a significant main effect on participants' intentions to drink and buy the fruit juice. Unexpectedly, contrary to H₂,

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there was not a significant interaction between camera angle and slogan ($F(1, 191) = 0.02, p = 0.877, \eta^2 < 0.001, \beta = -0.08, 95\% CI = [-1.16, 0.99]$), suggesting no effect of metaphorical congruency on consumers' behavioral intentions. The results did not change substantially when levels of hunger and thirst were controlled for (see Table 2 for the regression model). Level of thirst significantly predicted consumers' behavioral intentions ($F(1, 189) = 6.94, p = 0.009, \eta^2 = 0.035, \beta = 0.02, 95\% CI = [0.004, 0.028]$), whereas level of hunger did not ($F(1, 189) = 0.02, p = 0.877, \eta^2 < 0.001, \beta = 0.001, 95\% CI = [-0.01, 0.01]$).

Self-control. In order to test H₅, we regressed perceived healthiness, perceived tastiness and behavioral intentions, respectively, on camera angle manipulation, slogan manipulation, self-control and all the interactions. Camera angle ($t(1, 187) = 2.53, p = 0.012, \eta^2 = 0.031, \beta = 3.13, 95\% CI = [0.69, 5.57]$) and self-control ($t(1, 187) = 2.09, p = 0.038, \eta^2 = 0.023, \beta = 0.54, 95\% CI = [0.03, 1.04]$) had significant positive effects on perceived healthiness of the juice product and their interaction effect was negative and significant ($t(1, 187) = -2.10, p = 0.037, \eta^2 = 0.020, \beta = -0.78, 95\% CI = [-1.51, -0.05]$). Unexpectedly, and contrary to H₅, this analysis revealed that the effect of verticality on perceived healthiness was attenuated as the level of self-control increased. No other effects were significant and the results did not change substantially when levels of hunger and thirst were added into the models (see Table 3 for details).

Table 2. Regression Models Predicting Perceived Healthiness, Perceived Tastiness and Behavioral Intentions with Camera Angle Manipulation, Slogan Manipulation and Levels of Hunger and Thirst.

	Perceived healthiness ($R^2 = 0.06$)	Perceived tastiness ($R^2 = 0.02$)	Behavioral intentions ($R^2 = 0.05$)
Camera angle (0 = downward, 1 = upward)	0.65* [0.08, 1.21]	-0.24 [-0.88, 0.40]	0.36 [-0.42, 1.15]
Slogan (0 = tasty, 1 = healthy)	0.26 [-0.29, 0.80]	0.10 [-0.52, 0.72]	0.53 [-0.23, 1.29]
Camera angle*Slogan	-0.38 [-1.15, 0.38]	0.18 [-0.69, 1.05]	-0.26 [-1.33, 0.80]
Level of hunger	0.008* [0.0002, 0.0148]	-0.001 [-0.009, 0.007]	0.001 [-0.01, 0.01]
Level of thirst	0.003 [-0.01, 0.01]	0.01 [-0.001, 0.018]	0.02** [0.004, 0.028]

Note. Unstandardized regression coefficients and 95% CIs (in brackets) are shown. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3. Regression Models Predicting Perceived Healthiness, Perceived Tastiness and Behavioral Intentions with Camera Angle Manipulation, Slogan Manipulation, Self-Control and Levels of Hunger and Thirst.

	Without control variables			With control variables		
	Perceived healthiness ($R^2 = 0.08$)	Perceived tastiness ($R^2 = 0.02$)	Behavioral intentions ($R^2 = 0.03$)	Perceived healthiness ($R^2 = 0.10$)	Perceived tastiness ($R^2 = 0.04$)	Behavioral intentions ($R^2 = 0.06$)
Camera angle (0 = downward, 1 = upward)	3.13* [0.69, 5.57]	-0.68 [-3.46, 2.11]	2.76 [-0.71, 6.23]	3.18* [0.76, 5.59]	-0.65 [-3.43, 2.13]	2.82 [-0.59, 6.24]
Slogan (0 = tasty, 1 = healthy)	0.25 [-2.21, 2.70]	-0.46 [-3.26, 2.34]	1.97 [-1.52, 5.45]	0.53 [-1.91, 2.96]	-0.38 [-3.19, 2.42]	2.18 [-1.27, 5.63]
Self-control	0.54* [0.03, 1.04]	-0.19 [-0.77, 0.39]	0.45 [-0.28, 1.17]	0.53* [0.03, 1.03]	-0.18 [-0.76, 0.40]	0.46 [-0.25, 1.17]

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Camera angle*Slogan	−2.04 [−5.47, 1.38]	−0.97 [−4.88, 2.94]	−3.80 [−8.67, 1.07]	−2.31 [−5.72, 1.10]	−0.87 [−4.79, 3.05]	−3.69 [−8.51, 1.14]
Camera angle*Self- control	−0.78* [−1.51, −0.05]	0.11 [−0.73, 0.95]	−0.77 [−1.81, 0.28]	−0.77* [−1.50, −0.04]	0.12 [−0.72, 0.95]	−0.75 [−1.78, 0.27]
Slogan*Self- control	−0.02 [−0.74, 0.70]	0.14 [−0.69, 0.96]	−0.49 [−1.51, 0.54]	−0.07 [−0.79, 0.65]	0.14 [−0.68, 0.97]	−0.49 [−1.51, 0.52]
Camera- angle*Slogan*Se lf-control	0.54 [−0.50, 1.57]	0.40 [−0.78, 1.57]	1.15 [−0.32, 2.61]	0.59 [−0.44, 1.62]	0.34 [−0.84, 1.52]	1.05 [−0.40, 2.51]
Level of hunger	/	/	/	0.007 [−0.0004, 0.0142]	−0.0004 [−0.009, 0.008]	0.001 [−0.009, 0.011]
Level of thirst	/	/	/	0.003 [−0.005, 0.012]	0.008 [−0.002, 0.018]	0.02* [0.003, 0.027]

Note. Unstandardized regression coefficients and 95% CIs (in brackets) are shown. * $p < 0.05$, ** p

< 0.01 , *** $p < 0.001$.

5.3. Discussion

Study 4 demonstrated that visual cues of high (vs. low) placement of a product led participants to perceive it as healthier, supporting H₄ and thereby confirming the concrete-to-abstract effect of the “Healthy is Up” metaphor. Importantly, the same visual cues of high placement did not lead participants to consider the product to be tastier, which excluded the alternative explanation that the effect of verticality on perceived healthiness was merely a spill-over of the valence-verticality association (i.e., the “Good is Up” metaphor). Tastiness has a positive valence but, unlike healthiness, is not metaphorically associated with verticality. Thus, the valence-verticality association expressed by the “Good is Up” metaphor cannot have caused the effect on perceived healthiness, otherwise an effect of similar magnitude on perceived tastiness should also be observed.

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Contrary to H₂, the results however provided little evidence that a mismatch (vs. match) between the visual verticality and the abstract concept made salient in an advertisement decreased consumers' intentions to purchase and consume the product. The absence of the metaphorical congruency effect on consumer behavioral intentions may be attributed to the complex nature of our stimuli. For instance, the slogans "Tasty Me!" and "Healthy Me!" were featured at the bottom part of the juice product across all the conditions, which might have a possible confounding effect. The low placement of the slogan was incongruent with the concept of health (but not taste) and might offset the effect of our intended manipulation of metaphorical congruency (i.e., the match between the upward camera-angle and the concept of health). Future research may explore the competitive or accumulative effects of different types of vertical cues on abstract concept processing.

More surprisingly, in the current study, the effect of trait self-control on participants' sensitivity to the "Healthy is Up" metaphor had the opposite direction to what we hypothesized in H₅ and previously observed in Study 2a. Participants who had a lower level of self-control were more likely to perceive the fruit juice as healthier in the upward conditions than in the downward conditions. The implications of these contrasting results in Study 2a and Study 4 are further developed in the general discussion section.

6. General Discussion

In the subsequent paragraphs, we outline the main contributions and implications of our findings at theoretical and practical levels together with the main limitations and research avenues.

6.1. Theoretical Contributions

In spite of minor inconsistencies, this series of studies offers solid and convergent evidence for the “Healthy is Up” metaphor and contributes to the literature on conceptual metaphors (Lakoff & Johnson, 1980). The metaphorical association between the abstract concept of health and the concrete concept of verticality is manifested in various ways. Study 1 reveals that a conceptual match (vs. mismatch) between verticality and health facilitates faster response speed in an IAT, which corroborates previous findings of the metaphorical congruency effects on processing fluency (e.g., Meier & Robinson, 2004; Xie, Wang, & Chang, 2014). Studies 2a, 2b, 3 and 4 demonstrate the bidirectional effects of the “Healthy is Up” metaphor, namely, that people tend to position healthy food up high and to prefer a food pyramid depicting healthy food at the top (abstract-to-concrete effect), as well as to consider a food product as healthier when it seems to be in a higher position (concrete-to-abstract effect).

Besides, it is worth mentioning that health-related information predicts the vertical placement of the product while taste-related information does not (Studies 2a and 2b), and vertical information impacts the perceived healthiness of the product but not the perceived tastiness (Study 4). In other words, this research shows that what is good for health is more strongly associated with high verticality than what tastes good. This result is aligned with prior literature showing that a given metaphorical cue can be related to healthiness but not to tastiness (Ooijen et al., 2017). However, although we controlled the valence (Studies 1, 2a and 2b) and the tastiness (Study 4) of the stimuli to rule out the metaphorical association between high verticality and (positive) valence as an alternative explanation (Meier & Robinson, 2004) and to validate the novelty of our research, we cannot completely exclude that “healthiness” is not more likely to be conceptually associated with “goodness” than “tastiness”. Moreover, verticality has been identified as a metaphorical

representation for many other concepts in the literature (Cian, 2017), ranging from morality (Dong et al., 2020) to rationality (Cian et al., 2015) through power (Schubert, 2005; Sundar & Noseworthy, 2014) to name but a few. Similar experimental manipulations (e.g., a tall, elongated bottle) have also been metaphorically associated with different concepts such as luxury (Van Rompay & Pruyn, 2011) and healthiness (Ooijen et al., 2017). Likewise, an upward camera angle has been metaphorically associated with power in prior literature (Van Rompay et al., 2012) and with healthiness in the present research. Future studies might therefore examine the conditions under which people infer healthiness rather than goodness, power, or another concept, from a vertical metaphorical cue.

The most surprising and stimulating result observed in the current research is that individual differences in self-control influence the concrete-to-abstract and the abstract-to-concrete effects of the “Healthy is Up” metaphor in the opposite directions. Indeed, as showed in Study 2a – and following a similar though not significant trend in Study 2b – people scoring high on self-control are more likely to associate a healthy product with a higher placement along the vertical dimension (reinforcing the abstract-to-concrete effect), whereas, as found in Study 4, people who score low on self-control are more likely to perceive a product as healthy when it is associated with a higher placement (reinforcing the concrete-to-abstract effect). This opposite pattern could not be anticipated, since, to our knowledge, no previous research has ever explored the role of the same dispositional trait in the bidirectional effects of a given metaphor. Instead, past researchers focused on how individual differences predict the metaphorical congruency effects which are intrinsically symmetric and are not directional (e.g., Meier, et al., 2007a, 2007b), or tested only one of the bidirectional effects (e.g., Fay & Maner, 2012).

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Although, to our knowledge, asymmetric interactions between individual differences and conceptual metaphors have never been reported in the literature, this may be inferred from prior research. Across six experiments, Casasanto and Boroditsky (2008) consistently found a concrete-to-abstract effect with the “Time is Space” metaphor, but not the reverse, such that spatial information influenced judgment about time duration whereas duration did not affect estimates of spatial displacement. On the other hand, Meier and Robinson’s (2004) experiments on the “Good is Up” metaphor only revealed an abstract-to-concrete effect: processing valence words altered participants’ attention in vertical space, such that participants responded faster to stimuli presented at the top (vs. bottom) of the screen after categorizing a positive (vs. negative) word, whereas processing vertical information failed to impact reaction times in categorizing valence words. Those results imply that the concrete-to-abstract and the abstract-to-concrete effects may be driven by different psychological mechanisms, which may help explain why the same personality trait can facilitate one effect (the concrete-to-abstract effect) but undermine the other (the abstract-to-concrete effect). Furthermore, as shown in previous research, the metaphorical congruency effects on product judgement were less pronounced when consumers had more prior knowledge about a product featured in the advertisement, as they tended to rely on their prior knowledge rather than the advertisement to form their judgement (Cian et al., 2015). This may also contribute to explaining our unexpected results in Study 4. Indeed, along this line of argument, one may speculate that participants scoring high in self-control, are more knowledgeable about healthy choice (Schreiber, Bucher, Collins & Dohle, 2020), and therefore less likely than participants who are low in self-control to be influenced by the vertical cues in the advertisement when they are judging the fruit juice featured.

The precise psychological mechanisms giving rise to the observed asymmetry remain to be elucidated in future research. A complementary research avenue might be to further explore the “Healthy is Up” metaphor in light of other individual difference measures. The interaction effect between the “Healthy is Up” metaphor and self-control observed in Studies 2a and 4 suggest that the accessibility of the metaphorical association between verticality and healthy food was predicted by self-control. However, this effect did not reach significance in Study 2b, whose purpose was to replicate Study 2a, and participants’ scores on self-control did not predict participants’ choices in favor of the “Healthy is Up” pyramid in Study 3. One of the main limitations of the Brief Self-Control Scale (BSCS; Tangney et al., 2004) used in this research is that none of its items refer to healthy eating goals, whereas individual differences in terms of health (vs. hedonic) goals proved successful to moderate the effect of a metaphor on the perception of healthy food products (e.g., Hung & Labroo, 2011; Ooijen et al., 2017). Future research investigating the metaphorical association between healthy food and verticality might thus consider measuring health goals to overcome some of the limitations of the present article.

6.2. Managerial and Public Policy Implications

Our findings have important implications for practitioners in marketing management and in public policy. The use of metaphors by practitioners is well-documented in the marketing literature (e.g., Zaltman & Zaltman, 2008) and in public policy (e.g., Sopory, 2017). Metaphors in the marketplace can be verbal (e.g., “are you up for the real food challenge?”²) and non-verbal (Hirschman, 2007). Non-verbal metaphors are commonly expressed via product packaging (e.g., Basso et al., 2014; Gil-Pérez, Rebollar, & Lidón, 2020; van Ooijen, Fransen, Verlegh, & Smit,

² <https://www.fitfatherproject.com/how-to-accomplish-the-100-days-of-real-food-challenge/>

2017; van Rompay & Fennis, 2019) and advertising (e.g., Djafarova, 2016; Forceville, 1996). In everyday life, consumers are faced with a large amount of distracting information when they are shopping, and this research suggests that healthy items should be promoted with vertical metaphors to further emphasize their healthiness, especially among consumers who are low in self-control. Some advertisements used vertical metaphors to promote food products. For instance, in its campaign “Color the classics”³, Whole Foods Market, a multinational supermarket chain associated to a “healthy lifestyle” by consumers (Ma, 2020), employed a vertical metaphor to communicate about their products, depicting healthy food products (e.g., courgettes, aubergines, beans) but also less healthy food products (e.g., cake and ice cream) picked on a fork oriented upwards. In this perspective, it could be worthwhile to study the boundary conditions of the “Healthy is Up” metaphor that pertain to the product category it is applied to. Indeed, prior literature found that elongated bottles can serve as a metaphoric cue to communicate about the healthiness of a food product to consumers (Ooijen et al., 2017). However, whereas an elongated shape enhances the perceived healthiness of healthy food products, it reduces the healthiness perceptions of unhealthy food products (Sheehan, Van Ittersum, Craig & Romero, 2020). By extension, one may speculate that the “Healthy is Up” metaphor, which enhances the perception of healthy food products, might not contribute to improving the perception of unhealthy food products.

In line with the “Healthy is Up” metaphor, verticality should also be further considered by practitioners when it comes to deciding where healthy food products should be placed on in-store displays. For instance, the Food Trust recommends to “place healthy beverages, fruit salads and

³ <https://workingnotworking.com/projects/206856-whole-foods-market-holiday>

yogurts on top shelves”⁴. This recommendation is supported by a field experiment showing that people prefer shelf displays offering a larger healthy snack assortment located on top shelves (van Kleef, Otten, & van Tripp, 2012). It is worthwhile to note that this recommendation should be implemented with caution for certain categories of products. For instance, if healthy cereals are displayed on the top shelves and, conversely, sugary cereals on the bottom shelves, this means that sugary cereals will be at children’s eye level and within their reach (Harris et al., 2020), which could reinforce the “vertically exploitive elements of child-targeted marketing” in store (Berry & McMullen, 2008, p.345). Future research might explore how solutions inspired by the “Healthy is Up” metaphor could be used to promote healthy food consumption among adults and children altogether.

In relation to public health policy, this research could also contribute to informing the implementation of healthy eating guidelines. Indeed, our results show that a revised version of the food pyramid depicting healthy food at the top, in line with the “Healthy is Up” metaphor, was favored by people when compared to the classic version of the food pyramid. Although alternative depictions have been implemented in various countries across the world, such as a clay pot in Guatemala and a rainbow in Bolivia (Oliveira et al., 2019), a five-storied pagoda in China (Yoshiike et al., 2007), or a plate in the UK, Canada and Mexico (Oliveira et al., 2019; Truman, 2018), one of the most recognized graphic presenting dietary guidelines is the Food Guide Pyramid (Kaufer-Horwitz et al., 2005) or Healthy Eating Pyramid (Fernandez et al., 2021). However, the use of a food pyramid to represent dietary guidelines is at odds with the “Healthy is Up” metaphor since healthy food is depicted at the bottom of the pyramid whereas unhealthy food is depicted at

⁴ http://thefoodtrust.org/uploads/media_items/phcsn-sell-healthy-guide.original.pdf

the top of the pyramid. One practical solution to overcome this limitation is to turn the food pyramid upside-down. This is illustrated by the Japanese Food Guide, for instance, which employed a spinning top that looks like an inverted triangle or a triangular cone (Yoshiike et al., 2007). This visual strategy allowed the Japanese public health authorities to depict the foods that should be eaten in largest amounts at the top rather than at the bottom of the nutrition guide (Yoshiike et al., 2007). Following a similar approach, the Flemish government updated its food guide in 2017, and adopted an inverted pyramid (the “food triangle”) as a nutrition guide in the Flemish Region in Belgium. As such, the Japanese Food Guide spinning top and the Flemish food triangle are more consistent with the “Healthy is Up” metaphor than the classic food pyramid usually depicted in Western countries (Fernandez et al., 2021). Along this line of argument, a next step could be to examine whether visual food-based dietary guidance inspired by the “Healthy is Up” metaphor could be helpful to improve the provision of information on portion sizes (Benelam & Stanner, 2019).

6.3. Limitations and Research Avenues

In addition to the limitations already discussed, there are other potential elements in our designs that may constrain the applicability of the present research and require further considerations and examinations.

First, unfortunately, no effect of metaphorical congruency effect on consumer behavior intentions was observed in Study 4. This may be explained by the fact that the metaphor congruency effect influenced healthiness perceptions among consumers who are low in self-control whereas literature shows that healthiness weights less than tastiness when they are making food choices (e.g., Sullivan, Hutcherson, Harris & Rangel, 2015). Complementary solutions relying, for

instance, on heuristics might be useful to promote healthy choice among individuals with low self-control (e.g., Salmon, Fennis, de Ridder, Adriaanse & De Vet, 2014).

Second, we have grounded our studies in the context of healthy food consumption, but the concept of health has much broader connotations. Future research can try to extend the effects of the “Healthy is Up” metaphor to other health-related fields such as physical exercise and sleep.

Last, our research relies solely on American samples because the “Healthy is Up” metaphor is initially documented by North American research on cognitive linguistics (Lakoff & Johnson, 1980). Nevertheless, the United States has less than five percent of the world’s population (United States Census Bureau, 2020) while it is a global goal to promote a healthy diet (World Health Organization, 2006). Considering that the embodied experience underpinning the “Healthy is Up” metaphor is not specific to US citizens since we witness healthy people standing up and sick ones lying down all around the world, it is plausible to expect similar conceptual associations between health and verticality in other cultures. Further investigation is thus needed in this regard.

7. Conclusion

In five studies, we have experimentally demonstrated that the metaphorical congruence between health and verticality enhances processing fluency, that health-related information impacts vertical judgments, and, in turn, that vertical information affects health-related judgments. This research contributes to the literature on the conceptual metaphor theory by providing the first set of comprehensive evidence for the cognitive influence of the “Healthy is Up” metaphor and its application to healthy food, as well as revealing the extent to which individual differences in self-control interact with the aforementioned effects of this metaphor. Overall, this research indicates

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that the “Healthy is Up” metaphor is a promising avenue to explore in developing practical strategies to encourage healthy food consumption as well as other healthy lifestyles.

8. References

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