

Are Consumers Aware of Top-Bottom but not of Left-Right Inferences?
Implications for Shelf Space Positions

Ana Valenzuela and Priya Raghubir

September 16, 2010

Abstract

Consumers' inferences summarize large amounts of information, which may have been encoded consciously or unconsciously. In this paper, we propose that the position of a product on a shelf is a source of information that consumers use to infer price and quality. The verticality inference captures that higher priced products are in top rows. The horizontality inference captures that higher priced products are on the right-hand side. These price inferences translate into quality inferences and result in items in the vertical and horizontal centres (middle row and/or column) being perceived as popular, as they represent price/ quality tradeoffs, and being preferred. Results across four experiments support that consumers make price, quality and popularity inferences based on a product's vertical and horizontal shelf space position. We argue that consumers are aware of verticality beliefs, which are reflected and reinforced by retailer displays, but make horizontality inferences using an unconscious encoding of the number line. Results show that horizontality effects are contingent on the accessibility of a number line (Study 2) whereas verticality effects are contingent on contextually determined diagnosticity of the schema (Study 3) and the level of resources deployed (Study 4). Results add to the literature on visual information processing and non-conscious processes. Implications for retailers and product managers are discussed.

Prior research on product placement has shown that the spatial position of products affects consumers' inferences about prices (Inman, McAlister and Hoyer 1990), their allocation of attention across brands (Chandon et al. 2007; Simonson and Winer 1992), inferences of their popularity (Valenzuela and Raghurir 2009), the number and type of product comparisons that buyers make before deciding what to buy (Breugelmans, Campo, and Gijbrecchts 2007), the level of exposure and physical interaction with a good (Folwell and Moberg 1993; Corstjens and Corstjens 1999), as well as brand sales (Curhan 1974; Desmet and Renaudin 1998; Drèze et al. 1994, Wilkinson, Mason and Paksoy 1982). Reflecting conventional wisdom, products placed at eye- and hand-level have a significantly higher probability of being selected (Folwell and Moberg 1993), but effects have been inconsistently noted for other positions. These effects range from an extreme position advantage (Nisbett and Wilson 1977), to a middle position advantage (Christenfeld 1995; Shaw 2000), no position advantage (Chandon et al. 2007), and position advantage contingent on product category (Drèze et al. 1994).

This paper examines whether the horizontal and vertical position of a product are used as information to make judgments, whether this is done within or outside of consumer awareness of the influence of position on judgments, and whether such inferences have consequences for preferences and choice. We develop a conceptual framework describing the inferences consumers draw from a product's position on a shelf. Study 1 documents that people believe that higher priced brands are on top (vs. bottom) shelves (verticality) and to the right- (vs. left-) hand side of a display (horizontality), with these two beliefs leading to perceptions that the product in the centre is the most popular option based on price/ quality tradeoffs (centrality). Study 2 aims at understanding the antecedent of the horizontality effect. We find that priming a number line affects horizontal (but not vertical) inferences. Building on the idea that consumers are aware of their verticality beliefs, but not of their horizontality beliefs, Study 3 manipulates the informational value of spatial positions by priming a schema-inconsistent retail display: Verticality effects are attenuated in the schema-inconsistent conditions, whereas horizontality effects are

not. Finally, Study 4 using different product categories and experimental tasks tests that the verticality inference is contingent on the availability of cognitive resources and is mediated by awareness of verticality schemas, whereas the horizontality inference is not. These results add to the literature on non-conscious effects in marketing (Fitzsimons et al., 2002). The paper concludes with a discussion of theoretical implications for visual information processing, non-conscious processes, as well as managerial implications for shelf space decisions for retailers and product managers.

THEORETICAL FRAMEWORK

Inferences from Position

There are certain spatial rules that govern the meaning of a specific position in an array. These rules apply to spatial arrays ranging from the ordering of response alternatives (e.g., Attali and Bar-Hillel 2003; Schuman and Presser 1996), to the placement of people (e.g., Taylor and Fiske 1975; McArthur and Post 1977; Raghurir and Valenzuela 2006), and products (Inman, McAlister and Hoyer 1990; Valenzuela and Raghurir 2009). Christenfeld (1995) showed a robust preference for the middle position for contexts ranging from products on a supermarket shelf to choice of bathroom stalls, toilet paper rolls within a stall, as well as choice of an arbitrary symbol. On the other hand, Nisbett and Wilson (1977) found that when choices were presented sequentially, people chose the last item in the sequence.

These effects do not seem to be driven by different level of attention paid to different positions. Shaw (2000) ruled out an attention mechanism explaining position effects by showing that there was no difference in the number of graphic items recalled from posters in the left, center and right position within a three-poster collage (see also Valenzuela and Raghurir 2009). Chandon et al.'s (2007) eye-tracking studies also concluded that even though the center of a display was more likely to be noticed, the resulting visual lift did not carry through to product

consideration and choice. Their findings supported better recall for products in top positions, although there was no difference in attention allocated to the right or left of a display.

We propose that an inferential process based on shelf space location, instead, explain position effects. There is evidence for this idea in prior research. For example, building on the findings of Bemmaor and Monchoux (1991) who showed that P-O-P signage multiplied the effect of price reduction and augmented sales, Inman et al. (1990) found that consumers believe that products that are placed at the end of the aisle as a promotion are offered at a discount even when they are not discounted and this is because consumers use aisle promotions as a proxy for price cuts. Valenzuela and Raghurir (2009) also recently provided evidence that people draw inferences about product popularity from a central position.

In this paper, we systematically examine inferential processes based on meaning extracted from shelf space positions. We propose that consumers may have expectations that retailers will order products using meaningful criteria such as price and quality, and, therefore, apply these beliefs to infer the price, quality, popularity, and value of products given their shelf space position (Wright, 2002). However, the vertical and horizontal positions have been assigned different meanings in the literature which is reviewed below.

Vertical Position

Two recent articles examined the effects of verticality in a spatial setting and found evidence supporting the meta-belief that “higher is better” (Meier and Robinson 2004; Schubert 2005). Meier and Robinson (2004) documented that the vertical position of two words differing in terms of their valence affected the speed with which they were recognized: Positive words were recognized faster when they were placed at the top of a computer screen, and negative words were recognized faster when they were placed at the bottom of the screen.

Schubert (2005) studied the notion that vertical spatial positions are associated with power. He found that people possess a shared spatial metaphor for power: Those in higher

physical positions were perceived to be more powerful. In one of his experiments, experimental participants were exposed to group labels on a computer screen with one placed at the top of the display and the other placed at the bottom. Labels at the top of a display were perceived to be more powerful than those placed at the bottom. Further, judgments about the relationship between a pair of occupations (*e.g.*, student/ professor) were faster when the more powerful profession was at the top of the display and the less powerful one at the bottom. These effects extended to domains other than people: Animal names placed at the top of a computer screen were judged as being worthy of greater respect than those placed at the bottom. Due to these shared beliefs, the vertical position of stimuli interfered with power judgments when placement was inconsistent with these beliefs.

In a recent application of Schubert's paper to marketing, Nelson and Simmons (2009) noted that beliefs in verticality also translated to cardinal direction: North-South. Arguing that people use the metaphor that "North is Up" and "South is down," and translate that to beliefs that going north is uphill and more effortful a journey than going south, they found that people estimate that it takes less time to travel south (versus north). This belief led to consumers being willing to pay less for a service located south of them and being more likely to shop at a destination south (versus north) of them, especially when the product to be purchased was not a complex one necessitating deeper consideration. They conjectured that if people perceived that it is harder to go north then they would infer that higher quality products are more likely to be in northern (versus southern) positions.

This metaphoric usage of "verticality" is also reflected in language that describes people's shared beliefs (Pinker 1997). Phrases such as "climbing to the top of the organizational ladder," "scaling heights," "pinnacle of success," "on top of things," "high point," versus "hitting rock bottom," "sinking to one's level," "down and out," use a vertical top-bottom analogy to reflect that it is better to be on top than on the bottom in a normative sense. The common use of prefixes such as "over" versus "under," "up" versus "down," "high" versus "low" also reflects spatial

undertones consistent with a uni-dimensional view of verticality: “Higher is better.” In the field of cross-cultural research, the horizontal/ vertical distinction captures the variation in the value that societies place on status-conferring divisions, as opposed to the value they place on equality (Shavitt et al. 2006). On this basis, we propose that consumers believe that top positions have higher priced and higher quality items than bottom positions. Operationally, we test the *Verticality Hypothesis*:

H1: Products are perceived to be more expensive and of higher quality when placed in higher positions in a vertical shelf display.

Horizontal Position

There is little prior research that has examined the meaning associated with a left-right ordering. Two commonly used meanings of left and right are political and physiological. Unlike verticality, horizontality is non-normative; that is, left is different from right, but one is not necessarily better than the other. In the political arena, left is associated with being more liberal, while right is associated with being more conservative.¹ In the physiological arena, the usage of left and right are based on the hemispheric view of the brain, which controls different functions (Sperry 1961). These are nominal rather than ordinal distinctions.

However, language and metaphorical use suggests that “right” may be normatively better than “left.” This could be due to the higher prevalence of right-handed people, and/ or the fact that “right” is a homonym that also means “correct,” or “entitlement:” both positive connotations, and “left” is a homonym that means “remaining.” For example, the origins of the word “left” imply

¹“The term originates from the [French Revolution](#), when [liberal](#) deputies from the [Third Estate](#) generally sat to the left of the president's chair, a habit which began in the [Estates General](#) of 1789. The nobility, members of the [Second Estate](#), generally sat to the right. It is still the tradition in the French [Assemblée Nationale](#) for the representatives to be seated left-to-right (relative to the Assemblée president) according to their political alignment.” http://en.wikipedia.org/wiki/Left-wing_politics#Origins_and_history_of_the_term, July 29, 2008, 20:30, PST.

poor quality,² and the translation of left from other languages has a negative connotation in English. For example, the French “gauche” (left) versus “droit” (right) are the origins of the English language use of gauche to imply awkward and clumsy, and “adroit” to imply accomplished.

Recent research in marketing has shown that the left-right location of a product image on a package can affect perceptions of how heavy or light the product is: Heavier locations are on the bottom (versus top), and on the right (versus left; Deng and Kahn 2009). Further, left-right position has also been shown to affect attention (Spalek and Hammad 2005) with English speaking readers directing their attention from left to right, but an Arabic sample doing the reverse, presumably due to the manner in which these languages are written and read.

Note that despite there being differences in left-right (or top-bottom) orientation in reading in the English and Arabic or Chinese languages, the number line increases from left to right in all language systems, with higher numbers on the right of a horizontal display. Building on this universality of the number line, research by Dehaene (1999) showed that people perform better with large numbers if they hold their response key in their right hand but do better with small numbers if they hold the response key in their left hand, but the effect is reversed when participants cross their hands. Dehaene concluded that the actual hand used to make the response was, in fact, irrelevant. It was the horizontal right-left location that the participants unconsciously associated with larger and smaller numbers respectively that mattered; an association that was deep seated in the brain.

On this basis, we suggest that consumers associate positions that are to the right in a horizontal shelf space array with having higher prices and quality. Therefore, we test the

Horizontality Hypothesis:

² “From [Middle English](#), *left*, *lift*, *luft*; from [Anglo-Saxon](#), *left*, *lyft* lit. worthless, weak allied to [Anglo-Saxon](#) lyft-ádl, a palsy,” <http://en.wiktionary.org/wiki/left>, July 29, 2008, 20:30, PST.

H2: Products are perceived to be more expensive and of higher quality, the more to the right-hand side they are placed in a horizontal shelf display.

Central Position

The “center” has a positive connotation. It implies being away from any extreme, with “central” relating to what is most important (e.g., “central argument”), and attention getting (e.g., “centerpiece”). Research in social psychology supports this: People in the center have an advantage over those at extremes (Raghubir and Valenzuela 2006; Taylor and Fiske 1975), with products in the centre of a horizontal array more likely to be chosen because they are perceived to be the most popular (Valenzuela and Raghubir 2009).

We now propose that the underlying antecedent of the perception of popularity of products in the center of an array is that they represent price-quality tradeoffs. If H1 and H2 are true, then products on either end of a vertical or horizontal array represent extremes in terms of price and quality: Low price-low quality or high price-high quality. Items in the center of these arrays would accordingly be perceived to be of moderate price and quality, and, therefore, represent a compromise option between two price-quality extremes (Simonson, 1989). Thus, we suggest that the underlying reason why products in the centre are perceived to be the most popular is because they represent a compromise between price and quality. We propose the *Centre as a Compromise Hypothesis*:

H3: Consumer preference for the center over the horizontal and vertical extremes is mediated by price and quality inferences that together determine perceptions of popularity.

Study 1 examines whether consumers infer that products that are on the top (vs. bottom) and on the right (vs. left) are more expensive and of higher quality, leading to products in the

center being perceived to be the most popular as they represent a compromise price/ quality tradeoff (H1, H2, H3).

STUDY 1: Consumers' Inferences from Vertical, Horizontal and Central Positions

Study 1 tests whether the horizontal and vertical position of a brand influences consumers' beliefs about its price and quality (H1 and H2), and how these inferences translate into inferences about its popularity and affect product preferences (H3).

Method

Participants. Study participants were undergraduate business school students from two US campuses who completed the exercise for partial course credit (n = 181).

Design. We manipulated position at five levels (labeled A1, A2, A3, A4, and A5) within subjects and layout at two levels between-subjects (horizontal and vertical). In the horizontal layout condition, all brands were placed from left (A1) to right (A5) on the same row, and in the vertical layout condition they were all placed from top (A1) to bottom (A5) in the same column.

Procedure. Participants were asked to imagine that they were on vacation in Turkey and planning to purchase a bottle of red wine. They were given a brief description of wines in Turkey (see Appendix) and then given the following scenario:

"You are running late so you walk into the food store around the corner from your hotel. You go to the wine aisle and they have only five different brands of red wine, with no description in English on them and no price tags on them either. You know that the prices of different wines differ and that the taxes on them can make that difference quite important. However, you are in a hurry, there is a long line at the cashier's, and no one to ask for advice in the little corner store, so you need to quickly choose a bottle from the five available."

Measures. After reading the scenario, participants selected which brand they would choose. They then estimated each brand's price using the following four response categories: <\$6.00, \$6.00–\$9.99, \$10.00–\$14.99, and \$15.00+ (category midpoints were used to estimate

mean prices). Participants then rated the quality (1 = not at all/ 7 = very good), popularity (1 = unpopular/ 7 = popular), and price perception (1 = Cheap/ 7 = Expensive) of all five options. Results are provided in Table 1 and Figure 1. Finally, participants rated their levels of motivation ($M = 3.75$), task difficulty ($M = 3.48$), and purchase frequency ($M = 2.14$) of wine using seven-point scales (1 = Not at all/ Very) that did not vary across conditions.

-- Insert Table 1 and Figures 1a-1f about here. --

Results

Price Judgments. Price estimates of the five brands on the price perception categorical scale were cross-tabulated in both orientation conditions ($\chi^2_3 > 18$, p 's $< .001$ for both). For the vertical layout, price estimates decreased from top to bottom (M s = \$10.90, \$10.57, \$10.25, \$9.88, \$9.54, Figure 1a) supporting H1, and for the horizontal layout they increased from left to right (M s = \$8.60, \$9.35, \$10.88, \$10.79 to \$12.15, Figure 1b), supporting H2.

A five position ANOVA on price ratings on the interval scale showed consistent results: Price ratings reduced as position moved from top to bottom (M s = 4.29, 4.14, 3.88, 3.64, 3.35; $F(4, 416) = 4.54$, $p < .01$; Figure 1c); and increased as position moved from left to right (M s = 2.77, 3.50, 4.07, 4.38, and 4.73; $F(4, 292) = 17.30$, $p < .001$; Figure 1c). Thus, both the verticality and the horizontality hypotheses (H1 and H2) were supported for price judgments.

Quality perceptions. An ANOVA on quality perceptions of the five positions by orientation condition showed that quality perceptions tracked those of price perceptions, supporting H1 and H2. In the vertical layout, as position moved from top to bottom, perceived quality was marginally lower (M s = 4.54, 4.59, 4.60, 4.27, 4.08; $F(4, 416) = 1.96$, $p < .10$; Figure 1c), and in the

horizontal layout, as position moved from left to right, perceived quality was significantly higher ($M_s = 3.44, 4.11, 4.82, 4.96$ and 5.32 ; $F(4, 288) = 17.17, p < .001$; Figure 1d).³

Popularity Perceptions: A 5 (positions) x 2 (orientations) ANOVA on popularity perceptions showed that the center position was perceived to be the most popular in both the vertical orientation ($M_s = 4.29, 4.97, 5.32, 4.54,$ and 3.81 ; $F(4, 416) = 17.36, p < .001$; Figure 1e) as well as in the horizontal orientation ($M_s = 4.40, 4.78, 5.18, 4.68,$ and 4.11 ; $F(4, 288) = 5.25, p < .01$; Figure 1f). This inverted-U shape is borne out by significant quadratic contrasts in both orientations (Vertical $F(1, 104) = 53.64, p < .001$, Horizontal $F(1, 72) = 17.67, p < .001$).⁴ These results replicate those of Valenzuela and Raghurir (2009). Overall, the data suggest that people infer price from position in a linear manner, and then quality from price also in a linear manner. However, they then judge perceived popularity based on a price-quality tradeoff, leading to an inverted U pattern with the centre position representing a middle-of-the-road price and quality point in the middle of the distribution as argued by H3.

Preferences. To examine whether position affects consumer preferences, we examined the percentage of people choosing each of the five brands in both orientation conditions. Within the vertical layout, products placed in the 2nd and 3rd rows are preferred to those placed in the 1st, 4th

³ To examine whether quality perceptions were mediated by price perceptions, we conducted two separate ANCOVAs on quality perceptions incorporating both types of price perceptions as covariates (Baron and Kenny 1986). When price perceptions (elicited before quality perceptions) were added as covariates, there was a pattern of partial mediation in the vertical orientation ($F(14, 396) = 2.84, p < .05$), and perfect mediation in the horizontal orientation ($F < 1$). In both orientations, the covariates showed significant interactions with the position factor (Vertical: $F(4, 396) = 32.03, 11.50, 9.48, 6.37, 24.99$ for top to bottom rows, $F(4, 264) = 23.85, 11.01, 16.48, 12.01,$ and 26.63 for left to right columns, $p_s < .05$ for all). To assess that the mediation analysis was robust to order of elicitation, we redid the analysis with the second price perception measure. When the price ratings (elicited after quality perceptions) were added as covariates, the effect of position was no longer significant in either the vertical ($F = 1.18, p > .30$) or the horizontal layout condition ($F < 1$). In the vertical orientation condition, four of the covariates were involved in significant interactions with the position factor ($F(4, 392) = 19.08, 4.91, 5.44,$ and 13.84 , for 1st, 3rd, 4th and 5th price perception; $p_s < .05$ for all). In the horizontal orientation condition, all five interactions were significant ($F(4, 264) = 12.09, 3.73, 6.66, 5.23,$ and 14.68 from left to right; $p_s < .05$). Across both price measures (one elicited prior to quality perceptions and one subsequent to price perceptions), there is convergent evidence that quality perceptions are based on price perceptions, with price perceptions based on vertical and horizontal position.

⁴ To examine whether quality perceptions mediate popularity perceptions, we reran the above analyses incorporating quality perceptions as covariates. In the vertical orientation condition, mediation was perfect: the effect of position was not significant (Position $F < 1$, quadratic contrast $p > .10$) and there were interaction effects of quality perceptions with the position factor for the first, third, fourth and fifth quality ratings ($F(4, 268) = 2.04, 2.05, 2.15, 4.90, p < .10$). In the horizontal orientation condition, the pattern was of partial mediation: the effect of position reduced to non-significance ($F(4, 268) = 1.66, p > .15$) but the quadratic contrast remained significant ($F(4, 67) = 4.54, p < .05$).

and 5th rows (Choice = 16.04%, 31.13%, 27.36%, 9.43% and 16.04% from 1st to 5th, $\chi^2_4 = 17.02$, $p < .01$). Within the horizontal layout, the center column is more preferred to the extreme left or right ones (Choice = 14.67%, 22.67%, 38.67%, 14.67% and 9.33% from left to right respectively, $\chi^2_4 = 19.73$, $p < .001$), replicating Valenzuela and Raghurir (2009), and supporting H3.⁵

Discussion

Study 1 demonstrated that shelf space positions lead to price inferences which affect quality perceptions and carry through to both perceptions of product popularity and preferences. Results support H1 and H2: products are judged as more expensive the higher in a vertical shelf display and the more to the right in a horizontal shelf display they are, which leads to matching quality inferences. As a consequence, brands in the center of both orientations (rows and columns) represent a moderate price/ quality tradeoff. These brands are perceived to be the most popular options and, consequently, are most preferred – the centrality effect (H3). Said differently, the preference for the center option replicates earlier results (Valenzuela and Raghurir 2009), with greater insight regarding the process underlying popularity perceptions. They mirror a price/ quality compromise effect (cf. Simonson 1989) in a context where consumers do not have specific attribute information to make decisions, but infer price and quality from a product's *vertical* and *horizontal* position.

It is important to note that consumers' inferences summarize large amounts of information, which may have been encoded consciously or unconsciously. They represent cumulative implicit knowledge that has good ecological mapping (Greifener, Bless, and Pham 2010). We propose that although horizontal and vertical inferences may lead to similar effects, the route

⁵ To examine whether perceptions of popularity predicted choice, we ran a binomial logistic regression of whether people chose a variety in the central versus extreme positions with popularity ratings as an independent variable. The model was significant ($\chi^2(5) = 16.75$, $p < 0.05$) as was the coefficient associated with popularity ratings of the center ($B = .460$, $p < 0.05$) and the second option ($B = -.405$, $p < 0.05$), supporting a pattern of mediation: the center option is more likely to be chosen because it is perceived to be most popular, and this perception of popularity is based on perceptions of the brand in the middle position representing a price-quality compromise between two extremes. The order of elicitation of price, quality and popularity perceptions was varied in follow up studies to confirm the robustness of these mediation analyses. The same patterns of mediation were successfully replicated in later studies.

through which they do so is different: specifically, with horizontality inferences unconsciously determined and verticality inferences consciously determined. In particular, verticality inferences are based on beliefs learnt through social exposure (i.e. exposure to status rankings or actual retail stores), whereas horizontality inferences are based on the direct application of the number line. Specifically, Schubert (2005) suggests that the origin of verticality inferences is the strongly held meta-belief that higher is better. On the other hand, Dehaene (1999) supports horizontal associations of the number line with larger and smaller number, which happen outside of people's awareness. Furthermore, although there is a paucity of literature to directly support this proposition, prior literature is consistent with the idea that both inferential processes are based on schemas that are organizationally similar being based on a linear array but different in terms of the belief content.

Examining social status judgments, Chiao, Bordeaux and Ambadi (2004) reported that participants were fastest when asked to compare occupations that were further apart in social status: a social status distance effect. In follow up work, Chiao et al. (2009) found new physiological evidence based on fMRI scans that mental representations of social status hierarchy share common and overlapping features with numerical representations. Specifically, whereas the left area of the HIPS (horizontal intraparietal sulci) is activated when people make numerical comparisons or judge the relative status of cars, the right side of the HIPS area is activated only when they judge the relative status of people. They conclude that people's mental representations of social status may be projected onto an internal number line to actually make a judgment.

Chiao et al.'s (2009) evidence implicating the role of HIPS builds on the "Three Circuit" model proposed by Dehaene, Piazza, Pinel, and Cohen (2003). Dehaene et al. (2003) argued that the HIPS area is central to the processing of quantity information (like subtraction of small numbers, but not multiplication which can be learned and reproduced by rote), whereas two other areas of the brain appear to process verbal and visual aspects of numerical cognition.

Dehaene et al. (2003) suggested that the quantitative HIPS system may extend to other categories that have an ordinal element; a speculation confirmed by Chiao et al. (2009) in the domain of the status of people and products.

This conclusion can also be reinterpreted to understand Chiao et al.'s (2004) finding that reaction times are faster when people make numeric judgments as compared to status judgments. Status judgments seem to imply a two-stage process: making a judgment and then translating it onto an internal number line; whereas number judgments only involve the second step. In defense of this argument, Dehaene (1999) references the work conducted with animals (e.g., Hauser, Carey and Hauser 2000) and children (e.g., Dehaene et al. 1998, Spelke and Dehaene 1999) who are able to make numerosity judgments and elementary computations. In fact, Dehaene et al. (2003), suggest that evolution may have endowed the human brain with a predisposition to acquire and represent numerical information. On the other hand, inferences based on social beliefs need to be learnt and reinforced through daily exposure in peoples' lives (e.g., Chiao et al. 2004).

Relating this literature back to the antecedents of the horizontality and verticality effects, daily exposure to belief-consistent vertical or horizontal ordering is dependent on retailers' layouts. In order to explore whether there are indeed differences in consumers' consistent exposure to vertical and horizontal product ordering in layouts, we conducted a pilot and field study. They were intended to examine whether consumers consciously believe that meaningful horizontal and vertical ordering exists and whether retailers use horizontal and vertical placement as a way to order products on a shelf. These results are reported below.

Pilot Study: To explicitly examine whether consumers believe that products are arranged according to prices across rows (verticality schema) or columns (horizontal schema), we conducted a pilot study (n = 94). Participants were asked to rate their level of agreement on a seven-point scale with a midpoint of 4, with two statements that tested their explicit belief in the verticality and horizontality schemas: "Higher priced products are placed on the top of a display,"

and “Higher priced products are placed on the right of the display.” As expected, consumers have weaker left-right horizontality beliefs (Mean = 3.6) than top-bottom verticality beliefs (Mean = 4.5, $t_{91} = 2.82$, $p < 0.01$).

Wine Audit: We conducted a shelf price audit of wine prices in two cities, one in the US and another in Europe ($n = 374$). In each city, we chose two wine stores and examined the price displays for three varietals: Merlot, Chardonnay, and Pinot Noir. For each varietal in each store, the horizontal and vertical position of the bottle of wine was recorded, as was its price. We then examined whether there was any evidence for retailers of wine to display bottles of wine ordered in terms of price points from top to bottom and from left to right facing the display. The regression equation included dummy variables for the three varietals, and the four stores as well as row (top = 1) and column (left = 1) position. The regression was significant ($F(8, 364) = 51.61$, $p < .001$, $R^2_a = .52$). Consistent with the verticality schema, the effect of the row coefficient was negative and significant suggesting that higher priced wines are, in fact, placed on top rows ($B = -.59$, $t = -15.83$, $p < .001$). It is important to note that left-right placement does not consistently follow a set of rules (column coefficient was not significant, $p > .80$). There were significant effects associated with all the dummy coefficients capturing international, varietal, and retailer differences in price points.

The results of the wine audit suggest that retailer layouts seem to more consistently follow top-bottom price ordering consistent with consumers' verticality inferences but do not follow any left-right price ordering. This wine audit provides evidence that can explain the results of the pilot test. Together, the results of the pilot study and the wine store audit suggest that consumers may have stronger beliefs about the meaning of top-bottom price ordering than they have of left-right price ordering because they are more consistently exposed to them. Thus, as they have a set of beliefs about vertical placement that is reflected by retail layouts (i.e., a vertical retail-based schema that is diagnostic), they can use these. But, as they do not have a diagnostic retail-based schema for horizontal order, they are likely to construct horizontal meaning from the

basic number processing rules -- higher to the right -- which they are predisposed to (Dehaene et al. 2003).

To summarize, prior literature examining the manner in which ordinal information is processed suggests that the route through which verticality inferences operate are via status judgments. Consumers are aware of these inferences, they are reflected in retail layouts that not only make them diagnostic, but also reinforce them. Horizontality inferences, on the other hand, operate via a different route. They operate via an application of a number line that increases from left to right. They are not used because they are perceived to be diagnostic per se, but merely because they are accessible. The next study examines this hypothesis.

STUDY 2: The Schema Accessibility Hypothesis – Number Line Prime

We have argued that the use of the horizontality schema is based on consumers' predisposition towards associations with the number line. If schematic inferences based on horizontal placement are not based on retail information but on basic number line ordering of high and low numbers, then, if consumers were exposed to different number line orientations of large and small numbers, then horizontality-based inferences should be greater when the number line has a horizontal orientation (thus, it is more accessible) as compared to a vertical orientation. However, the orientation of a number line should not affect verticality inferences. We propose the *Schema Accessibility Hypothesis*:

H4: Priming a number line in a horizontal (versus vertical) orientation will increase horizontality effects, but will not influence verticality effects.

Method

Study participants (n = 107) were enrolled in a marketing class at a business school and completed the study for partial course credit. The overall design was a 2 (prime orientation:

horizontal/ vertical) x 2 (display orientation: horizontal/ vertical) between subjects design, with five positions (within-subject).

Procedure

Prime was manipulated through a series of three pictures of standard rulers that were presented either horizontally or vertically. The cover story used for this task was that we were interested in students' preferences for stationery products. They were asked to choose their favorite of the three rulers.

Subsequent to this all participants were provided the same "tourist scenario" information about buying wines in Turkey as in Study 1. Display orientation was manipulated by providing five products that were presented horizontally (A1 to A5: from left to right) or vertically (A1 to A5 from top to bottom). Participants were asked to rate the quality and price of the five products using a seven point scale. As price and quality ratings were highly correlated ($r_s = .71, .54, .32, .54$ and $.67, p < .001$ for products labeled A1 to A5 respectively), we compute a price-quality index for each of the five products which served as the dependent measure.

Results

Position Based Inferences: A 2 (prime: horizontal/ vertical) x 2 (orientation: horizontal/ vertical) x 5 (position: repeated measure) analysis on the price-quality index revealed a three way interaction ($F(4, 408) = 3.64, p < .05, \eta^2 = .03$). Other significant effects included a main effect of position ($F(4, 408) = 6.99, p < .05, \eta^2 = .06$), and a position x display orientation interaction ($F(4, 408) = 5.86, p < .05, \eta^2 = .05$). Means by condition are provided in Table 2.

We conducted follow up analyses to examine the effect of prime separately for the horizontal orientation and vertical orientation. When the orientation was horizontal, the 2 (prime) x 5 (position) ANOVA on the price-quality index revealed significant main effects of position ($F(4, 212) = 13.96, p < .05, \eta^2 = .21$), and the key position x prime interaction ($F(4, 212) = 2.50, p <$

.05, $\eta^2 = .04$). Means show that the horizontal prime exacerbates the left-right effect ($M_s = 2.48, 3.33, 3.96, 4.53, \text{ and } 4.59$ from left to right; $F(4, 100) = 14.07, p < .05, \eta^2 = .36$) compared to the vertical prime ($M_s = 3.48, 3.77, 4.09, 4.18 \text{ and } 4.45$; $F(4, 108) = 2.25, p < .07, \eta^2 = .08$). There were no effects in the vertical orientation.

-- Insert Table 2 and Figure 2 around here. --

Preferences: In the horizontal orientation, when participants were primed with a ruler in the vertical orientation, we replicated the centre effect in choices (15%, 11%, 56%, 11%, 7% from left to right). However, when participants were primed with a ruler in the horizontal orientation their preferences shifted to the right (4%, 11%, 33%, 52%, 0%; choice by position $\chi^2_4 = 12.42, p < .05$).

In the vertical orientation, priming did not affect preferences which were higher for the 2nd and 3rd rows (8%, 35%, 27%, 15%, 15% and 13%, 26%, 29%, 13%, 9% for horizontal and vertical prime; $\chi^2_4 = 1.68, p > .80$).

Discussion

In this study, we expected that being exposed to information that makes the orientation of larger and smaller numbers within the number line less accessible, would only affect the inferential processes based on the horizontal positions but not on vertical positions. Study 2 results provide evidence that the number line is an antecedent to the horizontality effect, while it is unrelated to the verticality effect. In fact, when participants were primed with a number line (vertical or horizontal), we did not see any evidence of the verticality effect at all.

Study 2 results provide support for the idea that the antecedents of horizontal and vertical inferences are different. Having socially and consistently been exposed to the verticality schema, consumers use it to infer prices (as predicted by H1) because it is perceived to be diagnostic (Feldman and Lynch 1988). At the same time, consumers may also infer prices from

horizontal displays (as predicted by H2) even in the absence of a clear horizontal belief about the meaning of left-right price ordering. This implies that consumers will apply the verticality schema to the extent that it is diagnostic, but infer prices from horizontal order irrespective of its diagnosticity, and based on its mere accessibility (Menon and Raghurir 2003). The next study goes on to further examine the implications of the differences between horizontality and verticality-based inferences, and consequently speaks to their robustness and boundary conditions.

STUDY 3: The Schema Diagnosticity Hypothesis

If consumers were to experience a disconnect between actual retailer practices and their expectations regarding those practices, then, consumers would have to put their meta-beliefs into question (Friestad and Wright 1994). This would only happen for meta-beliefs that consumers have consciously learnt and are actually aware of, as in the case of the verticality schema. It should not occur in the case of horizontality inferences that exist outside of consumers' awareness. We expect that horizontality-based inferences will be less dependent than verticality-based inferences to new information that alters the diagnosticity associated with shelf space beliefs. Specifically, this would imply that contextual information can change the meaning associated with shelf space positions and lead to inferences based on vertical but not horizontal positions being discredited. We propose the *Schema Diagnosticity Hypothesis* to examine the process underlying the use of the verticality and horizontality schemas:

H5: Contextual information inconsistent with shelf space schemas will lead to a greater attenuation of verticality effects versus horizontality effects.

Method

Study 3 ($n = 113$) tests the effect of providing contextual retail information that is either schema consistent (higher prices on top and on the right) or inconsistent (lower prices on the top and on the right) on consumer judgments. The overall design was a 2 (schema: consistent or inconsistent) \times 2 (layout: horizontal, vertical) \times 5 (position) mixed design with the first two factors manipulated between-subjects (position is a repeated measure).

The procedure was similar to Study 1 and 2. However, brand price estimate response categories were expanded to six categories: 1 = < \$6.00, 2 = \$6.00-\$7.99, 3 = \$8.00-\$9.99, 4 = \$10- \$11.99, 5 = \$12- \$13.99, 6 = \$14+ so that we could treat these as interval measures for ease of analysis. The order of dependent variables was changed to Popularity-Quality-Price to examine the robustness of mediation paths across order of elicitation.

Schema consistency was manipulated by providing shelf displays in the introduction (see Appendix). In the schema-consistent condition wines that were more expensive were on the top-right (French Burgundy Reserve), and those that were less expensive were on the bottom-left (Turkish Tekel White) and in the schema inconsistent condition the display was rotated such that these positions were reversed. As a manipulation check, we elicited open-ended price estimates of seven wines to ensure that the wines used to operationalize higher priced wines were perceived to be more expensive than those used to operationalize lower priced wines.

Results

Manipulation Check. The prices of the seven wines differed in the direction expected (French Burgundy Reserve = \$21.24, Italian Pinot Gris = \$19.09, Australian Chardonnay = \$15.83, Spanish Rosé = \$18.47, Dikmen Red = \$11.35, Kavaklidere White = \$11.21 and Tekel White = \$10.36; $F(6, 654) = 11.38, p < .001$) and was not contingent on other factors (p 's > .10).

Price Estimates: A 2 (schema consistency) \times 2 (orientation) \times 5 (position) ANOVA on price estimates revealed a significant three-way interaction ($F(4, 420) = 4.72, p < .01$), as well as a position \times orientation interaction ($F(4, 420) = 23.11, p < .001$).

Separate analyses of the position effect in both orientations in the two schema consistency conditions, showed that in the schema consistent conditions verticality and horizontality effects replicated. There was a main effect of vertical orientation ($F(4, 108) = 18.84, p < .001$), reflecting prices reducing from top to bottom ($M_s = 4.86, 4.71, 4.11, 3.25$ to 2.71 , Linear $F(1, 27) = 26.90, p < .001$; Table 3) and horizontal orientation ($F(4, 104) = 13.77, p < .001$), reflecting prices increasing from left to right ($M_s = 3.07, 3.63, 4.22, 4.74$ to 4.9 ; Linear $F(1, 26) = 19.42, p < .001$; Table 3).

As argued by H4, in the schema inconsistent condition, both effects were attenuated, but while the verticality effect was no longer significant ($F < 1$), the horizontality effect remained for the first three positions and then leveled out ($F(4, 112) = 4.91, p < .001$; $M_s = 2.97, 3.52, 4.28, 4.17$ and $4.17, p < .001$, see Figure 3a).

-- Insert Table 3 and Figures 3a and 3b around here. --

Quality perceptions: The $2 \times 2 \times 5$ ANOVA on quality perceptions revealed a significant position x orientation interaction ($F(4, 420) = 16.92, p < .001$), which was further contingent on schema consistency ($F(4, 420) = 3.66, p < .01$). Separate one-way ANOVAs on the position effect showed that in the consistent schema conditions, both vertical ($F(4, 108) = 19.89, p < .001$) and horizontal ($F(4, 108) = 7.38, p < .001$) main effects were significant, reflecting linear trends ($F(1, 27) = 31.55$ and 10.23 for vertical and horizontal respectively, both $p_s < .001$). The means displayed the same pattern as price estimates (reducing from top to bottom $M_s = 5.64, 5.43, 4.75, 4.18$ and 3.36); and increasing from left to right ($M_s = 3.61, 4.36, 4.68, 5.11$ and 5.11), replicating results of Study 1. In the inconsistent schema condition, the verticality effect was entirely attenuated ($F < 1$), while the horizontality effect was only partially attenuated and remained significant overall ($F(4, 112) = 2.71, p < .05$, see Table 3 for means).

Popularity Perceptions. An analysis of popularity perceptions showed a significant effect of position: The center position was perceived to be the most popular ($M_s = 4.27, 4.58, 4.84, 4.22,$

and 3.70, $F(4, 420) = 8.62, p < .001$, Quadratic $F(1, 109) = 15.03, p < .001$) and this effect was not contingent on any of the between-subject factors.

Preferences. In the inconsistent schema condition where no price or quality inferences were drawn for vertical orientation, there is no reason to expect a centrality effect. However, if the horizontality effects are attenuated but still present, consumers should continue to exhibit a preference for the center in the horizontal orientation. This was the pattern observed (see figure 3b, and Table 3).

Across conditions, in the horizontal orientation, the center column was preferred to the extreme left or right ones (Choice = 13.21%, 5.66%, 58.49%, 9.43% and 13.21% from left to right, $\chi^2_4 = 10.12, p < .05$); and this was true irrespective of whether the schema was consistent (4%, 8%, 60%, 8% and 20% from left to right, $\chi^2_4 = 26.80, p < .001$) or inconsistent (21%, 4%, 57%, 11% and 7% from left to right, $\chi^2_4 = 26.64, p < .001$).

Across conditions, in the vertical orientation, preferences were skewed towards higher rows (Choice = 26.92%, 32.69%, 17.30%, 7.69% and 15.38% for top to bottom; $\chi^2_4 = 24.40, p < .001$). Whereas higher rows were preferred in the schema consistent condition, (31%, 46%, 15%, 4% and 4% for top to bottom; $\chi^2_4 = 17.46, p < .001$), there was no preference for any row in the schema inconsistent condition (23%, 19.2%, 19.2%, 11.5%, 27%, $\chi^2_4 = 1.69, p > .80$). Thus, schema consistency attenuated position effects in the vertical orientation, but not in the horizontal orientation.

Discussion

To summarize, Study 3 demonstrated that changing the meaning of an existing retail-based schema eliminates price and quality inferences based on vertical positions, but only partially attenuates price and quality inferences based on horizontal positions. The attenuation of

position-based inferences leads to an elimination of the centrality effect on choice in the vertical orientation, but the centrality effect remains robust in the horizontal orientation.

These results are consistent with the idea that, although consumers are not aware of how they are assigning meaning to horizontal placement, they still draw inferences based on it (Study 1) and exhibit a preference for horizontal centrality, which is robust and not driven by schematic inferences (Study 3). Given the potentially non-controllable nature of the horizontality effect (Dehaene et al. 2003; Chiao et al. 2004), the next study examines the use of the verticality and horizontality schema under conditions that manipulate the level of resources which consumers deploy to make judgments.

STUDY 4: The Schema Resource-Dependency Hypothesis

So far we have identified one implication of consumers' awareness of their use of the verticality (versus horizontality) schema, that is, consumers use the verticality schema to the extent it is diagnostic, but use the horizontality schema irrespective of its diagnosticity (Study 3). A second implication of consumers' differential awareness of horizontality and verticality schemas is that these schemas may be differentially used as a function of the level of resources deployed in a task. Schemas that are more controllable should be less likely to be used as the level of resources deployed in a task reduces. Also, possibly because of the double step process (status judgment applied to number line; Chiao et al. 2004) described earlier, verticality inferences should require more resources and be more sensitive to resource manipulations. Thus, we propose the *Schema Resource-dependency Hypothesis (H6)*:

H6: Decreasing the resources deployed in a task will lead to a greater attenuation of verticality effects versus horizontality effects.

If there are differences in the awareness of the influence of vertical vs. horizontal orientation as argued, then there should be different boundary conditions for horizontality and verticality effects as argued in H4-H6. These differences are based on the presumption that the use of the verticality schema is contingent on the strength of people's verticality beliefs, namely their belief that higher priced items are placed on the top rows. The stronger this verticality belief, the more likely they are to use it to make inferences. However, we expect the use of people's horizontality schema to be robust – it will not change as a function of whether people explicitly believe that prices are or are not ordered from left to right. To directly test the role of people's awareness in the use of a schema, we propose the *Schema Awareness Hypothesis (H7)*:

H7: The verticality effect is mediated by belief strength, but the horizontality effect is independent of belief strength.

Method

This study used a different set of product categories and experimental procedures to test that the effects noted in previous studies were generalizable. Study 4's participants (n = 81) were told that they had to design a duty-free store and define the shelf space position of 25 items in the categories of chocolates and Swatches. They were given 25 different options (each a color printed sticker with the brand name, visual, and price of the product)⁶ that they had to place on the 5x5 empty display. We manipulated the extent to which participants deployed resources for the task by informing them that their input was going to be used to design an actual duty free store based on the responses of either 100 students (only students at their campus) or 10,000 students (pooled with students from 100 campuses nationwide), with the best five responses receiving an honorarium of \$100 each.

⁶ Pictures and details of all 25 brands are available from the authors.

The manipulation of resources deployed for the task was examined by asking respondents how motivated they were, how important it was to make the best judgments, how difficult and effortful the shelf space allocation task was, and how much time and thought it took (all elicited on 1-7 scales with higher numbers reflecting greater use of resources). The six items were averaged to form a resource deployment scale ($\alpha = .81$).

The primary dependent variable was the price of the item that was placed in a given position. Additionally, to examine process, we asked participants the extent to which price was an influence in their choice of which items to place in top (versus bottom) rows and left (versus right) columns separately for the two categories. The agreement with the statements correlated across categories ($r_s = .56$ and $.61$ for top-bottom and left-right respectively, $p_s < .01$ for both), and these were averaged into two indices.

All participants responded to how frequently they purchased the two products (Chocolates = 4.6, Swatches = 2.2), how knowledgeable they were (Chocolates = 4.4, Swatches = 3.5), how much price variation (Chocolates = 4.5, Swatches = 5.4) and quality variation (Chocolates = 4.8, Swatches = 5.4) they believe existed in the category, with all items elicited on a seven point scale (1 = Not at all/ Very Little; 7 = Very/ A lot).

Results

Manipulation Check. The manipulation of resource deployment was successful. An ANOVA on the six-item resource deployment scale showed that people used more resources to make the shelf space decision when they were informed that their chances of winning were 5/ 100 (Mean = 5.11), as compared to 5/ 10,000 (Mean = 4.52, $F(1, 79) = 7.17$, $p < .01$, $\eta^2 = .08$).

Position-based Inferences. We conducted a 5 (row) x 5 (column) x 2 (resources) x 2 (categories) ANOVA on the price of the products assigned to the different positions, with the first two factors within-subjects, the resource factor between-subjects, and the last factor (product category) a random replicate within-subjects. This analysis revealed significant effects of rows

and columns ($F(4, 324) = 16.41$ and 3.56 , $ps < .01$), replicating earlier effects for verticality (M s top to bottom = \$86.5, \$77.4, \$77.1, \$62.7, \$54.1, Linear $F(1, 28) = 26.95$, $p < .001$), and horizontality (M s left to right = \$67.3, \$70.9, \$74.5, \$72.3, and \$73.0, Linear $F(1, 81) = 3.71$, $p < .05$). Note that the left-right price progression levels out after the centre position. More importantly, we find a three-way interaction between rows, column and resource deployment ($F(32, 1392) = 1.67$, $p < .05$). As argued by H6, resource deployment moderated the verticality effect ($F(8, 324) = 2.49$, $p < .05$), whereas the effect of columns (horizontality) was robust (Figures 4a and 4b).

When participants deploy fewer resources to the task, then while their horizontality shelf space allocation decisions remain unchanged (that is, lower prices on the left hand side columns), their verticality decisions change. Their verticality decisions reflect an inverted U-shaped pattern where they place higher priced products in the middle rows (rather than in the top rows). Thus, by reducing the amount of effort and attention deployed, participants did not apply their consciously learned rule that higher priced products are placed on top rows, but did apply the rule they used outside of awareness: that lower priced products are placed on the left hand side. Said differently, decreasing the amount of resources deployed does not change the horizontality effect, whereas it changes the direction of the verticality effect (replacing the linear top-bottom belief with a “center is higher” belief), suggesting that this effect is conscious and resource-dependent.

Mediation Analysis to examine the awareness of the use of the schemas. To directly examine whether awareness in the rules that people used to make product placements in the two categories mediated the row and column (verticality and horizontality) effects, we repeated the 5 (row) x 5 (column) x 2 (resources) x 2 (categories) ANOVA on the price of the products assigned to the different positions incorporating the beliefs that top-bottom placement and right-left placement were based on price judgments. This analysis revealed that the effect of rows, the verticality effect, was no longer significant ($F < 1$), while the effect of columns, the horizontality

effect, remained significant ($F(4, 344) = 2.64, p < .05$), with the row by column interaction also significant ($F(16, 1376) = 1.84, p < .05$). Most importantly, the effect of the covariate “top-bottom influence in the shelf placement decision” was significant ($F(1, 86) = 4.74, p < .05$), while the effect of “right-left influence” was not ($p > .15$). This pattern suggests that people’s awareness of the influence of the use of verticality schemas mediates their use of the schema, whereas their awareness of the influence of the horizontality schema does not.

-- Insert Figures 4a and 4b around here. --

Discussion

To summarize, the results of this study show that verticality schemas are more resource-dependent and less robust than horizontality schemas, which are robust to manipulations of resources deployed.

GENERAL DISCUSSION

This paper investigated whether, how, and when consumers extract meaning from the position of products in both horizontal and vertical shelf space arrays, and how these inferences translate into their preferences. We tested three basic hypotheses: consumers believe products are placed in decreasing order of price from top to bottom rows (*H1: verticality*) and from right to left rows (*H2: horizontality*), leading to preferences for center positions in both orientations as they represent a balanced price/ quality tradeoff (*H3: centrality*). Study 1 finds support for the verticality, horizontality, and centrality hypotheses.

We then argue, consumers’ inferences summarize large amounts of information, which may have been encoded consciously or unconsciously. Specifically, we test whether though the horizontality and verticality schemas have similar effects, they have different antecedents, with the former unconsciously determined and the latter consciously determined. We propose that verticality inferences are based on beliefs learnt through social exposure (e.g., exposure to status rankings or actual retail stores), whereas horizontality inferences are based on the direct

application of the number line which occurs outside of awareness. This hypothesis builds on prior research that has identified that reaction times for numeric judgments are shorter than those of status judgments (Chiao et al. 2004), implying that numerical judgments that are the proposed antecedent of horizontality inferences may be more automatic and require less resources than status judgments that are the proposed antecedent of verticality inferences.

We conduct a pilot study and a wine store price audit that shows that consumers have shared shelf layout schemas regarding verticality, which are confirmed in retail practice, but not for horizontality. Study 2 directly tests the idea that the number line is an antecedent to the horizontality effect, while it is unrelated to the verticality effect (*Schema Accessibility Hypothesis*). Results show that priming participants with a number line that goes from left to right exacerbates the horizontality effect.

Building on these results, we then investigate whether the divergence between the application and the conscious awareness of a schema has implications for the boundary conditions of the verticality and horizontality effect. The argument goes thus: Having consistently been exposed to the verticality schema, consumers use it to infer prices knowingly when they perceive it to be diagnostic. At the same time, consumers also infer prices from horizontal displays even in the absence of a clear horizontal belief about the meaning of left-right price ordering. This implies that position effects in the horizontal orientation may be less controllable than vertical effects because of their different antecedents: the awareness of meaningful vertical retail order but the more automatic application of the number line for horizontal positions. The next two studies examined the difference in moderating conditions for the use of vertical vs. horizontal shelf space schemas. If horizontality effects are less controllable, they will be present irrespective of the diagnosticity of the schema (*Schema Diagnosticity Hypothesis*), and will also be more robust to conditions in which consumers deploy fewer resources to make decisions (*Schema Resource-dependency Hypothesis*) as well as independent of the strength of beliefs (*Schema Awareness Hypothesis*) as compared to verticality effects.

Results support these asymmetric effects for horizontality and verticality inferences. Interfering with position-based inferences by providing inconsistent schema based information contextually eliminates verticality effects but only attenuates horizontality price-quality inferences, while the preference for the horizontal centre remains robust (Study 3). Study 4 shows that the use of the horizontal schema is robust to the level of resources deployed in a shelf space placement task, while the use of the vertical schema is not. Finally, mediation analyses demonstrate that verticality effects are perfectly mediated by retail-based schematic inferences, while horizontality effects are not (Study 4). This provides convergent evidence that the use of the vertical schema is contingent on its diagnosticity, reflecting that it is a controlled and conscious process (Feldman and Lynch 1988), whereas the use of the horizontal schema may be contingent on its mere accessibility, and automatic (Menon and Raghurir 2003).

Overall, results of these studies support our primary thesis: Consumers generally believe that products are spatially ordered according to general, meaningful criteria, specifically price and quality. Consequently, consumers make inferences about an option based on its spatial, horizontal or vertical position in shelf space arrays. These inferences lead to their judging items in the centre as representing a compromise between price and quality, which translates into an inference of popularity and a centre advantage in choice. However, while consumers are aware of the criteria they apply to evaluate products based on their vertical placement, presumably because retailer displays more consistently reinforce these beliefs, they are not aware of the criteria they apply to evaluate products based on their horizontal placement. This makes the verticality effect easier to control than the horizontality effect.

Theoretical Implications

Position Effects. Studies on order effects have shown that when there is sequentially presented information, the first or last items in a sequence are more influential than the middle one (e.g., Nisbett and Wilson 1977). This paper investigates a different pattern of results, which

replicates earlier findings by Christenfeld (1995) and Shaw (2000) that choice behavior among arrays of identical items reliably favors items located in the middle position. Although earlier studies have explained order effects in terms of attention (e.g. Schuman and Presser 1996), this paper develops a schema-based explanation for order effects that is inference-based.

Specifically, these results add to the literature that centre positions are chosen based on perceptions of their popularity (Valenzuela and Raghurir 2009) by showing that these popularity perceptions are themselves based on price and quality inferences, and are asymmetric across the horizontal and vertical centre.

Compromise Effects. The results of this paper also speak to the literature on compromise effects. Prior research on compromise effects used stimuli in which product alternatives were clearly defined on a set of attributes (in an absolute or relative way) and attribute levels were ordered monotonically (Simonson, 1989, Simonson and Tversky 1992). Unlike past research, the current context only provides visual cues regarding a product's spatial position in an array. It is the inferences drawn from these visual cues that lead to a preference for items in the centre, conceptually replicating compromise effects in the absence of actual attribute information.

Schema-based inferences. We proposed that there are different antecedents behind schematic inferences. In other words, the disparity between consumers' beliefs about retailer practice (awareness of verticality and horizontality schemas) and their own beliefs were a factor contributing to the asymmetric effects of preferences in the horizontal versus vertical orientation. Paraphrasing the earlier discussion, we suggested that when retailer practice reinforces consumer expectations, consumers are more likely to be aware of their schema, and, ironically, less prone to use it. However, when consumers have a schema that is difficult to explain or justify in terms of their experience, either in the retail environment, or in terms of their meta-beliefs, then it is difficult to control the use of this schema, making it robust and persistent. This suggests that inferences based on verticality schemas may represent conscious and controlled processes, but inferences based on horizontality schemas may represent automatic processes.

Visual Information Processing. This paper adds to research on the effect of visual information on consumer judgments. Prior approaches have examined the effect of visual cues on judgments such as volume and consumption (Krishna 2008) but there is relatively little research on the kinds of inferences that people draw from spatial information. Given the increasing interest in visual information applied to marketing domains (Wedel and Pieters 2008), this paper adds to the evidence that visual product information is not only used to make cognitive judgments, but also affects inferences and preferences.

Managerial Implications

The value of specific shelf positions, such as central positions, is conventional wisdom for practitioners given that they believe it increases the exposure and attention paid to a product (Gladson 1989). Shelf positions may affect not only the exposure of the product but also its physical accessibility, product adjacencies and, of course, product ordering. Various studies have explored shelf placement effects, from early articles in *Progressive Grocer* using IRI data (Progressive Grocer 1971) to recent research by Chandon et al. (2007) using eye-tracking data. Findings consistently support that retailers should factor subjective considerations of product characteristics into shelf allocation decisions (Curhan 1971). This paper highlights another reason for managers to pay premiums, and retailers to charge premiums for specific shelf positions: The fact that consumers extract meaning from horizontal and vertical shelf space positions. As a consequence, the physical position of a product on the shelf should match its perceptual positioning (*i.e.*, premium products should benefit from being placed in premium shelf positions – the top right-hand side⁷), especially in the case of categories in which consumers have little prior information about brands (Fazio, Powell and Williams 1989).

⁷ Wineries believe that the top-right position presents an advantage, but because they think women purchase wine and reach up with their right hand when in the store: Personal conversation, wine manager.

In a related study, Drèze et al. (1994) examined the effect of vertical and horizontal placement on brand choice. Across eight product categories with an average of 115 items each, they showed that while physical location had a general effect on sales, the magnitude of the shock varied according to product category and, more importantly, position on the shelf. Moving a product from the worst to the best vertical position increased sales by up to 40%, whereas a similar horizontal movement increased sales by 15%. However, the “best” position was contingent on product category itself. This paper adds to the understanding of which brands in a product category are likely to benefit from specific shelf space positions. Drèze et al.’s (1994) demonstration that “ideal” positions were contingent on product category could also be reassessed in light of the proposed framework: product category differences could reflect differential importance of price, quality, value (price/ quality tradeoff), popularity, or presence of promotions in a consumer’s purchase decision.

These differences could also reflect a differential use of schema-based inferences contingent on factors such as i) consumers’ knowledge about brand quality in the category (effects should be muted for more familiar categories); ii) the level of price differential between options (effects should be amplified with product and quality differences); iii) the length of a product display and presence of sub-categories (that could increase the difficulty associated with making inferences based on horizontal position); and iv) the consistency of retail practice in monotonically ordering products by price in either vertical or horizontal arrays. These are offered as areas for future research.

Limitations and Future Research

One of the key limitations of the studies reported pertains to external validity: Studies reported are stylized laboratory experiments aimed at theory development, rather than analyses of supermarket data across a range of product categories that are appropriate for theory testing. Future research should examine the robustness of the theory proposed in this paper in the

marketplace. For example, a more typical marketing environment with prices included may interfere with position effects. In that respect, it would be interesting to test whether position effects apply in a situation where there is attribute information available, and whether position effects distort the processing and memory of available attribute information when the attribute information is not consistent with the expected ordering of the products.

Further, while shelf position can impact consumer perceptions, it is also important to consider other cues that shoppers may use to help guide their purchases. For example, they may infer popularity based on the amount of space assigned to a product on the shelf or the stock level of various brands (those with lower inventory would be presumed to be better buys, van Herpen, Pieters, and Zeelenberg, 2009). In the current paper, we do not introduce any such competition for visual attention. However, these are interesting areas for future research. There could also be individual differences on how product position affects preferences. For example, we could consider clustering groups of consumers who infer position information similarly. Other constructs, such as the need to justify a choice, could also moderate the effects. If the choice of the central item is easier to justify, centre effects should be exacerbated. Cultural differences in collectivism which are likely to exacerbate the preference for a popular option (Markus & Kitayama, 1991) as well as reading patterns (Spalek and Hammad 2005) should also be considered.

Results of our studies suggest that the option in the center represents a default preference; though, when schemas are not diagnostic, preference shifts towards items that are displayed earlier on the shelf (top or left). This could be due to some combination of items in earlier positions representing the most convenient option (easier to reach), the option that is attended to first, or the promoted option according to schematic inferences that promoted products are on the extremes. The temporal sequence of presentation may also affect position effects. It is possible that extremity prevails for choices containing sequentially presented options, whereas centrality rules for those containing simultaneously presented options. Future

research could examine the conditions favoring primacy and recency effects in shelf layout presentation.

Finally, the conjecture that verticality effects are more conscious and controlled processes compared to horizontality effects, which may be more automatic in nature, needs to be further investigated. Verticality effects were eliminated as predicted when schemas were not diagnostic (Study 3) and resources were not deployed (Study 4), however they were also not obtained when a number scale was primed (Study 2). This was unexpected and suggests the possibility that the presence of the number scale may have inhibited the conscious use of the verticality schema projected onto the number line. We offer this as an area for future research.

Appendix

Information provided about Turkish wines in Studies 1-3:

“Good wine has been produced in Turkey for millennia, and still is.

The peoples of the [Byzantine Empire](#) enjoyed their wines and developed careful cultivation methods for their grapes. With the fall of the empire (1923) and founding of the European-style [Turkish Republic](#), many citizens of Greek heritage moved to Greece, but in the secular republic wine-making was encouraged.

Both **Tekel**, the government-owned monopoly company, and a few favored vintners such as **Kavaklidere**, produced simple table wines. Imported wines were rare, and very expensive because of high import duties. Simple table wines such as **Kavak** and **Çankaya** (white), **Dikmen** (red), **Lâl** (rosé/blush) and **Villa Doluca** (white and red) are drinkable and not expensive (US\$6 to \$9), but because discerning (and wealthy) Turkish wine-drinkers are only a small market, the better vintages are **surprisingly expensive** (US\$10 to \$18 and up). **High taxes** of YTL3.28 per bottle also play their part in the high price of wine. The tax just about doubles the cost of a bottle of inexpensive table wine.”

Wine Layout provided in the Schema Consistent Condition in Study 3

(Highest priced wines on top right hand corner)

Italian Pinot Gris	French Chablis	French Rosé	Italian Cabernet	French Burgundy (Reserve)
Australian Chardonnay	Australian Chablis	Australian Rosé	Australian Merlot	Australian Pinot Noir
South African White	New Zealand Sauvignon Blanc	Spanish Rosé	Chilean Red	Argentinian Malbec
Kavak White	Çankaya White	Lâl Rosé	Villa Doluca Red	Dikmen Red
Tekel White	Kavaklidere White	Lâl	Tekel Red	Kavaklidere Red

Wine Layout provided in the Schema Inconsistent Condition in Study 3

(Highest priced wines in bottom left hand corner)

Kavaklidere Red	Tekel Red	Lâl	Kavaklidere White	Tekel White
Dikmen Red	Villa Doluca Red	Lâl Rosé	Çankaya White	Kavak White
Argentinian Malbec	Chilean Red	Spanish Rosé	New Zealand Sauvignon Blanc	South African White
Australian Pinot Noir	Australian Merlot	Australian Rosé	Australian Chablis	Australian Chardonnay
French Burgundy (Reserve)	Italian Cabernet	French Rosé	French Chablis	Italian Pinot Gris

References

- Attali, Yigal and Maya Bar- Hillel (2003), "Guess where: The Position of Correct Answers in Multiple-choice Test Items as a Psychometric Variable," Journal of Educational Measurement, 40(2), 109-128.
- Baron, Reuben M., and David A. Kenny, (1986), "The moderator-mediator distinction in social psychological research: Conceptual, strategic, and statistical considerations," Journal of Personality and Social Psychology, 51(6), 1173-1182.
- Bemmaor, Albert C. and Dominique Mouchoux (1991), "Measuring the Short-Term Effect of In-Store Promotion and Retail Advertising on Brand Sales: A Factorial Experiment," Journal of Marketing Research, 28(2), 202-214.
- Breugelmans, Els, Katia Campo, and Els Gijsbrechts (2007), "Shelf Sequence and Proximity Effects in Online Stores," Marketing Letters, 18 (1-2), 117-33.
- Chandon, Pierre, J. Wesley Hutchinson, Eric T. Bradlow and Scott Young (2007), "Measuring the Value of Point-of-Purchase Marketing with Commercial Eye-Tracking-Data," in Visual Marketing: From Attention to Action, ed. Michel Wedel and Rik Pieters, Mahwah, New-Jersey: Lawrence Erlbaum Associates.
- Chiao, Joan Y., Andrew R. Bordeaux, and Nalini Ambady (2004), "Mental Representations of Social Status," Cognition, b49-b57.
- _____, Tokiko Harada, Emily R. Oby, Zhang Li, Todd Parish, Donna J. Bridge (2009), "Neural Representations of Social Status Hierarchy in Human Inferior Parietal Cortex," Neuropsychologia, 354-363.
- Christenfeld, Nicholas (1995), "Choices from Identical Options," Psychological Science, 6(1), 50-55.
- Corstjens, Judith and Marcel Corstjens (1999), Store Wars: The Battle for Mindspace and Shelfspace, London (UK): Wiley.
- Curhan, Ronald C. (1971), "Shelf Space Allocation and Profit Maximization in Mass Retailing," Journal of Marketing, 37 (July), 54-60.
- _____, (1974), "The Effects of Merchandising and Temporary Promotional Activities on the Sales of Fresh Fruits and Vegetables in Supermarkets," Journal of Marketing Research, 11(3), 286-294.
- Deheane, Stanislas (1999), The number sense : how the mind creates mathematics, Oxford University Press: New York, NY.
- _____, Manuela Piazza, Philippe Pinel, and Laurent Cohen (2003), "Three Parietal Circuits for Number Processing," Cognitive Neuropsychology, 20:3, 487-506.
- _____, G. Dehaene-Lambertz, and L. Cohen (1998), "Abstract representations of numbers in the Animal and Human Brain," Trends in Neuroscience, 21, 355-361.

- Deng, Xiaoyan and Barbara E. Kahn, "Is Your Product on the Right Side? The "Location Effect" on Perceived Product Heaviness and Package Evaluation," Journal of Marketing Research, Dec.
- Desmet, Pierre and Valérie Renaudin (1998), "Estimation of product category sales responsiveness to allocated shelf space," International Journal of Research in Marketing, 15(5), 443-457.
- Drèze, Xavier, Stephen J. Hoch and Mary E. Purk (1994), "Shelf Management and Space Elasticity," Journal of Retailing, 70(4), 301-26.
- Fazio, Russell H., Martha C. Powell and Carol J. Williams (1989), "The Role of Attitude Accessibility in the Attitude-to-Behavior Process," Journal of Consumer Research, 16(3), 280-288.
- Feldman, Jack M., and John G. Lynch J. G. (1988), "Self-generated validity and other effects of measurement on belief, attitude, intention and behavior," Journal of Applied Psychology, 73, 421-435.
- Fitzsimons, Gavan, J. Wesley Hutchinson, Patti Williams, Joseph W. Alba, Tanya Chartrand, Joel Huber, Frank Kardes, Geeta Menon, Priya Raghurir, J. Edward Russo, Baba Shiv, and Nader Tavassoli (2002), "Non-Conscious Influences on Consumer Choice," Marketing Letters, 13 (3), August, 269-269.
- Folwell, Raymond J. and D. Andy Moberg (1993), "Factors in Retail Shelf Management Impacting Wine Sales," Agribusiness, 9(6), 595-603.
- Friestad, Marian and Peter Wright (1994), "The Persuasion Knowledge Model: How People Cope with Persuasion Attempts," Journal of Consumer Research, 21(1), 1-31.
- Gladson, T. R. (1989), "Retail Shelf Space Management," The Nielsen Researcher, 2(1), 20-24.
- Greifender, Rainer, Herbert Bless, and Michel Tuan Pham (2010), "When do people rely on Affective and Cognitive Feelings in Judgment? A Review," Personality and Social Psychology Review, forthcoming.
- Hauser, M.D., S. Carey, and L.B. Hauser (2000), "Spontaneous Number Representation in Semi-free-ranging Rhesus Monkeys," Proceedings of the Royal Society of London B, Biological Science, 267, 829-833.
- Inman, J. Jeffrey, Leigh McAlister and Wayne D. Hoyer (1990), "Promotion Signal: Proxy for a Price Cut?" Journal of Consumer Research, 17 (June), 74-81.
- Krishna, Aradhna (2008). Spatial perception research: An integrative review of length, area, volume, and number perception. In Michel Wedel, and Rik Pieters (Eds.), Visual Marketing: From Attention to Action (pp. 167-192). New York: Lawrence Erlbaum Associates.
- Markus. Hazel A. and Kitayama, Shinobu (1991), "Culture and the self: Implications for Cognition, Emotion, and Motivation," Psychological Review, 98, 224-253.

- McArthur, Leslie Z. and David L. Post (1977), "Figural Emphasis and Person Perception," Journal of Experimental Social Psychology, 13, 520-535.
- Meier, Brian P and Michael D. Robinson (2004), "Why the Sunny Side is Up: Associations between Affect and Vertical Position," Psychological Science, 15, (April), 243-247.
- Menon, Geeta, and Priya Raghurir (2003), "Ease-of-Retrieval as an Automatic Input in Judgments: A Mere Accessibility Framework?" Journal of Consumer Research, 30 (2), September, 230-243.
- Nelson, Leif D, and Joseph P. Simmons (2009), "On Southbound Ease and Northbound Fees: Literal Consequences of the Metaphoric Link between Vertical Position and Cardinal Direction," Journal of Marketing Research, December.
- Nisbett, Richard E. and Timothy D. Wilson (1977) "Telling More than We can Know: Verbal Reports on Mental Processes," Psychological Review, 84(3), 231-259.
- Pinker, Steven (1997), How the Mind Works, New York: W.W. Norton & Company.
- Progressive Grocer (1971), ""Ways to Make Every Foot of Shelf Space Pay Off," 50(Mar), 40-49.
- Raghurir, Priya, and Ana Valenzuela (2006), "Center of Inattention: Position Biases in Decision Making," Organizational Behavior and Human Decision Processes, 99(1), January, 66-80.
- Schubert, Thomas (2005), "Your highness: Vertical Positions as Perceptual Symbols of Power," Journal of Personality and Social Psychology, 89(1), 1-21.
- Schuman, Howard and Stanley Presser (1996), Questions and Answers in Attitude Surveys: Experiments on Question Form, Wording, and Context, Sage Publications: Thousand Oaks, CA.
- Shavitt, Sharon, Ashok Lalwani, Jing Zhang, and Carlos Torelli (2006) "The horizontal/vertical distinction in cross-cultural consumer research," Journal of Consumer Psychology, 16(4), 325-342.
- Shaw, Jerry I. (2000), "Centrality Preferences in Choices Among Similar Options," Journal of General Psychology, 127(2), 157-164.
- Simonson, Itamar (1989), "Choice Based on Reasons: The Case of Attraction and Compromise Effects," Journal of Consumer Research, 16, 158-74.
- _____, and Amos Tversky (1992), "Choice in Context: Tradeoff Contrast and Extremeness Aversion," Journal of Marketing Research, 29 (August), 281-95.
- _____, and Russell Winer (1992), "The Influence of Purchase Quantity and Display Format on Consumer Preference for Variety," Journal of Consumer Research, 19(1), 133-8.
- Spalek, Thomas M. and Sherief Hammad (2005), "The Left-to-Right Bias in Inhibition of Return Is Due to the Direction of Reading," Psychological Science, 16(1), 15-18.
- Spelke, E., and Stanislaus Dehaene (1999), "On the Foundation of Numerical Thinking: Reply to Simon," Trends in Cognitive Science, 3, 365-366.

Sperry, Roger W. (1961), "Cerebral organization and behaviour," Science, 133, 1749-1757.

Taylor, Shelley E., and Susan T. Fiske (1975), "Point of View and Perceptions of Causality," Journal of Personality and Social Psychology, 32, 439-445.

Valenzuela, Ana and Priya Raghurir (2009), "Position Based Schemas: The Center-Stage Effect," Journal of Consumer Psychology, 9(2), April, 185-196.

van Herpen, Erica, Rik Pieters and Marcel Zeelenberg (2009), "When demand accelerates demand: Trailing the bandwagon," Journal of Consumer Psychology, 19 (3), July, 302-312.

Wedel, Michel and Rik Pieters (2008), Visual Marketing: From Attention to Action, New York: Lawrence Erlbaum Associates.

Wilkinson, Judy B., Mason, J. Barry and Christie H. Paksoy (1982), "Assessing the Impact of Short-Term Supermarket Strategy Variables," Journal of Marketing Research, 19(1), 72-86.

Wright, Peter (2002), "Marketplace metacognition and social intelligence," Journal of Consumer Research, 28(4), 677-682.

Table 1: Results of Study 1

Vertical Orientation	Top		Middle		Bottom
1. Choice %	16.04	31.13	27.36	9.43	16.04
2. Average Price in \$ ⁸	10.90	10.57	10.25	9.88	9.54
3. Perceived Quality ⁹	4.54	4.59	4.60	4.27	4.08
4. Perceived Popularity	4.29	4.97	5.32	4.54	3.81
5. Price Perception	4.29	4.14	3.88	3.64	3.35
Horizontal Orientation	Left		Middle		Right
1. Choice %	14.67	22.67	38.67	14.67	9.33
2. Average Price in \$	8.60	9.35	10.88	10.79	12.15
3. Perceived Quality	3.44	4.11	4.82	4.96	5.32
4. Perceived Popularity	4.40	4.78	5.18	4.68	4.11
5. Price Perception	2.77	3.50	4.07	4.38	4.73

Order of elicitation: Choice first, average price in \$ second, perceived quality third, perceived popularity fourth, price perception last.

⁸ Weighted average using mid-points of the four price categories: < \$6.00, \$6.00-\$9.99, \$10 - \$14.99, and \$15 +.

⁹ Quality perceptions elicited using 1 = Not at all/ 7 = Very good; Popularity perceptions elicited using 1 = Unpopular/ 7 = Popular; and Price perceptions elicited using a 1=Cheap/ 7 = Expensive.

Table 2: Results of Study 2

Price-Quality Index						
Prime	Display	A1	A2	A3	A4	A5
Horizontal	Horizontal	2.48	3.33	3.96	4.53	4.59
	Vertical	4.04	4.39	4.28	3.87	3.65
	Total	3.26	3.86	4.12	4.20	4.12
Vertical	Horizontal	3.48	3.77	4.09	4.18	4.45
	Vertical	3.54	3.77	3.71	4.19	4.02
	Total	3.51	3.77	3.91	4.18	4.25
Total	Horizontal	2.99	3.55	4.03	4.35	4.52
	Vertical	3.80	4.10	4.01	4.02	3.82
	Total	3.38	3.82	4.02	4.19	4.18

Order of elicitation: Choice first, perceived price second, perceived quality last.

Table 3: Results of Study 3

Vertical Orientation	Top		Middle		Bottom
Schema Consistent Condition					
1. Price Perception	4.86	4.71	4.11	3.25	2.71
2. Perceived Quality	5.64	5.43	4.75	4.18	3.36
3. Perceived Popularity	4.71	4.75	4.61	4.07	3.50
4. Choice %	30.8	46.2	15.4	3.8	3.8
Schema Inconsistent Condition					
1. Price Perception	4.07	3.96	4.00	3.75	3.64
2. Perceived Quality	4.61	4.64	4.50	4.14	4.14
3. Perceived Popularity	4.25	4.61	4.64	3.94	3.71
4. Choice %	23.1	19.2	19.2	11.5	26.9
Horizontal Orientation	Left		Middle		Right
Schema Consistent Condition					
1. Price Perception	3.07	3.63	4.22	4.74	4.93
2. Perceived Quality	3.61	4.36	4.68	5.11	5.11
3. Perceived Popularity	4.21	4.57	5.04	4.46	3.96
4. Choice %	4.0	8.0	60.0	8.0	20.0
Schema Inconsistent Condition					
1. Price Perception	2.97	3.52	4.28	4.17	4.17
2. Perceived Quality	3.61	4.00	4.72	4.55	4.41
3. Perceived Popularity	3.90	4.38	5.07	4.41	3.62
4. Choice %	21.4	3.6	57.1	10.7	7.1

Order of elicitation: Choice first, perceived popularity second, perceived quality third, price perception last.

Figure 1: Results of Study 1

Figure 1a

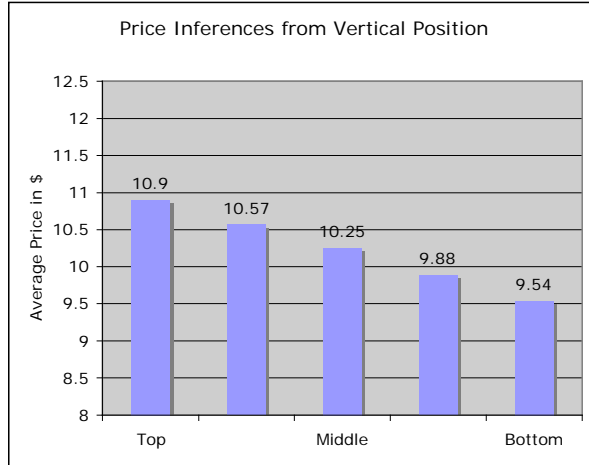


Figure 1c

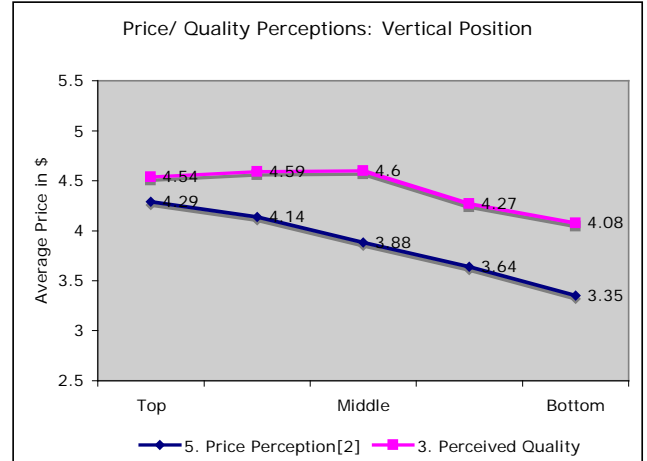


Figure 1b

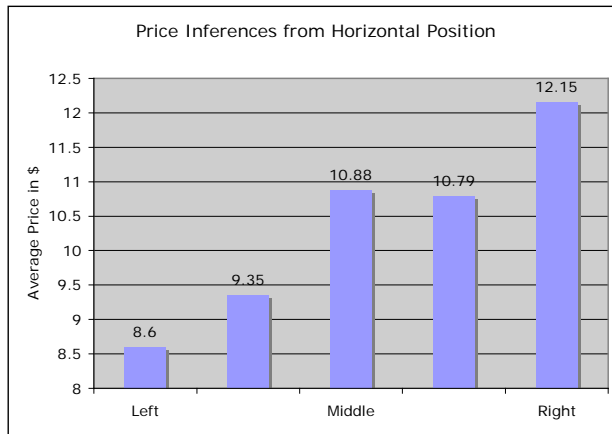


Figure 1d

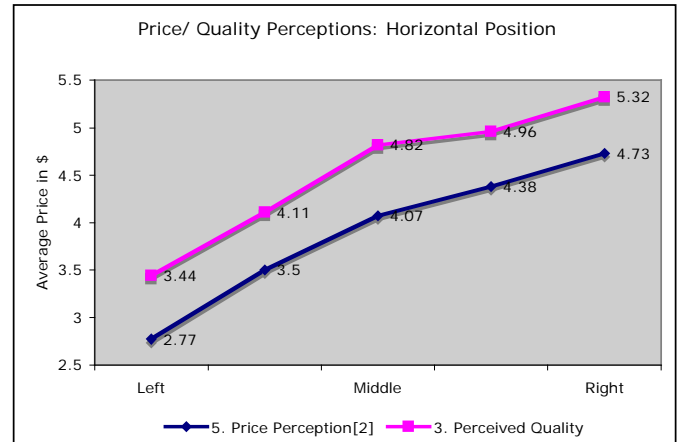


Figure 1e

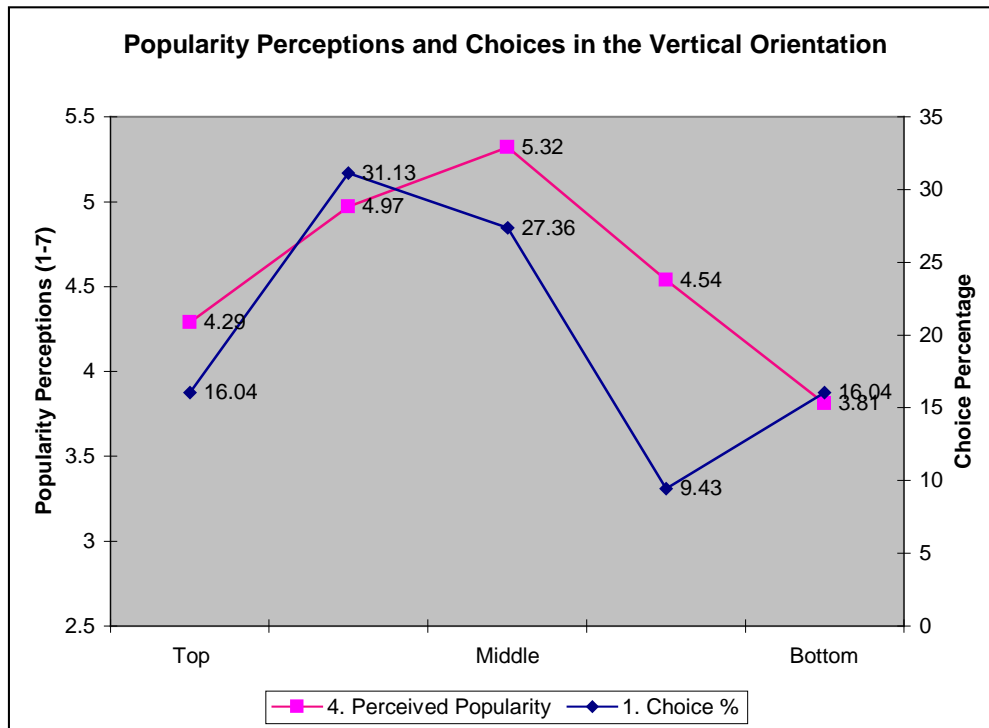


Figure 1f

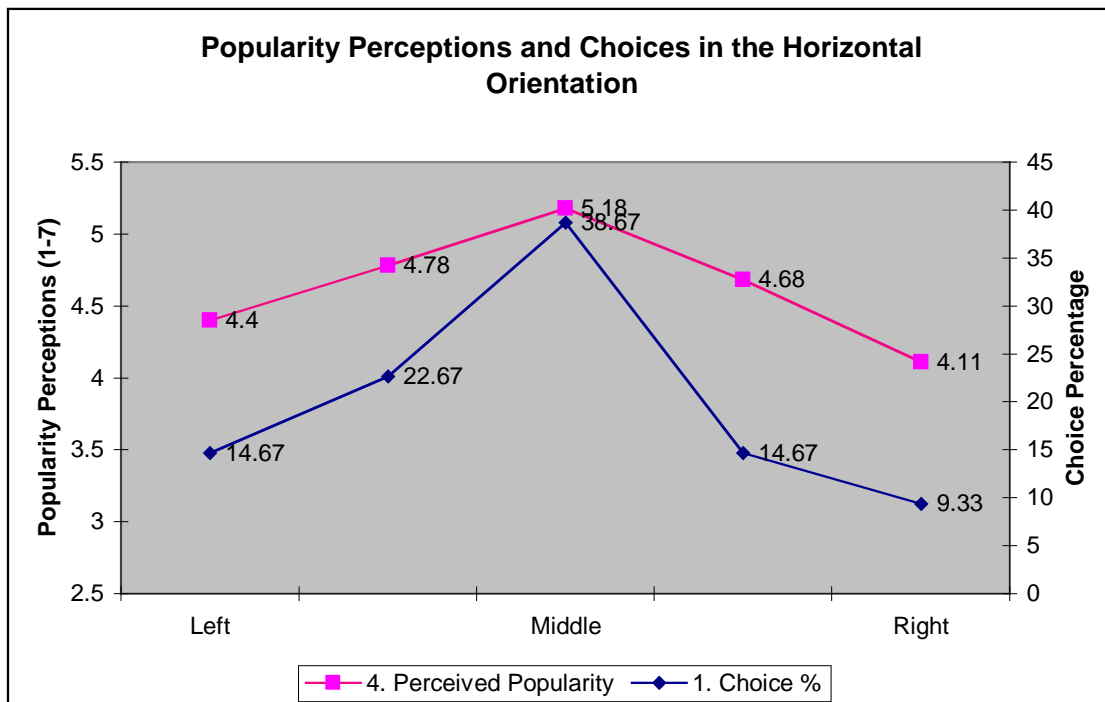


Figure 2: Results of Study 2

Price Quality Index

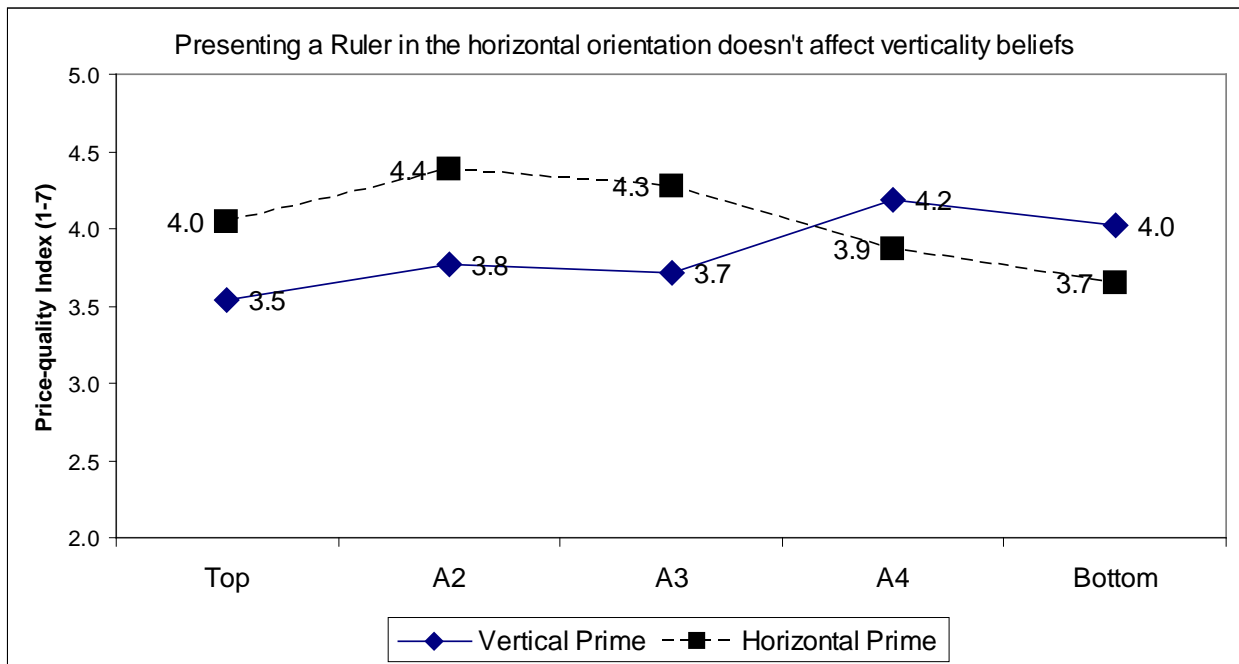
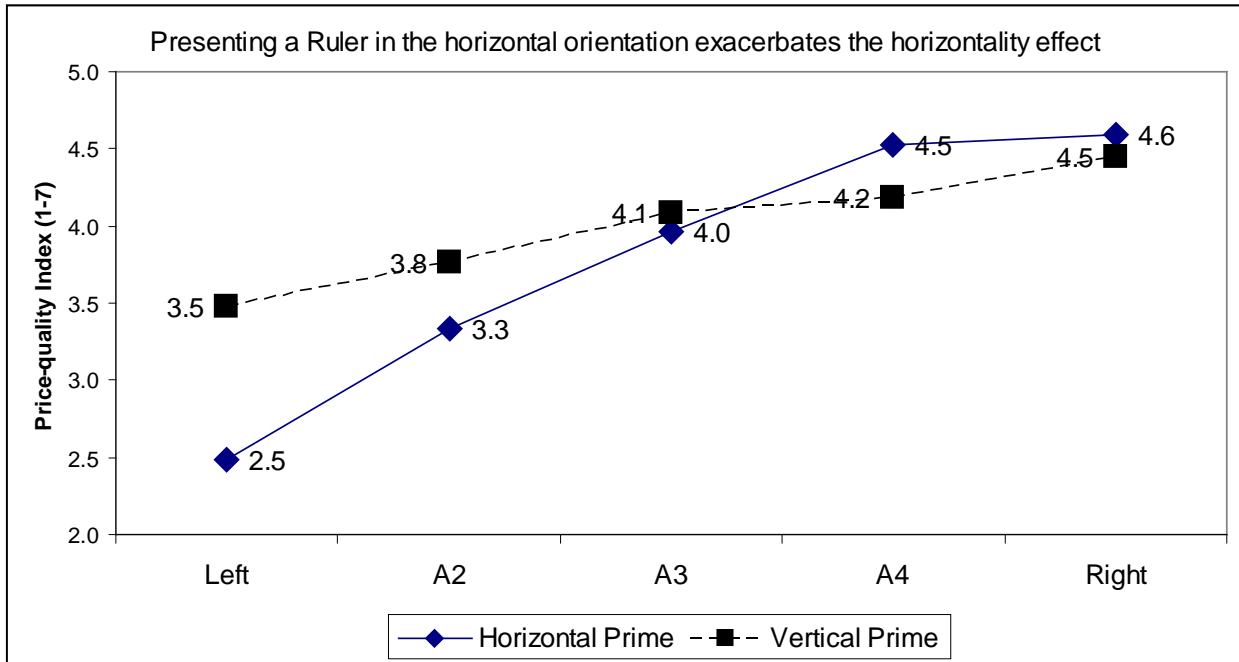


Figure 3: Results of Study 3

Figure 3a

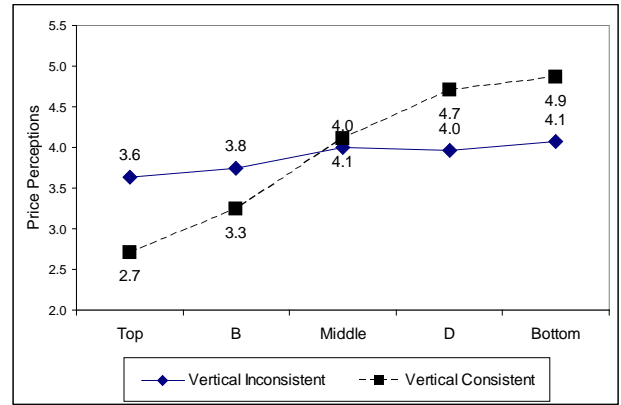
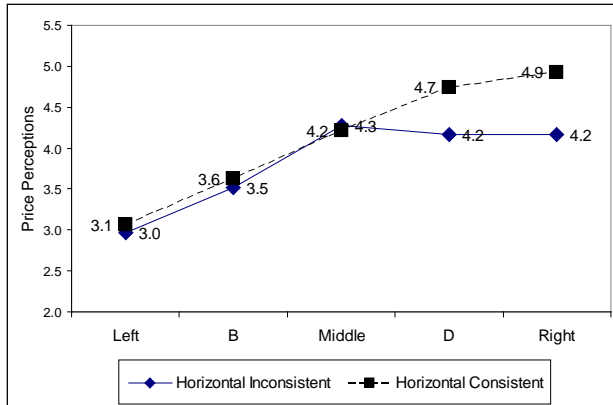


Figure 3b

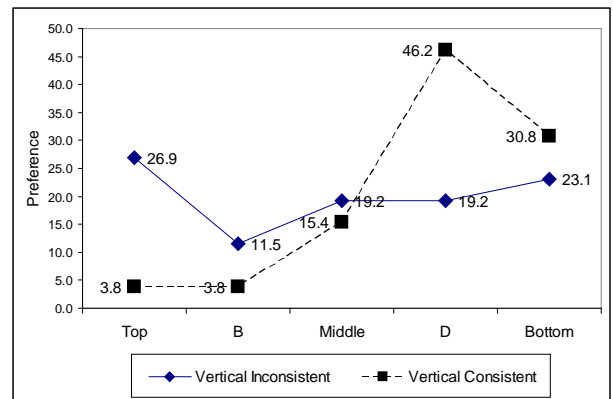
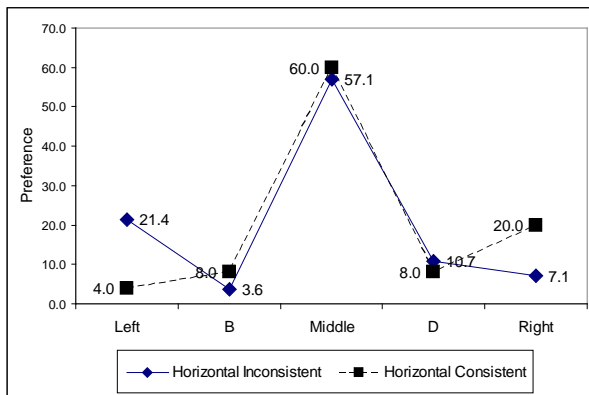


Figure 4: Results of Study 4

Figure 4a

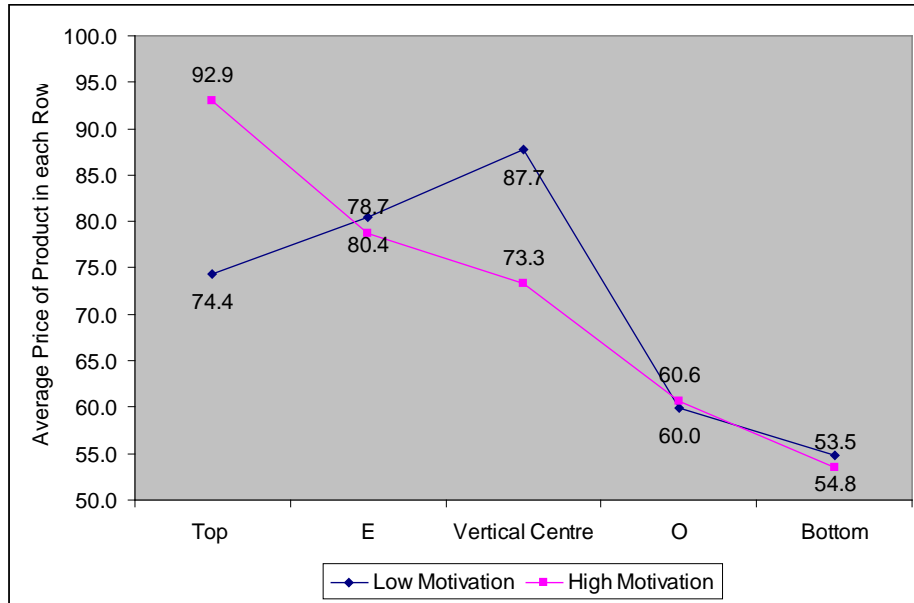


Figure 4b

