JCR MANUSCRIPT REVIEW HISTORY 004-2

MANUSCRIPT (ROUND 2)

The Influence of Ceiling Height: The Effect of Priming on the Type of Processing People Use

ABSTRACT

This paper examines the possibility that variations in ceiling height can prime concepts that, in turn, affect the very manner in which people process information. We theorized that when reasonably salient, a high versus low ceiling can prime the concepts of freedom versus confinement, respectively. These concepts, in turn, can prompt people's use of predominately relational versus item-specific processing. Three studies found support for this theorizing. On a variety of measures, ceiling height-induced relational or item-specific processing was indicated by people's reliance on integrated and abstract versus discrete and concrete ideation. Hence, this research sheds light on when and how ceiling height can affect people's responses, and it discusses the assorted types of responses that may be so affected.

There appears to be wide-spread belief that ceiling height can affect the quality of indoor consumption experiences. Fischl and Gärling (2004) found that ceiling height ranked among the top three architectural details that influenced consumers' psychological well-being. Much anecdotal evidence also supports this view. A home development company that uses design ideas inspired by the guru of transcendental meditation maintains that homes with higher ceilings induce clearer and improved thinking, more energy, and better health among residents (Bivins 1997). Airplane manufacturers seem to concur that higher ceilings can enhance people's consumption experience, even if the increased height is only illusory. Such manufacturers use numerous techniques to engender the illusion of increased vertical space or volume in plane interiors, including repositioning overhead baggage bins, installing gently arched illuminated ceiling panels, and affixing wavy mirrors on the bulkheads beneath overhead storage bins (Lunsford and Michaels, 2002).

Despite such anecdotal evidence that ceiling height exerts a critical influence on consumers, we were unable to uncover any theory or research that explains how, when, and why ceiling height might exert an effect. This paper seeks to address this issue by investigating the thesis that ceiling height may affect the very manner in which consumers process information and thus how they respond to products. To illustrate, suppose that you were shopping for a sophisticated new coffee table and paused to evaluate how sophisticated one of the contenders truly appeared to be. We propose that different types of concepts might be activated or primed by the showroom ceiling if it were relatively high, as it tends to be in most contemporary mall stores, versus low, as it is in most strip mall shops and outlet centers. Relatively high ceilings may prime thoughts related to freedom, whereas lower ceilings may prompt those that pertain to confinement. We suggest that, in turn, these alternative concepts may affect the particular manner in which people process information, namely

whether they rely on relational or item-specific processing. Finally, the type of processing that is used could alter how people elaborate and ultimately evaluate the table's features.

The preceding notion that ceiling height might prime certain concepts or networks of associations that then affect *how* people process product information is quite novel. Clearly, it is well established that exposure to particular objects can prime concepts that are related to them (e.g., Aarts and Dijksterhuis 2003; Garcia et al. 2002), and that the heightened accessibility of such primed concepts can spill over and affect people's perceptions or even their overt behaviors (Bargh, Chen, and Burrows 1996; Mandel 2003). However, it is typically assumed that such effects occur because associations to the primed concept "spill over" and affect perceptions or behaviorial representations. In contrast, we propose that, in certain instances, effects on perceptions or behavior may occur because the primed concepts actually affect the very type of processing that people use. That this possibility is novel is suggested by the fact that we could identify only one developed body of research, which posits that this alternative mechanism can occur (e.g., self-construal effects; Kühnen and Oyserman 2002). Moreover, even in that case, both the semantic content of the primed concepts and the types of processing that are claimed to be stimulated differ from the ones that we propose are activated by a high versus low ceiling.

In sum, this paper develops theory that seeks to understand the possible effects of the atmospheric variable ceiling height. While we recognize that variations in ceiling height alters room volume, which likely causes any actual effects, for convenience, we shall refer to the focal variable as ceiling height. However, we consider the issue and implications of room volume further in the General Discussion. In total, we report three experiments that examine whether, when, and how ceiling height may affect the very manner in which consumers process information and thus how they respond to products.

Investigating this possibility is important for several reasons. First, it could contribute to theory by more firmly establishing whether primed concepts can truly shape people's type of processing. Second, it can shed light on some possible consequences that ceiling height may have on how consumers categorize, construe, and evaluate products. Finally, it could be of considerable practical importance. For, despite the fact that ceiling height is an atmospheric variable that is present in virtually all consumer contexts -- both where goods are purchased and used, it has yet to be investigated empirically. We begin by developing in more detail our theorizing and its conceptual underpinnings.

CEILING HEIGHT AND TYPE OF PROCESSING

There is reason to believe that a high versus low ceiling height may activate the concepts of freedom versus confinement. Hall (1966), a research pioneer in how environment affects people's sensory experiences, proposed that, spatially, edifices can communicate different semantic associations. He notes that chapels, which are small and contained, are likely to convey the notion of confinement or restrictedness, whereas awe inspiring cathedrals are reminiscent of the freedom and openness of the cosmos. Other researchers offer seemingly parallel propositions. Moore et al. (1979) proposed that low ceilings may encourage quieter, more restricted play, while higher ceilings (e.g., above eight feet) foster more active (i.e., freer) play. Echoing similar sentiments, Kraft (1987) posited that high, downward-looking camera angles, which tend to compress height, convey the notion of passivity; however, low, upward-looking angles, which accentuate height, connote action and thus freedom of movement. Thus, taken together, such research leads to the contention that relatively high versus low ceilings are likely to prime the concepts of freedom versus confinement, respectively.

Yet, could these concepts, in turn, influence the type of processing that people employ? As noted previously, at least some research suggests this possibility. The self-construal literature indicates that exposure to primes that evoke the concept of interdependence versus independence stimulates a processing mode that treats stimuli and their contexts as undifferentiated wholes as opposed to separate, independent entities (Kühnen and Oyserman 2002; Monga and John 2006). Presumably the effect of such priming on people's processing occurs because the semantic meaning of the primed concept implicates and activates the type of processing that ensues. That is, the notion of interdependence implies treating data as a unified whole, whereas the notion of independence implies treating data as detached entities. A similar process (i.e., where a primed concept semantically implicates the ensuing type of processing) has been observed in an article by Sassenberg and Moskowitz (2005). They found that priming the concept of creativity (i.e., thinking in a nonstandard way) stimulated a general style of processing that entailed inhibiting automatically activated (e.g., stereotypic) associations**.**

Hence, combining the preceding notions, we reasoned that, provided that individuals are somewhat aware of ceiling height (e.g., they are not oblivious to their surroundings), a high versus low ceiling height is likely to prime the concepts of freedom versus confinement, as Hall (1966) and others contend. Moreover, these concepts, in turn, may shape the type of processing that people use, because, similar to how the priming of interdependence versus independence appears to affect type of processing, the semantic meanings of the ceiling height-primed concepts (i.e., freedom versus confinement) may implicate alternative types of processing. Specifically, individuals in a relatively high ceiling environment, which presumably primes the concept of freedom, should rely predominately on relational processing. This follows because relational elaboration entails elaborating *freely* or uninhibitedly on multiple pieces of data so as to discern

commonalities or higher-order abstract points of intersection that they share (Einstein and Hunt 1980; Hunt and Einstein 1981). On the other hand, individuals who are in a low ceiling room that primes the concept of confinement may engage predominately in item-specific processing. This should occur because item-specific elaboration involves *confining* or restricting one's focus to each item by itself and concentrating on its precise, context specific (i.e., relatively concrete) attributes. Figure 1 outlines this sequence of events and theorizing. We now turn to the first of our three studies.

Insert Figure 1 about here

EXPERIMENT 1

Overview and Hypotheses

Experiment 1 examined our initial thesis: Provided that ceiling height is reasonably salient, can a high versus low ceiling prime freedom- versus confinement-related concepts? Borrowing a method used by Aarts and Dijksterhuis (2003), we assessed this question by developing two tasks that should be sensitive to these two concepts. The first assessed whether high versus low ceiling height can activate such freedom- versus confinement-related concepts and thereby influence individuals' current perceived body state (i.e., their feelings of being relatively free versus confined). Because we expected that individuals would be sensitive to the ceiling height-induced primes, those in a room with a fairly salient high (low) ceiling would report a higher (lower) freedom-related body state, but a lower (higher) confinement-related body state.

A second task involved solving several anagrams by rearranging their letters so that each formed a word. In three different conditions, the words that could be formed were semantically

related to the concept of freedom, that of confinement, or they were unrelated to either concept. If, per our theorizing, a fairly salient high (low) ceiling primes freedom-related (confinement-related) concepts, individuals in a higher ceiling room should exhibit faster response times (RT) when solving freedom-related anagrams, slower RT when solving confinement-related ones, and equivalent RT when solving unrelated anagrams. More specifically:

H1a: Individuals in room with a fairly high versus low ceiling should experience higher levels of a freedom-related body state, but lower levels of a confinement-related body state.

H1b: Individuals in a room with a high versus low ceiling should exhibit faster RT when solving freedom-related anagrams, slower RT when solving confinement-related anagrams, but equal RT when solving anagrams unrelated to either concept.

Method

Stimuli. Experiment 1 was conducted in four rooms that were identical except for ceiling height. Although each room had a 10 foot ceiling, a professional engineer installed false ceilings in two of the rooms. This was done by fashioning new ceilings out of foam board and lowering the rooms' ceiling height to eight feet. Eight to 10 foot ceilings were selected because they are common in both residential and commercial settings. The false ceilings looked natural. Further, to make the ceiling height reasonably salient, we hung three colorful Chinese lanterns (on average, 14" in diameter) from the ceiling, which should enhance participants' attentiveness to the ceiling height. Sample pictures of the rooms are presented in Appendices A and B.

The study was computer-administered and consisted of two tasks. In the first, participants were asked to rate the degree to which six different items reflected their current body state (from 1=not at all to 7=very much). Three of these items reflected freedom-related feelings, namely a

sense of being free, unrestricted, and open. The other three items, which tapped confinement-related body states, queried individuals' sense of being encumbered, inhibited, and confined.

In a second task, participants received and were asked to solve 12 anagrams. Three of these anagrams formed words that were related semantically to the concept of freedom, namely, liberated, unlimited, and emancipated. Another three were related to the concept of confinement, specifically, bound, restrained, and restricted. Finally, six anagrams were filler words related to neither concept. These words were check, radio, lunch, violin, paper, and cheese.

Procedure. For $5 each, a total of 32 students participated in the study individually. Upon arrival, each was escorted to one of the four rooms and asked to wait for a minute while the study administrator retrieved a consent form. This one minute waiting period was implemented to encourage participants to scan the room environment and notice the colorful lanterns, which should make the ceiling height somewhat salient. After a minute, the administrator returned with the form and then logged the respondent onto the study website. The initial computer screen informed participants that they would be asked to complete several unrelated tasks.

Respondents began by rating their current body state on each of six randomly presented items. Three items were freedom-related, and three were confinement-related. Next, for the anagram task, 12 randomized anagrams appeared on the screen one at a time. Participants' RT when solving them was recorded in milliseconds. Finally, demographic questions were asked.

RESULTS

Because two participants failed to complete the tasks, their responses were excluded from further analysis. Thus, data from 30 respondents were analyzed for each task.

Body State Assessment. Each respondent's ratings on the three freedom-related items were averaged to form a freedom body state index ($\propto = .71$). The same was done for the confinement-

related items, forming a confinement body state index ($\propto$ = .84). A 2 (ceiling height: high vs. low) by 2 (rating index: freedom vs. confinement) within subjects ANOVA was conducted, revealing a significant interaction ($F(1, 28) = 7.69$, $p < .01$). Consistent with H1a, individuals in a high versus low ceiling room reported being in a higher freedom body state ($M_{high} = 5.11$, $M_{low} = 4.29$; $F(1, 28) = 4.48$, $p < .05$), but a lower confinement body state ($M_{high} = 1.89$, $M_{low} = 3.00$; $F(1, 28) = 7.69$, $p < .01$).

Anagram Solving. RT to the three freedom-related anagrams were averaged to form a freedom anagram RT index. Similar computations were performed to create both a confinement anagram RT index and an unrelated anagram RT index. A 2 (ceiling height: high vs. low) X 3 (anagram RT index: freedom, confinement, unrelated) within subject ANOVA revealed a significant interaction involving these two factors ($F(2, 27) = 5.69$, $p < .01$). Planned contrasts found support for H1b. Participants in the high versus low ceiling room exhibited faster RT to freedom-related anagrams ($M_{high} = 8038.69$, $M_{low} = 14187.02$; $F(1, 28) = 4.50$, $p < .05$), yet slower RT to confinement-related anagrams ($M_{high} = 14988.18$, $M_{low} = 10168.69$; $F(1, 28) = 5.56$, $p < .03$), and comparable RT to unrelated anagrams ($M_{high} = 10449.08$, $M_{low} = 9408.08$; $F < 1$).

DISCUSSION

The results of Experiment 1 support the thesis that ceiling height can prime particular concepts. When salient, relatively high ceilings appear to activate concepts related to freedom, while low ceilings prime confinement-related concepts. Yet, while these findings are valuable, support for our theorizing requires evidence for two other propositions. First, the proposed theory contends that ceiling height-primed freedom- versus confinement-related concepts should stimulate the prevailing use of relational versus item-specific processing, respectively. Second, these effects of ceiling height are deemed likely to emerge only when the salience and thus

people's awareness of ceiling height is reasonably high (i.e., people are cognizant of their surroundings, including ceiling height, and are not preoccupied with proximate matters).

Experiment 2 extends the previous study by addressing these issues. Specifically, it examines whether a high versus low ceiling height can affect individuals' reliance on relational versus item-specific processing, respectively, which in this study is indicated by the degree of integration and abstractness of participants' ideation. As Einstein and Hunt (1980, pg. 597) note, because relational processing requires the encoding of shared relations between items that often possess minimal, if any, commonalities, it fosters "the *abstraction* of similarities." In other words, identifying such between-item relations generally entails discerning higher order, abstract points of intersection among the items. In contrast, item-specific processing entails the encoding of the context-specific details possessed by each individual item. As numerous researchers have proposed (Nussbaum, Trope and Liberman 2003; Semin and Fiedler 1991), such a focus on the context-specific aspects of items fosters relatively concrete ideation.

Yet, importantly, differences in such abstractness of ideation induced by ceiling height should be moderated by individuals' awareness of the ceiling height. Indeed, if, ceiling height goes unnoticed (e.g., people are preoccupied with proximate matters), it is unlikely to activate the concepts primed by high or low ceiling height and hence produce no effect on type of processing. Thus, ceiling height should affect people's use of relational or item-specific elaboration only when it was relatively salient, rendering individuals reasonably attentive to it.

EXPERIMENT 2

Overview and Hypotheses

Experiment 2 assessed whether a high versus low ceiling height prompts individuals to employ alternative types of processing (i.e., relational versus item-specific), provided that ceiling

height is sufficiently salient. To examine this, we varied ceiling height salience and devised two different tasks that we reasoned would be sensitive to the type of processing participants used.

The first was a categorization task in which participants received a list of disparate items within a broad category (i.e., different sports). They were asked first to identify as many dimensions as they could that were shared by the items (e.g., equipment required for the sport, as some sort of apparatus was needed for each sport). Then, for each dimension, they were requested to categorize the items into subgroups based on each item's value on the dimension (e.g., the type of equipment needed). Last, they provided descriptive labels for all the subgroups.

The type of processing individuals used was expected to be manifested on several indicators. First, individuals in a high versus low ceiling room should identify a larger number of shared dimensions. This follows because these individuals' proposed greater reliance on relational versus item-specific elaboration should prompt them to discern more connections among the disparate stimulus items. Second, those in a high rather than low ceiling room also should identify more dimensions that are abstract (versus concrete) in nature. This should ensue because the relational elaboration presumably favored by those in a high versus low ceiling room should foster "general relationships abstracted from the instances" (Einstein and Hunt 1980, pg. 597). In contrast, the item-specific elaboration favored by those in a lower ceiling room should spawn more context-specific, precise associations to each item, and these reflect relatively concrete ideation (Liberman, Sagristano and Trope 2002; Semin and Fiedler 1991). Third, due to their greater reliance on relational versus item-specific elaboration, individuals in a high versus low ceiling room should assign the stimulus items (i.e., sports) into fewer subgroups per dimension. This follows because relational processors' more extensive search for shared and more abstract relations among items should prompt the production of more inclusive categories (i.e., fewer

subgroups) comprised of seemingly disparate items (Isen 1987; Seibt and Forster 2004; Liberman et al. 2002).

A second task, one of more direct consumer relevance, entailed evaluating two products. Individuals examined two product photos that were chosen because each depicted a product that was quite sophisticated in appearance, except for a few of its features that were relatively crude. Participants were asked to evaluate the degree to which each product was sophisticated. We reasoned that individuals in a high versus low ceiling room, who presumably favor the use of relational versus item-specific processing, would evaluate the products as more sophisticated, for their relational processing should encourage sensitivity to the shared aspects of the product features, causing individuals to largely disregard the few aberrant (i.e., crude) ones. On the other hand, those in a low ceiling room, who presumably rely primarily on item-specific processing, are likely to be more sensitive to each product's discrete and specific product features, which would include the limited number that do not imply product sophistication (i.e., crude features).

Still, as noted earlier, each of the preceding predictions is based on the qualification that individuals are sufficiently attentive to the ceiling height such that the intended types of concepts are primed. Hence, the following two-way interactions are expected:

H2: When the salience of the ceiling height is relatively high, individuals in a high versus low ceiling room should produce a larger number of shared category dimensions overall, a larger number of abstract (not concrete) dimensions, and a smaller number of subgroups per dimension. Such effects should be absent, however, when ceiling height salience is low.

H3: When the salience of the ceiling height is relatively high, individuals in a high versus low ceiling room should evaluate the target products as more sophisticated, but this effect should be absent when the salience of the ceiling height is low.

Method

Stimuli. Ceiling height was manipulated in the same manner as in experiment 1, and each participant completed the study individually in a relatively high (10 foot) or low (8 foot) ceiling room. In addition, the salience of the ceiling height was varied via the placement of three colorful lanterns. In the ceiling height high salience condition, the lanterns were suspended from the ceiling, as this could attract participants' attention to the ceiling height. In the ceiling height low salience condition, the lanterns were at or near eye level, with two on the table at which participants were seated and one on the floor.

Stimuli were developed for two tasks. For the categorization task, two research assistants aided in the selection of the stimulus items. Each was supplied with an extensive list of sports and asked to identify as many different dimensions as they could that were shared by the sports, even though the value of the sports on such dimensions might vary (e.g., for the dimension of the equipment required, alternative values included an aircraft, a ball, a sailboat, etc.). Examples of items from a different category were provided to clarify what was meant by the terms dimensions and values. Using the definitions identified by previous researchers (Semin and Fiedler 1988, 1991), the research assistants were encouraged to identify both relatively concrete dimensions that could be verified objectively (e.g., the equipment required for the sports) and those that were abstract, defined as ones that were subjective and could not be readily verified (e.g., the intensity of the sport). Employing such input, 10 sports items were selected (i.e., sky surfing, basketball, sailing, swimming, parachuting, boxing, chess, fishing, soccer, and cycling) because these sports vary on a number of abstract and concrete dimensions.

For the second task, product evaluation, photos of a coffee table and a wine rack were used. These were selected based on the comments of individuals in a small focus group, who agreed

that while each product possessed a sophisticated overall appearance, each also featured certain details that were rather crude (e.g., protruding knots in the wood of the coffee table, see sample product photo in appendix C). Four evaluation items that tapped the degree of product sophistication were chosen as the dependent measures. On a 7-point scale, the anchors of the items were crude/polished, course/refined, organic/cultivated design, and rough/sleek. The four items exhibited acceptable reliability levels ($\propto$ = .74 and .80 for coffee table and wine rack, respectively), and thus were averaged to form separate product evaluation indices.

Procedure. A total of 100 students were recruited to participate individually in the study in exchange for $5. Upon arrival, participants were escorted to a high (10 foot) or low (8 foot) ceiling room. As in experiment 1, at the start, each participant was left alone in the room for about one minute. This provided them an opportunity to attend to their surroundings and the lanterns, which served to vary ceiling height salience. When the administrator returned, participants were informed that two questionnaires with unrelated tasks would be administered.

Participants then received the first questionnaire, which contained only the categorization task. The instructions explained what they were to do with the stimulus items, and this was clarified via an example that used items from a different general category. Specifically, participants were instructed to examine the stimulus list of 10 disparate sports and to identify as many different dimensions as they could that were shared by the full set of items. Then for each dimension, they were asked to assign the items into subgroups that captured the values of the items on that dimension, and finally they were to label each subgroup. No time limit was imposed. After this task was completed, the first questionnaire was collected, and participants were told that there would be a minute or so break before they began the second questionnaire. This break was implemented to counteract possible dissipation of the ceiling height prime, as it

provided participants another opportunity to attend to the lanterns before they completed the remaining materials. Depending on the placement of the lanterns, this should heighten or limit participants' attentiveness to the room's ceiling height.

After the break, the second questionnaire was distributed, which contained the product evaluation task. Participants were told that they would be shown photos of some products that soon would be available in stores and that their views about these products would be sought. Photos of the two products, a coffee table and a wine rack, were presented. Product order was rotated, and participants were allowed unlimited time to examine each photo. After viewing each photo separately, participants evaluated the depicted product on the four items described earlier.

RESULTS

All measures were analyzed as a 2 (ceiling height: high vs. low) by 2 (ceiling height salience: high vs. low) between subject factorial design. Table 1 reports treatment means for all measures.

Insert table 1 about here

Categorization. Participants' responses to the categorization task were coded in three ways: (1) the total number of shared dimensions that participants identified, (2), the degree of abstractness of the dimensions produced by each participant, and (3) the average number of subgroups formed per dimension (note that because this measure is "per dimension," it is not confounded with the total number of dimensions). As we clarify shortly, the second measure was coded using criteria adapted from Semin and Fiedler's linguistic category model (LCM; 1988, 1991). The LCM was employed because it appears to be the only model that specifies precise criteria for determining degree of abstraction.

The LCM distinguishes among four levels of abstraction in language used to describe people and behaviors. With one exception, the criteria that the model offers for delineating abstraction levels can be adapted to the kinds of item dimensions that people identified. The sole exception is the model's fourth and most abstract level, which concerns people's dispositions. No parallel exists in language used to describe dimensions (versus to describe people and behaviors), so we could not use this level. Hence, three levels of abstraction, ranging from most concrete to most abstract, were adapted from the LCM and used to identify how abstract all identified dimensions were. Using our own labels, the following elucidates the criteria we used to define each level.

The first and most concrete level, labeled objectively interpreted dimensions (OID), consists of dimensions whose interpretation is "easily verified" (Semin and Fiedler 1988, pg. 559), for it is "objective [from] observable events" (Semin and Fiedler 1991, pg. 5). Examples include sports dimensions such as "the physical environment where the sport occurs" and "the number of sport participants," for the value of each sport on such dimensions can be determined quite objectively. The second level, labeled subjectively interpreted dimensions (SID), consists of dimensions that are less verifiable (Semin and Fiedler 1988) and thus require considerable "interpretation beyond [the] description," (Semin and Fiedler 1991, pg. 5). These are exemplified by sports dimensions like "intensity level of sport" and "age of sport participants," because interpreting the value of each sport on these items is a more subjective judgment that is open to variable interpretation. At the third, highly abstract level are dimensions that reflect one's psychological (i.e., emotional or mental) state in relation to the items (e.g., sports). Labeled as psychological state dimensions (PSD), examples include "sports I would (not) like to play" and "sports that people feel are challenging." These dimensions are both highly interpretative and decontextualized.

Using these criteria, two trained judges who were blind to the experimental conditions coded all identified sports dimensions into one of these abstraction levels, with OIDs coded as 1, SIDs as 2, and PSDs as 3. Interjudge reliability was high (r = .94). Then each participant's overall value of dimension abstraction was determined using the same formula employed by Semin and Fiedler (1989). Specifically, the frequencies of OIDs, SIDs (multiplied by 2), and PSDs (multiplied by 3) were summed. This result was then divided by the total number of dimensions identified by each participant. This produced a score that ranged from 1 to 3.

The predicted two-way interaction of ceiling height and ceiling height salience emerged on each of the dependent measures, namely total number of dimensions identified ($F(1, 95) = 5.69$, $p < .02$), the degree of abstraction of the dimensions ($F(1, 95) = 4.00$, $p < .05$), and the average number of subgroups formed per dimension ($F(1, 95) = 5.97$, $p < .02$). Further, planned contrasts revealed that, as anticipated, when the salience of the ceiling height was relatively high (i.e., the lanterns hung from the ceiling and thus increased attentiveness to ceiling height), participants in the high versus low ceiling condition produced a larger number of dimensions ($F(1, 95) = 11.93$, $p < .001$), greater abstraction in the sports dimensions that they identified ($F(1, 95) = 6.00$, $p < .05$), and a smaller average number of subgroups per dimension ($F(1, 95) = 4.73$, $p < .05$). These differences were absent, however, when the salience of the ceiling height was low ($ps > .21$; lanterns were placed at or near eye level, thereby limiting attention to the ceiling height).

Product Evaluations. An interaction of ceiling height and ceiling height salience also emerged on evaluations of both the coffee table ($F(1, 95) = 5.67$, $p < .02$) and the wine rack ($F(1, 95) = 8.50$, $p < .01$). Planned contrasts revealed that, as predicted, when the salience of the ceiling height was high, participants in high versus low ceiling rooms evaluated both the coffee table ($F(1, 95) = 4.55$, $p < .05$) and the wine rack ($F(1, 95) = 8.11$, $p < .01$) as more

sophisticated. However, when ceiling height salience was low, such differences in product evaluation were absent (*ps* > .22).

DISCUSSION

The results of this study build on those of experiment 1, which showed that a high (low) ceiling height can prime thoughts that relate to the concept of freedom (confinement). Experiment 2 adds to this by showing that such ceiling height-primed thoughts can prompt relational (item-specific) processing, as indicated by the degree to which people's responses reflect heightened use of fairly integrative and abstract (discrete and concrete) ideation. Specifically, individuals who completed the study in a high versus low ceiling room appeared to rely predominately on relational elaboration and therefore identified more dimensions shared by a number of rather dissimilar items, exhibited a greater degree of abstraction in the dimensions they identified, and sorted these items into fewer and thus more inclusive subgroups per dimension. Further, and of more direct relevance to consumer settings, those in a high versus low ceiling room evaluated products as more sophisticated when they were largely sophisticated in appearance but did possess some features that were crude. This suggests that individuals emphasized the commonalities among product features (versus the specifics of each individual feature) when rendering their evaluations. Yet critically, each of these outcomes was qualified by the salience of the ceiling height, with evidence of relational and item-specific processing emerging only when ceiling height was salient, such that individuals noticed the ceiling height and apparently experienced activation of freedom- versus confinement-related thoughts.[1]

[1] Importantly, in a separate study, we assessed whether the ceiling height manipulations used in this and the previous study produced any differences in participants' mood. Using the same ceiling height (high vs. low) and ceiling height salience (high vs. low) conditions employed in experiment 2, 64 participants' mood was assessed on 12 items, with half of the items representing a positive mood (e.g., happy and cheerful) and the others representing a negative mood (e.g., downbeat and gloomy). As expected, treatment effects were absent on both the positive (p > .66) and negative (p > .13) mood index. Further, in yet another study, we fully replicated our findings on all measures in Experiment 2 by priming individuals directly with the concepts of freedom versus confinement, but

While the findings of experiment 2 are provocative, they are not without limitations. Some might be more convinced that ceiling height truly prompts alternative types of processing if we used firmly and repeatedly established indicators of relational and item-specific processing. Also, evidence for our theorizing would be bolstered greatly if the freedom and confinement concepts activated by ceiling height were found to mediate measures that reflect people's use of relational and item-specific processing. Experiment 3 seeks to address these issues.

EXPERIMENT 3

Overview and Hypotheses

Previous studies have shown repeatedly that relational and item-specific processing produce different and reliable effects on particular memory measures, namely recall clustering and cued recall (e.g., Hunt and Seta 1984). Thus, we developed stimuli that would allow us to administer such measures. As in experiment 1, participants completed the study in either a high or low ceiling room, but the salience of the ceiling height was always high, as the lanterns always hung from the ceiling. All participants began by receiving a list of 36 items from six different categories. Later, participants engaged in free recall and then cued recall of the items. The free recall task enabled the assessment of recall clustering of same-category items (i.e., successive recall of such items, which indicates that shared categories were discerned), a measure that has been shown repeatedly to be a reliable indicator of relational processing (e.g., Hunt and Seta 1984; Meyers-Levy 1991). The cued recall task allowed assessment of the number of items recalled per category when category labels were provided. This measure is a proven indicator of

---

holding ceiling height constant. Measures verified that our manipulations of the two primed concepts were perceived to be equally favorable and did not affect respondents' mood. Thus, taken together, the results of these two studies suggest strongly that neither differences in the favorableness of the ceiling height-primed concepts nor ceiling height per se are likely to account for the treatment effects observed in any of our studies.

item-specific processing (e.g., Hunt and Seta 1984). Finally, individuals rated their current body state on the same freedom- and confinement-related items used in experiment 1.

If, per our theorizing, a fairly salient high versus a low ceiling primes freedom- rather than confinement-related concepts and this in turn encourages relational versus item-specific elaboration respectively, people in a high versus low ceiling room should report a higher level of a freedom-related body state, reflecting sensitivity to the high ceiling (i.e., freedom) prime. Further, they should exhibit greater recall clustering during free recall, indicating their prevailing use of relational processing. In contrast, those in the low versus high ceiling room should report a higher level of a confinement-related body state, reflecting sensitivity to the low ceiling (i.e., confinement) prime, and they should produce superior item recall during cued recall, indicating their dominant reliance on item-specific processing. As such, mediation effects can be specified:

> **H4:** When the salience of ceiling height is high, individuals in a high versus low ceiling room should exhibit greater recall clustering during free recall; further this effect should be mediated by these individuals' heightened freedom-related body state. However, individuals in a low versus high ceiling room should recall more items per category in a cued recall task; this effect should be mediated by their heightened confinement-related body state.

Method

Stimuli. The same high (10 foot) or low (8 foot) ceiling rooms were employed as were used in experiment 1. Also like experiment 1, the lanterns always hung from the ceiling, rendering the ceiling height fairly salient. A 36 item list comprised of six items from each of six different categories (e.g., fruits, birds) was created for this study. The items and categories were taken from Battig and Montague (1969). All items were listed in a random order, but no consecutively presented items belonged to the same category.

Procedure. Thirty four participants completed the study individually. Each was assigned randomly to either a high or low ceiling room, and as in the previous studies, each was left alone in the room for one minute while the experimenter retrieved a consent form. The study began by asking participants to rate their current body state on the same six freedom- and confinement-related items used in experiment 1. Next, participants were instructed to examine carefully the list of 36 multi-category items, for they were told they would make use of them later. Then, to clear memory, participants completed some filler questions. This was followed by an unaided, free recall task that asked participants to record as many of the 36 items as they could. A cued recall task followed. Participants were provided the names of the six represented categories and asked to recall all items from the list, recording each item below its appropriate category name.

RESULTS

Because relational processing has been shown reliably to promote clustering of items that belong to a common category, clustering of the multi-category items during participants' free recall was assessed using adjusted ratio of clustering (ARC; Hunt and Einstein 1981). ARC scores range from 1.0 to –1.0, where 1.0 indicates perfect clustering and 0 indicates chance clustering. In addition, item-specific processing has been found to prompt heightened item recall when individuals are cued with the items' category names. Thus, cued recall was assessed by calculating the average number of items recalled per each of the six represented categories.

Results obtained on both memory measures supported the proposition that individuals in a high (low) ceiling room engaged primarily in relational (item-specific) elaboration. Specifically, during free recall, those in a high versus low ceiling room exhibited more recall clustering (i.e., higher ARC scores), indicating the use of greater relational processing (M_{high} = .74, M_{low} = .49; $F(1, 31) = 4.96$, $p < .05$). However, participants in a low versus high ceiling

room identified more items during cued recall, indicating greater reliance on item-specific elaboration (M_{high} = 2.80, M_{low} = 3.33; $F(1, 31) = 4.13$, $p < .05$).

In addition, participants' responses to items assessing their current body state replicated those reported in experiment 1. Indicating that the intended concepts were primed by the room's ceiling height, participants in a high versus low ceiling room reported that they felt a greater freedom-related state (M_{high} = 5.08, M_{low} = 4.14; $F(1, 31) = 7.92$, $p < .01$), but a lower confinement-related state (M_{high} = 2.18, M_{low} = 3.22; $F(1, 31) = 5.42$, $p < .05$).

Mediation analysis. Mediation analyses were conducted to assess whether participants' perceived current body state, which was influenced by the ceiling height-induced freedom- versus confinement-related prime, mediated the effects of ceiling height on type of processing (Baron and Kenney 1986). Results supported our hypotheses. Specifically, ceiling height significantly affected ARC (i.e., clustering) scores (b = .25, $p < .05$), and it influenced participants' freedom-related body state (b = 1.08, $p < .01$). Moreover, the effect of ceiling height on ARC scores was mediated by participants' freedom-related state ($b_{ceiling\ height}$ = .05, p = .69; $b_{freedom}$ = .15, $p < .05$; Sobel: Z = 2.00, p < .05). Similarly, ceiling height affected the average number of items recalled per category during cued recall (b = -.54, $p < .05$) and participants' confinement-related bodily state (b = -1.18, $p < .05$). Further, the effect of ceiling height on the cued recall measure was mediated by participants' confinement-related state ($b_{ceiling\ height}$ = -.22, p = .41; $b_{confinement}$ = .25, $p < .01$; Sobel Z = -1.86, $p < .06$). Note that participants' confinement-related body state did not mediate ARC scores ($b_{ceiling\ height}$ = .28, $p < .05$; $b_{confinement}$ = .06, $p >$ .18), and their freedom-related state did not mediate cued recall ($b_{ceiling\ height}$ = -.77, $p < .05$, $b_{freedom}$ = .24, $p > .11$).

DISCUSSION

Experiment 3 provides compelling support for our theorizing that ceiling height can induce alternative types of elaboration and that the concepts primed by ceiling height mediate such effects. Specifically, the findings suggest that, when salient, a relatively high ceiling activated freedom-related concepts and this resulted in enhanced recall clustering, which is an established indicator of relational processing. In contrast, a lower ceiling primed confinement-related concepts and this enhanced the average number of items recalled per cued category, a memory measure that is a known indicator of item-specific processing. Thus, the three studies we have reported suggest that the activation of freedom- versus confinement-related concepts mediate the effect of ceiling height on the type of processing that ensues. Moreover, the type of processing that occurs is distinguished by the degree of integrated and abstract ideation that it stimulates.

GENERAL DISCUSSION

The present research adds to our knowledge by showing that ceiling height, a virtually omnipresent atmospheric variable in consumer settings, can affect the manner in which individuals process information and thus their responses. Further, our research offers a theory that clarifies when and why this happens. Experiment 1 showed that exposure to a high versus low ceiling can prime freedom- versus confinement-related concepts. Experiments 2 and 3 built on this by demonstrating that these ceiling height-induced concepts can elicit predominately relational versus item-specific processing, respectively. Experiment 2 showed this by demonstrating how ceiling height affects the number and abstractness of dimensions shared by a set of items (i.e., sports) and the number of subgroups into which such items are divided per each dimension. Of more direct consumer relevance, this study also buttressed the preceding thesis by showing that people in a higher ceiling room produced product evaluations that emphasized the commonalities among the product's features as opposed to the implications of a few aberrant

features. At the same time, the preceding findings were qualified by an important moderator. Differences in people's type of processing and responses emerged only when ceiling height salience and thus their awareness of ceiling height was reasonably high. Experiment 3 added even more compelling evidence that the concepts primed by a high (low) ceiling can induce relational (item-specific) processing. It did so by examining two memory measures (i.e., recall clustering and cued item recall) that have been shown repeatedly to be highly reliable indicators of these two types of processing. Moreover, this study bolstered our theory by showing that each primed concept mediated the effect of ceiling height on the appropriate memory measure.

The current research makes several important theoretical contributions. It adds to the priming literature by showing that conceptual primes can influence people's responses in ways beyond simply affecting the accessibility of the thoughts on which such responses are based (i.e., spill over effects): Such primes also can exert influence by determining the very type of processing that people employ (i.e., relational or item-specific). Further, the present work contributes to the literature on atmospherics by offering a theory that illuminates when and how ceiling height, a neglected atmospheric variable, can affect the manner in which people process information and thus explain why such people categorize, evaluate or otherwise respond to stimuli differently. Finally, our research adds to work on type of processing. It shows that, by activating freedom- or confinement-related concepts, ceiling height can be an antecedent of type of processing. Thus, ceiling height represents an alternative and novel means of varying people's type of elaboration.

Although our research focused on only specific measures that were capable of shedding light on how and why (i.e., the mechanism by which) ceiling height can affect consumers' responses, our theory suggests intriguing implications about how consumptions contexts with relatively high or low ceilings are likely to affect assorted consumer behaviors. For example, because our

theory suggests that people in a higher ceiling room should rely greatly on more abstract, relational (versus item-specific) elaboration, it follows that they may solve various consumption-related problems by thinking of non-traditional, more creative ways to use products. Hence, such consumers may realize that they can simply, say, substitute baking soda and water for expensive silver tarnish remover, or store their jewelry in handy plastic airtight film containers to prevent tarnishing. Due to their reliance on relational processing, consumers in a higher ceiling room also may find that distally-related cues (e.g., spotting bottled water in a store) trigger their memory for needed products (e.g., new running shoes). Further, relationally-processing consumers in a high ceiling room may better make sense of quizzical ads (e.g., a Pennzoil ad that depicts a shapely nurse with a stethoscope spoon-feeding a large, dirty, disembodied engine), whereas item-specific-processing consumers in a low ceiling room may be more likely to react to ad disclaimers that appear in small type. Finally, retailers may benefit from reflecting on the nature of the goods they sell before deciding how high they wish their showroom ceilings to be. For example, art galleries that feature often hard-to-interpret abstract art may wish to install a high ceiling, which should prompt relational processing. Yet, those that feature more concrete, detail-filled representational art might benefit from low ceilings that prompt item-specific processing.

As we noted briefly in the introduction of this paper, the effects produced by high or low ceilings likely occur because such ceiling heights increase or decrease vertical room volume, thereby stimulating alternative concepts and types of processing. This suggests that it might be possible to replicate our effects if room width was varied and thus altered horizontal room volume. Likewise it seems plausible that, as airplane manufacturers are betting, similar effects may emerge from merely illusory higher ceilings. If so, relational versus item-specific processing may be engendered by other atmospheric variables that exert illusory influences on room volume

and thus the concepts that are activated. Specifically, relational versus item-specific processing may prevail in rooms that feature bright versus dim lighting, windows versus windowless walls, many versus few objects/products, high versus low density objects/products, and airy pastel versus more intense, richer colors, which can make rooms seemingly shrink.

The current research raises other provocative issues that should be studied as well. It showed that the effects produced by ceiling height occurred only when, due to salient ceiling-hung lanterns, people were likely to attend to ceiling height. When the lanterns were salient but largely at eye level, individuals presumably noted these lanterns but proceeded to focus their attention on the study materials, never noticing the ceiling height. Assuming that this reasoning is accurate, we expect that people will react to ceiling height spontaneously if the height is extreme (e.g., a soaring cathedral ceiling or a ceiling in a crawl space), because such extremity itself should make ceiling height salient. Yet, a pertinent practical question emerges: In typical stores with high and low ceilings, ones where there are no lanterns to render ceiling height salient, will consumers notice the ceiling height and respond as we predict? Although at present this remains an empirical question, we suspect that they will, particularly upon first entering the store. Retail anthropologist, Paco Underhill (1999; ABC 20/20 1999), has found that upon entering a store, consumers reliably slow down or pause within 25 feet of the store entrance and attempt to get their bearings by visually scanning the store broadly, indeed, perhaps noticing the ceiling height. This is all the more likely in stores that, as many do, hang store merchandise high on the walls or possess distinctive (e.g., contrasting colored) ceiling molding, lighting, signage, artwork, a clock or other decorative or functional items high on walls. Such items are likely to draw consumers' attention to ceiling height, as our lanterns did. Hence, the effects that we observed may well occur in true consumer contexts. Hopefully future work will explore this and many other issues.

References

Aarts, Henk and Ap Dijksterhuis (2003), "Environment, Situation Norm, and Social Behavior," *Journal of Personality and Social Psychology*, 84 (January), 18-28.

ABC 20/20 (1999), *Why We Buy*, interview with Paco Underhill, May 10, 1999.

Bargh, John A, Mark Chen, and Lara Burrows (1996), "The Automaticity of Social Behavior: Direct Effects of Trait Concept and Stereotype Activation on Action," *Journal of Personality and Social Psychology*, 71 (August), 230-244.

Baron, Reuben M. and David A. Kenney (1986), "The Moderator-Mediator Variable Distinction in Social Psychology Research: Conceptual, Strategic, and Statistical Considerations," *Journal of Personality and Social Psychology*, 51 (December), 1173-1182.

Battig, William F. and William E. Montague (1969) "Category Norms for Verbal Items in 56 Categories: A Replication and Extension of the Connecticut Category Norms," *Journal of Experimental Psychology Monograph*, 80 (June) part 2, 1-46.

Bivins, Ralph (1997), "Home Builders Toy with Better Designs as Baby Boomers Age," *The Houston Chronicle*, January 26, A34.

Einstein, Gilles O. and R. Reed Hunt (1980), "Levels of Processing and Organization: Additive Effects of Individual-Item and Relational Processing," *Journal of Experimental Psychology*: *Human Learning and Memory*, 6 (November), 588-598.

Fischl, Géza and Anita Gärling (2004), "Enhancing Well-Being in Health Care Facilities," in *Evaluation in Progress - Strategies for Environmental Research and Implementation (IAPS 18 Conference Proceedings on CD-Rom - ISBN 3-85437-263-9)*, eds. Bob Martens and Alexander G. Keul, July 7-9.

Garcia, Stephen M., Kim Weaver, Gordon B. Moskowitz, and John M. Darley (2002),

"Crowded Minds: The Implicit Bystander Effect," *Journal of Personality and Social Psychology*, 83 (October), 843-853.

Hall, Edward T. (1966). *Hidden Dimension*, Garden City, NY: Doubleday.

Hunt, R. Reed and Gilles O. Einstein (1981), "Relational and Item-Specific Information in Memory," *Journal of Verbal Learning and Verbal Behavior*, 20 (October), 497-514.

_____ and Catherine E. Seta (1984), "Category Size Effects in Recall: The Roles of Relational and Individual Item Information," *Journal of Experimental Psychology: Learning, Memory and Cognition,* 10 (July), 454-464.

Isen, Alice (1987), "Positive Affect, Cognitive Processes and Social Behavior," in *Advances in Experimental Social Psychology*, L. Berkowitz (ed.), vol. 20, NY: Academic Press, 204-253.

Kraft, Robert N. (1987), "The Influence of Camera Angle on Comprehension and Retention of Pictorial Events," *Memory and Cognition*, 15 (July), 291-307.

Kühnen, Ulrich and Daphna Oyserman (2002), "Thinking About the Self Influences Thinking in General: Cognitive Consequences of Salient Self-Concept," *Journal of Experimental Social Psychology*, 38 (September), 492-499.

Liberman, Nira, Michael D. Sagristano, and Yaacov Trope (2002) "The Effect of Temporal Distance on Level of Mental Construal," *Journal of Experimental Social Psychology*, 38 (November), 523-534.

Lunsford, J. Lynn and Daniel Michaels (2002), "A Global Journal Report: Masters of Illusion – Plane Designers Use Mirrors, Lighting, Repositioned Bins to Make Cabins Seem Roomier," *Wall Street Journal (Eastern Edition),* New York, N.Y., November 25, B1.

Mandel, Naomi (2003), "Shifting Selves and Decision Making: The Effects of Self-Construal Priming on Consumer Risk-Taking," *Journal of Consumer Research*, 30 (June), 30-40.

Meyers-Levy, Joan (1991), "Elaborating on Elaboration: The Distinction Between Relational and Item Specific Elaboration," *Journal of Consumer Research*, 18 (December), 358-367.

Monga, Alokparna and Deborah Roedder John (2006), "Cultural Differences in Brand Extension Evaluation: The Influence of Analytic versus Holistic Thinking," *Journal of Consumer Research*, forthcoming.

Moore, Gary T., Carol G. Lane, Ann B. Hill, Uriel Cohen, and Tim McGinty (1979). *Recommendations for Child Care Centers*, Milwaukee, WI: Center for Architecture and Urban Planning Research.

Nussbaum, Shiri, Yaacov Trope, and Nira Liberman (2003), "Creeping Dispositionism: The Temporal Dynamics of Behavior Prediction," *Journal of Personality and Social Psychology,* 84 (March), 485-497.

Sassenberg, Kai and Gordon B. Moskowitz (2005), "Don't Stereotype, Think Different! Overcoming Automatic Stereotype Activation by Mindset Priming," *Journal of Experimental Social Psychology,* 41 (September) 506–514.

Seibt, Beate and Jens Forster (2004), "Stereotype Threat and Performance: How Self-Stereotypes Influence Processing by Inducing Regulatory Foci," *Journal of Personality and Social Psychology*, 87 (July), 38-56.

Semin, Gün R. and Klaus Fiedler (1988), "The Cognitive Functions of Linguistic Categories in Describing Persons: Social Cognition and Language," *Journal of Personality and Social Psychology*, 54 (April), 558-568.

_____ and _____ (1991), "The Linguistic Category Model, Its Bases, Applications and Range," *European Review of Social Psychology*, 2, 1-30.

Underhill, Paco (1999a), *Why We Buy: The Science of Shopping,* NY: Simon and Schuster.

TABLE 1

TREATMENT MEANS AND STANDARD DEVIATIONS FOR EXPERIMENT 2

	Low Ceiling Height Salience		High Ceiling Height Salience	
	Low Ceiling	**High Ceiling**	**Low Ceiling**	**High Ceiling**
Categorization Task (Sports)				
Total Number of Dimensions Generated	3.54^{b} (.92)	3.60^{b} (1.18)	3.24^{b} (1.03)	4.39^{a} (1.40)
Average Number of Subgroups Per Dimension	2.40^{ab} (.47)	2.55^{b} (.42)	2.55^{b} (.63)	2.27^{a} (.22)
Degree of Abstraction of Dimensions	1.34^{b} (.26)	1.33^{b} (.24)	1.37^{b} (.26)	1.55^{a} (.20)
Product Evaluation Task (Degree of sophistication)				
Coffee Table	4.44^{ab} (1.02)	4.12^{b} (1.07)	4.11^{b} (.85)	4.73^{a} (1.12)
Wine Rack	5.95^{a} (.68)	5.67^{ab} (.96)	5.40^{b} (1.02)	6.10^{a} (.49)
Number of Respondents	25	29	24	22

Notes: Means within the same role that do not share a common superscript differ at $p < .05$.

FIGURE 1

MODEL OF THE MECHANISM BY WHICH CEILING HEIGHT CAN AFFECT TYPE OF PROCESSING

Ceiling Height	Associations to Activated Concept	Type of Processing Induced	Outcome
High →	Freedom-related →	Relational →	An emphasis on data integration and abstraction
Low →	Confinement-related →	Item-specific →	An emphasis on separately analyzed and specific, relatively concrete data

Appendix A: Sample Photo of Room with High Salience, High Ceiling Height

Appendix B: Sample Photo of Room with High Salience, Low Ceiling Height

Exhibit C: Sample Product (Coffee Table) Used in Experiment 2