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Men over women: The social transmission of gender stereotypes through spatial elevation☆,☆☆

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ABSTRACT

People draw from physical properties like spatial location to better understand complex concepts like power (Landau, Meier, & Keefer, 2010; T. W. Schubert, 2005). We examined the cultural implications of such associations for gender stereotypes. Specifically, we hypothesized that people would make location-based attributions of power and dominance when targets are situated in noisy, real-world environments (i.e., magazine pages; Study 1); that men generally appear higher than women across print media (Study 2: Content Analysis); and that this gender-location association would ultimately cause perceivers to think that men (in general) are more powerful and dominant people than are women (Study 3; meta-analysis). Results supported hypotheses and indicate that exposure to this cultural pattern in which men are higher than women (i.e., *male spatial elevation*) causes perceivers to endorse gender stereotypes of dominance. Accordingly, gender-location associations may account in part for the social transmission of gender stereotypes.

> "Adler observes that the notions of high and low have great importance …between boys, it is frequently a pretext or challenge. The little girl, to whom exploits are forbidden and who sits under a tree or by a cliff and sees the triumphant boys above her, feels herself, body and soul, inferior."
>
> -Simone de Beauvoir, 1949

In the opening quote, de Beauvoir relates high and low spatial locations to triumph and inferiority, respectively. In doing so, she used metaphor to illustrate one feature of traditional gender roles: girls and women are expected to behave with less dominance and power than boys and men. Metaphors are useful linguistic devices but several theories in cognitive linguistics suggest that metaphors also reflect how humans think. The most influential of these is Conceptual Metaphor Theory (CMT; Lakoff & Johnson, 1980), which begins with the idea that people form cognitive representations of the physical world based on their daily interactions with it. Critically, people use these concrete *source concepts* (e.g., height, heaviness, warmth) to understand abstract *target concepts* (e.g., power, importance, friendliness; Landau et al., 2010). For example, people may think of high versus low spatial position as a means of understanding the target concept of power or dominance (Lu, Schubert, & Zhu, 2017; T. W. Schubert, 2005; Von Hecker, Klauer, & Sankaran, 2013). Similarly, people may think of heavy versus light weight as a means of understanding the target concept of "importance" (Djordjevic & IJzerman, 2015; Schneider, Rutjens, Jostmann, & Lakens, 2011), or may think of warm versus cold sensation to help them understand the concept of friendliness (Williams & Bargh, 2008). These cognitive mappings are metaphorical in that the source and target concepts are semantically dissimilar. For example, spatial position regards the three dimensions of physical space whereas power and dominance regards social relationships, yet there is evidence that concepts of vertical space influence how people think about power.

Social psychologists have extended CMT by focusing on how metaphorical cognitive mappings shape social judgments. Specifically, the social psychological approach emphasizes that people draw from source concept(s) to reason about, interpret, and evaluate information related to target concepts (Landau et al., 2010). For example, there is evidence that the location of a person on the vertical plane can shape perceivers' judgments of that person's power and dominance, goodness, morality, and religiosity (Chasteen, Burdzy, & Pratt, 2010; Holmgren, Isager, & Schubert, 2018; Lu et al., 2017; Meier, Hauser, Robinson, Friesen, & Schjeldahl, 2007; Meier & Robinson, 2004, 2006). We refer to the relationship between spatial location and social concepts as *social-spatial associations*.

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We here examine the relationship between social-spatial associations and stereotypes. In so doing, we extend research on social-spatial associations in three ways. First, we tested how spatial location informs social judgment when stimuli are situated in real social environments. Specifically, and drawing from classic theories of perception (J. J. Gibson, 1979; McArthur & Baron, 1983) and judgment (Brunswik, 1949, 1955; Gigerenzer, 2004; Todd & Gigerenzer, 2000), we argue that the richness and complexity of real environments demands specific perceptual and cognitive processes that enable perceivers to navigate and learn from those environments. For example, experiments that present one word ("teacher") above another ("pupil") on an otherwise bare computer screen are valuable in isolating the psychological effects of location from other potential influences on social judgment, but in so doing potentially exaggerate those effects. Real physical environments include many perceptual and social variables that shape social judgment, and verticality may have little impact among these many variables. Conversely, if people must draw from representations of spatial location to make judgments of power, then verticality may influence judgments of power amidst many other visible social variables. In Study 1, we digitally manipulated the location of images in a sample of American magazine pages and measured participants' judgments of the pictured individuals.

In Studies 2 and 3, we examined the role of social-spatial associations in reinforcing gender stereotypes. Specifically, gender stereotypes hold that men are more powerful and dominant than women (Bailey & Kelly, 2015; Hoyt & Burnette, 2013; Kay et al., 2009; Prentice & Carranza, 2002). We hypothesized that this gender-based power difference would be reflected in the vertical locations of *culturally-prevalent images* (i.e., images seen by a large population). In Study 2, we collected a representative sample of pages from popular magazines and examined whether culturally-prevalent images of men were located higher than images of women. In Study 3, we tested the hypothesis that seeing men in high locations and women in low locations would cause participants to inflate their estimates of differences in power between women and men.

1. Do people draw inferences about power based on vertical location?

Conceptual Metaphor Theory has important implications for scientific understanding of social cognition (e.g., Landau et al., 2010) but research inspired by this theory is not without controversy (Ashton, Pilkington, & Lee, 2014; Hill & Lapsley, 2009; IJzerman & Koole, 2011; Lee & Schwarz, 2012; L. Schubert, Schubert, & Topolinski, 2013). For example, Conceptual Metaphor Theory suggests that the cognitive structure of concrete concepts in memory shapes the cognitive structure of abstract concepts; some scholars have thus argued that Conceptual Metaphor Theory exclusively postulates influences of source concept activation on judgments of target concepts (Lakoff & Johnson, 1980; Landau et al., 2010; Williams, Huang, & Bargh, 2009). Conversely, other theories posit *bidirectional* influences. For example, one alternative theory suggests that people learn simple associations between physical properties and abstract concepts and these simple associations thus allow for bidirectional influences, such that the activation of target concepts can influence judgments of source concepts. For example, children may learn to associate location with power because their parents and other authority figures are high in space (T. W. Schubert, 2005). There is compelling evidence for such bidirectional influences (Lakens, Semin, & Foroni, 2011; Lee & Schwarz, 2010, 2012; Meier & Robinson, 2004; Zhang, Zuo, Erskine, & Hu, 2016; Zhong & Leonardelli, 2008; Zhong & Liljenquist, 2006), but not all scholars agree such evidence is inconsistent with Conceptual Metaphor Theory (Landau, Keefer, & Meier, 2011).

For example, Lee and Schwarz (2012) draw a distinction between metaphorical structure and metaphorical processing. They argue, as does CMT, that people draw from their understanding of concrete concepts to understand abstract concepts, and therefore develop cognitive mappings between concrete and abstract concepts. Extending CMT, Lee and Schwarz then argue that once the concrete-abstract mapping has been established, bi-directional influences on processing can emerge. Specifically, an abstract concept can exert a "top-down" influence on human perception of source concepts just as current needs, stereotypes, and cultural knowledge exert such influence on human perception of elemental concepts (e.g., size).

Debates about the directionality of influence in metaphor effects are but one issue tackled by different social-cognitive theories. Other points of disagreement include the role of embodied processes in metaphorical influences, the mechanisms involved in how people learn concrete-abstract mappings, and the extent to which simpler, non-metaphorical factors can explain the existing evidence (IJzerman & Koole, 2011; McGlone, 2007). Yet one point of agreement among most theories is that they predict concrete-to-abstract effects: cognitive representations of concrete concepts (e.g., physical space) can influence how perceivers judge stimuli on semantically-distant abstract concepts (e.g., power; Landau et al., 2011). Our goal is not to distinguish among social-cognitive theories but to instead identify the generalizability of a phenomenon predicted by most of these theories: location of a stimulus on the vertical plane influences perceivers' abstract judgments of that stimulus. Specifically, we aim to identify the generalizability of such effects.

Questions about the generalizability of conceptual metaphor effects (Citron & Goldberg, 2014; IJzerman & Koole, 2011; Klein et al., 2018; Lakens et al., 2011; McGlone, 2007) have generally centered on whether the findings of specific studies generalize to other participant samples. In our view, however, any given finding should be considered within the broader network of research findings on individual metaphor effects. With respect to social-spatial associations, evidence from several different paradigms suggests that people associate conceptions of power with the vertical plane. For example, words related to power (e.g., teacher, master) were identified as "powerful" more quickly when they were located high (than low) in space (T. W. Schubert, 2005; Wu et al., 2016). In other studies, people were judged to be especially dominant when placed up on a pedestal (Schwartz, Tesser, & Powell, 1982), powerful animals were judged to be more dominant and higher in status when placed high on a screen (T. W. Schubert, 2005), CEOs were judged to be more dominant and powerful when placed higher in space than their subordinates (Giessner & Schubert, 2007), and the high or low status of exemplars were judged more quickly and accurately when located in congruent vertical locations (i.e., high status exemplars located higher than low status exemplars (Von Hecker et al., 2013). Conversely, in one Many Labs replication study (in which each participant completes many studies in a single session), judgments of CEOs' dominance and power were *not* influenced by the vertical locations of those CEOs (Klein et al., 2018; unlike Giessner & Schubert, 2007). Accordingly, there may be variability across samples in the extent to which participants attribute power to CEOs from locations in organizational charts. In our view, however, the broader network of findings currently support the theory that people judge things to be more powerful when those things appear high versus low on the vertical plane.

Exact study replications across participant samples provide tests for one specific form of generalization—generalization across participant samples. However, *when* issues of generalizability are important (see Mook, 1983), those issues are not limited to generalizability among participant samples. For example, Brunswik (Brunswik, 1949, 1955; Brunswik & Kamiya, 1953), Campbell and Stanley (1963), and others (Gigerenzer & Goldstein, 1996; Hursch, Hammond, & Hursch, 1964; McArthur & Baron, 1983) argue that the scientific generalizability of study findings critically depends on the extent to which study procedures and materials represent what people *typically* encounter in their lives. Ecological theories of perception (Brunswik, 1955; E. J. Gibson & Pick, 2000; J. J. Gibson, 1979; McArthur & Baron, 1983; Tolman &

Brunswik, 1935) are especially relevant to the current work. These theories emphasize that people typically encounter stimuli against a rich backdrop of visual and social noise, and that a crucial task for perception is to identify the "distal" (often, abstract) characteristics of a stimulus from amidst this noise. For example, perceivers may use the concrete characteristic of spatial location to evaluate the extent to which a stimulus person is powerful and dominant but only when other visible cues to power (e.g., clothing, scene, nonverbal posture) are held constant. For example, spatial location may have little or no influence on social judgments in the social contexts perceivers *typically* encounter, as target persons in these contexts vary in the clothes they wear, the scenes in which they are situated, and in the body postures and other visible cues to power and dominance that they exhibit.

It is also possible that spatial location *does* influence power judgments in noisy and frequently encountered visual environments. According to Conceptual Metaphor Theory and extensions of it, thinking about power requires perceivers to bring to mind concepts of spatial location so whenever people judge others' power they may draw from the spatial location of a stimulus—even when faced the stimulus is located in a noisy and rich complexity of the environment: simply bringing power concepts to mind during judgment may prioritize the perception and use of spatial parameters in perception. Second, the balance of evidence suggests that the influence of spatial location on power judgments is robust to different paradigms and stimuli. In Study 1, we therefore examined whether vertical location of a person would influence judgments of that person's power amidst the visual and social complexity typical of social contexts.

2. Social-spatial associations: conduits for cultural reinforcement?

To the extent that the effects of spatial location on social judgment generalize to typical and complex social environments, they may have important downstream consequences for how those environments shape social cognition. *Typical* social environments are those that many people frequently encounter. Accordingly, the composition of typical environments may exert culturally-widespread influences on perceivers' beliefs. For example, to the extent that perceivers encode women's and men's locations in typical environments, they may incidentally activate and encode the corresponding power inference along with other encoded information (e.g., perceived gender). Paired encoding of power and social category (e.g., gender) may strengthen or weaken perceivers' beliefs about the power and dominance of those social categories (e.g., women vs. men).

People have a variety of beliefs associated with power, including beliefs about who has power. For example, people believe that supervisors and men are more powerful than interns and women, respectively. These beliefs may be represented in human memory, such as stereotypes that men are more powerful and have more dominant personalities than women (Bailey & Kelly, 2015; Eckes, 2002; Fiske, Cuddy, Glick, & Xu, 2002; Prentice & Carranza, 2002; Rudman & Glick, 2001; Rudman, Greenwald, & McGhee, 2001; Spence & Buckner, 2000). We pursued the hypothesis that social environments may reinforce stereotypes of power through social-spatial associations. Specifically, we examined if seeing covariation between gender and spatial location would cause perceivers to endorse gender stereotypes of power.

2.1. Social construction of gender stereotypes

Feminist theorists have frequently argued that people's gender stereotypes reflect what they have learned from the social environment, rather than from inherent beliefs about differences between women and men (de Beauvoir, 1949; Eagly & Karau, 2002; Eagly & Steffen, 1984; Friedan, 1963; Steinem, 1983; Wollstonecraft, 1792). For example, Social Role Theory suggests that perceivers learn that women are nurturing because perceivers more frequently encounter women than men in nurturing roles (e.g., "housewife", "maid"; Eagly & Steffen, 1984). In this way, perceivers learn gender stereotypes through encounters with the social environment. Social Role Theory and other theories that regard the social construction of gender roles are built, in part, on more basic assumptions about how people process social information. For example, Social Role Theory assumes that people draw dispositional inferences about women and men from their role-driven behavior and in this way the theory builds on well-supported assumptions about social information processing (i.e., correspondence bias; Wood & Eagly, 2012) to explain how social environments reinforce gender stereotypes.

We take a similar approach here. Basic assumptions about how people use conceptual metaphor in social information processing may help to explain how social environments reinforce gender stereotypes of power. To the extent that people conceptualize power by their understanding of spatial locations, they may conceptualize gender stereotypes of power by their understanding of where women and men are typically located in space. Accordingly, people may believe that men are more powerful than women to the extent that their social environments typically locate men higher than women. We hypothesized that gender stereotypes of power would be reflected in the vertical plane of common social environments (i.e., in visual media; Hypothesis 2), and would be reinforced via exposure to those environments (Hypothesis 3).

2.2. Do typical environments include covariation between gender and vertical location?

Hypothesis 2 is not a direct test of Conceptual Metaphor Theory per se, but it was motivated by that theory. Specifically, CMT assumes that the way the human mind structures and processes information influences a wide range of behaviors, such as the phrases we use in speech and the environments that we create for ourselves. This idea is central to Conceptual Metaphor Theory analyses of language, which suggest that the way source-targets are mapped in human memory is cause—not consequent—of common linguistic metaphors (Lakoff & Johnson, 1980, 1999; Landau et al., 2010). Yet source-target concept associations in human memory should not *only* be reflected in the language we use but also in the physical properties of the environments we construct (e.g., buildings, art, mass media). Accordingly, people may place images of men higher in space than images of women because such spatial selections reflect conceptual mappings of power onto space.

Conceptual Metaphor Theory presents only one of several mechanisms that may cause men to be located higher than women in culturally-distributed visual media. For example, people perceive more masculinity in a face when it has a high (vs. low) location (Lamer, Weisbuch, & Sweeny, 2017). To the extent that people prefer scenes that are familiar or prototypical (Reber, Winkielman, & Schwarz, 1998; Schnall & Clore, 2004a; Zitek & Tiedens, 2012), they may place images of men higher in space than images of women. Hence, metaphor may be unnecessary to explain any relationship between a person's gender and their spatial location in common environments. We do not aim here to disentangle the processes that would *cause* men to be located higher in space than women in common visual media—we instead focused on the hypothesis that an environmental association between the vertical plane and gender is prevalent in American visual media (Hypothesis 2).

2.3. Do gender stereotypes draw from social-spatial associations?

Hypothesis 3 suggests that observing covariation between vertical position and gender reinforces the belief that men are more powerful and dominant than women. This effect should only occur to the extent that perceivers map their concepts of power onto the semantically-distant concept of spatial location. Nonetheless, the effect could occur through at least two distinct but not mutually exclusive routes. First, covariation between verticality and gender may exert its effects on

perceivers as they *retrieve* information about the power/dominance of women and men: when making explicit judgments about the power and dominance of women (or men), people may recruit from their spatial representations of women (or men). To the extent perceivers have recently seen men higher in space than women, they would recruit from spatial representations that cause them to think that men are more powerful than women.

A second possibility is that people incidentally *encode* information about a woman or man's power during the process of encoding a person's spatial location. This exemplar-based information may then generalize to representations of women and men in general. To the extent that seeing people in high or low spatial positions causes perceivers to immediately activate concepts of high or low power, respectively (for an analogous analysis of cleanliness and morality, see Lee & Schwarz, 2012), repeatedly seeing men high in space may cause perceivers to strengthen their cognitive association between men and power. At the time of judgment, this changed representation is retrieved. Other pathways are possible as well but the main point for our purposes is that each of these speculative mechanisms requires the perceiver to map gendered concepts of power onto gendered concepts of verticality. This effect should be considered metaphorical to the extent that concepts of power and location are semantically-distant (Landau et al., 2011). More generally, we predicted that seeing men in high spatial locations and women in low spatial locations (vs. the opposite) would cause perceivers to more strongly endorse the view that men are more powerful and have more dominant dispositions than women (Hypothesis 3).

3. Cultural snapshots

We hypothesized that (1) perceivers draw inferences of power from a person's location in the complex noise of typical social environments, that (2) a person's location and gender covary in typical social environments, and that (3) perceiving such covariation causes perceivers to strengthen their gender stereotypes of power. Collectively, these three hypotheses represent our proposal that gender stereotypes are reinforced through the vertical plane of culturally-distributed visual media. Such effects would have widespread implications for how gender stereotypes are maintained within a widely-distributed population. Tests of these hypotheses require a method that allows generalization from the stimulus sample to culturally-distributed visual environments—put differently, the stimulus sample should be *representative* of what a large population frequently encounters.

For perceivers to learn from patterns of spatial elevation as we have hypothesized in Hypothesis 3 especially, they must engage cognitive operations that have not been previously examined in the context of social-spatial associations. First, there is little evidence that the spatial locations of individual people can influence stereotypes about social categories. Evidence to date suggests that social-spatial associations influence social judgment through short-term memory: activation of a concrete concept influences perceivers' abstract evaluation of an exemplar (Giessner, Ryan, Schubert, & van Quaquebeke, 2011; Sanna, Chang, Miceli, & Lundberg, 2011; T. W. Schubert, 2005; Wu et al., 2016). Conversely, we have argued that repeated pairings of men (women) with high (low) spatial position may influence cognitive representations of gender stereotypes. Stereotypes are presumably stored in long-term memory (Hilton & von Hippel, 1996; Sherman, 1996) and as described above, so social-spatial associations must influence these stereotypes by altering how information about spatial location is encoded in memory (e.g., as power) or by altering long-term memory representations of men's and women's typical locations. In either case, support for Hypothesis 3 would suggest that social-spatial associations influence long-term memory representations.

Second, information about gender and spatial location (even if encoded with respect to power, see above) must accumulate *over time* because covariation can only be observed across occurrences. Put differently, support for Hypothesis 3 should only emerge if perceivers track covariation of gender and location over time. Theories of perception and judgment in the ecological tradition (Brunswik, 1956; Bullock & Todd, 1999; J. J. Gibson, 1979; Gigerenzer, 2004; Hammond & Stewart, 2001; McArthur & Baron, 1983) suggest that perceivers should indeed track covariation, and these theories provide a framework to understand how people change their beliefs in response to such covariation. A common tenet among these theories is that human minds adapt to the complex statistical structure of their environments. Such adaptation is not simple, since people live in uncertain environments. When people see a woman or man, they see them amidst colors, textures, edges, objects, buildings, symbols, weather, and so on. The nearly infinite array of cues have certain probabilistic associations with each other (Hursch et al., 1964), with each of many distal variables (Tolman & Brunswik, 1935), and with gender. For example, we've suggested that people learn about the abstract traits (i.e., power) of women and men by perceiving covariation between gender and concrete vertical location. Yet the locations of women and men along the vertical plane may be noticed but not encoded into long-term memory, especially when locations must be encoded amidst the many other cues, perceptual features, and objects in a scene. Learning gender-location associations thus requires that people track the specific relationship between gender and location (or power implied by location) across time and different types of noisy scenes. Accordingly, in the current work, we examine if people learn about the abstract traits of men and women from gender-location covariation across the complex, rich, and interrelated social scenes that people frequently encounter. Representative design is necessary for testing this idea.

Representative design is critical to our goals in another way: correlations between features may depend on the presence or absence of still other features. For example, covariation may emerge between gender and verbal interruptions, such that women are interrupted more often than men, but only in the context of certain other features (e.g., conference tables, formal clothing, outside the home). Conversely, a correlation of features may also emerge *across* contexts. The persistence of covarying features across domains increases the number of people exposed to them, and the frequency with which any single person sees these features together (assuming each person frequents different social contexts). For example, men tend to be paid more than women, regardless of the domain (e.g., nursing, teaching, business; Hegewisch, Williams, & Harbin, 2012). Hence, in the current work, we measure genders and locations in oft-encountered social scenes, but we also measure features which may potentially moderate the association between gender and location.

We use a methodology termed *cultural snapshots* (Pauker, Brey, Lamer, & Weisbuch, 2019; Weisbuch, Lamer, Treinen, & Pauker, 2017) to examine (a) if the relationship between vertical location and gender constitutes a social pattern that appears across social scenes and (b) if this social pattern is a *plausible cause* of widespread gender stereotypes. Because we examine social patterns across environments that are encountered by widely-distributed population, we refer to them as *cultural patterns* (see Weisbuch et al., 2017). The cultural snapshots methodology requires us to use identical materials to identify and manipulate these cultural patterns in real social scenes, so as to achieve truly representative design. Cultural snapshots are recordings drawn from scenes that are seen repeatedly by many people in their day-to-day lives, such as television programs, urban street corners, or magazine pages. For example, in 2014, US adults reported reading (on median) 7.3 magazine issues per month. There are nearly 300 million magazine subscriptions in the US alone and on average, people read about half of the pages in a magazine (*Consumer magazines*, 2014; *Magazine release standards*, 2011; Nielsen, 2015).[1] Accordingly, any pattern that appears across the pages of all or most magazines is likely to be seen several

[1] We surveyed 300 Mechanical Turk workers to ask about the percentage of a magazine's pages that they looked at after picking it up (M = 46% of pages).

hundred times monthly (or more) by many Americans. This fact underscores the practical significance of results from the experimental studies we report below, where we examine how limited exposure to gendered vertical positioning in magazine pages influences participants' gender stereotypes. This experimental model exposes people to a very small dose of a pattern that they more frequently encounter in daily life. Accordingly, even small statistical effects in the experimental model reflect practically-meaningful effects on cognition.

4. Study 1

Study 1 examined the causal influence of vertical space in magazines on impressions of social power. Although prior research has established that people seem to associate vertical space with power (e.g., T. W. Schubert, 2005; Schwartz et al., 1982; Von Hecker et al., 2013), it is not clear that vertical space is utilized by perceivers to infer power in natural scenes. When placed amidst the perceptual and social noise of real images, and real magazine pages, vertical position may fail to influence inferences of power. Perceivers may neglect vertical space in favor of other, more obvious cues to power, such as work-role or posture. Although vertical location is a necessary feature of any magazine image, it is not clear that perceivers utilize this cue in drawing impressions of the women and men in those noisy images.

In Study 1, we also examined the role of *absolute* spatial location in impression formation. Most previous studies examining vertical spatial cues measure attributions of power and dominance for one target placed high or low *in relation* to another target (e.g., Schubert, 2005). Given that magazine pages far more often include a single image than multiple images (see Footnote 5), it was important to test if vertical spatial location of a single target would sufficiently influence impressions of power. Thus, we here examined the extent to which individual women and men pictured in magazines are believed to have more power when they are depicted high versus low on a page.

4.1. Methods

4.1.1. Stimuli

We used pages from three popular US magazines (*Time, People,* and *National Geographic*: total circulation ≈ 66 million in 2018) to generate a set of experimental stimuli in which women and men are depicted high or low on the page. One way to do so would be to simply sample magazine images featuring a perceived woman or man. However, that strategy introduces potential confounds—for example, we might unintentionally select more images of women depicted in work roles (e.g., teaching a class) low (vs. high) in space and/or more images of men depicted in work roles high (vs. low) in space. To avoid these and other possible confounds, we collected real magazine images and edited each page to create a pair of stimuli. Specifically, we selected 84 pages (42 women, 42 men) from 3 magazines (i.e., *Time, National Geographic,* and *People*). We then created two versions of each page by relocating the image to a high position or to a low position. Each pair was thus *identical* aside from whether the image on the page was placed in a high or low spatial location (see Fig. 1).

Pages were selected to ensure that images of women and men were well-matched on race, age, emotion, posture, frequency in work roles, page type, horizontal placement, and image size. Accordingly, we conducted a series of chi-square and independent samples *t*-tests to confirm similarity across pages featuring women versus men.[2] As intended, female and male targets in the selected magazine pages were of similar perceived race, $X^2(1, N = 90) = 0.05$, $p = .822$; perceived age, $X^2(3, N = 90) = 3.15$, $p = .369$; displayed similar affective valence, $t(88) = 0.49$, $p = .624$; displayed similar posture (standing vs. sitting/kneeling/laying vs. unclear), $X^2(2, N = 90) = 2.27$, $p = .322$; were depicted in work roles with similar frequency, $X^2(1, N = 90) = 0.74$, $p = .389$; and were depicted in advertisements and stories with similar frequency, $X^2(1, N = 90) = 0.19$, $p = .664$. Women and men were also placed equidistant from the left edge of the page, $t(88) = 0.42$, $p = .677$; and took up similar area on the pages, $t(88) = 0.08$, $p = .936$.

From these 168 images, we created two counterbalanced conditions each with an equal number of high and low images of women and men. Each counterbalancing condition included the same 84 magazine pages, with 42 pages with images of women and 42 pages with images of men. Thus, each image was presented in the high position in one condition and in the low position in the other condition. Neither condition included systematic covariation between gender and vertical position. In summary, the experimental manipulation of spatial elevation included two counterbalancing conditions with identical image content but for the vertical location of each target.

4.1.2. Participant coders

Coders were recruited from Amazon's Mechanical Turk and were paid for their participation. The study was approved by the institutional review board at the University of Denver. The experiment was conducted through Qualtrics® software. The sample consisted of 205 participant coders (51% women), including 158 White, 18 Black, 10 Latina (o), 17 Asian, 1 Native American, and 1 mixed-race participants ranging in age from 18 to 82.

4.1.3. Procedure

Participant coders were randomly assigned to see one of two counterbalancing conditions and to one of two rating questions. Each image was presented for 5 s and was replaced by the rating question. By virtue of random assignment, coders either indicated the degree to which “this person has power and status” or the degree to which “this person has a dominant personality” (1, *Not at all,* to 7, *Extremely*). There were between 48 and 54 coders in each condition. We report all measures, manipulations, and exclusions for this study.

4.2. Results

Cross-classified mixed models were estimated to examine whether the vertical location of the target ratings influenced perceived power, status, and dominance. Mixed models were estimated in R (R Core Team, 2017) with the lme4 package (Bates, Maechler, Bolker, & Walker, 2015) using Satterthwaite approximate degrees of freedom (i.e., lmerTest;Kuznetsova, Brockhoff, & Christensen, 2017).[3] Ratings were analyzed as a function of target gender (woman (1) vs. man (−1); contrast-coded), target location (high (1) vs. low (−1); contrast-coded), rating type (dominance (1) vs. power (−1); contrast-coded), and all possible interactions. Random intercepts of and stimuli subject were included in the model.[4] The predicted effect of target location was significant, $b = 0.04$, $se = 0.01$, $t(16840) = 4.26$, $p < .001$, such that targets were rated as more dominant and powerful when their image

[2] There were 4 pages that inadvertently featured > 1 target. Therefore, analyses were conducted on all 90 targets (*n* of Women = 45) across the 84 pages.

[3] Significance testing with mixed effects models can be calculated several different ways. In this case, we estimated degrees of freedom using Satterthwaite's procedures which are based on the number of participants rather than groups (Satterthwaite, 1946). Degrees of freedom may vary substantially within the same model based on which effect is evaluated. The Satterthwaite method has demonstrated reliability in mixed effects models with sufficient sample sizes and low Type I error rates (Manor & Zucker, 2004). See Kuznetsova, Brockhoff, and Christensen (2017 for more information on the implementation of this estimation procedure in R.

[4] Including random slopes exceeded what the data could reliably estimate in Studies 1 and 2. We therefore report all models with random intercepts. Computations run using the simR package (Green & Macleod, 2016) indicated that observed power was 100%, 95% CI [92.89, 100.00]. R code provided in supplementary online materials.

Fig. 1. Example of page edited to have target low or high on the page.

appeared high in space ($M = 4.26$, $SD = 1.00$) than when their image appeared low in space ($M = 4.17$, $SD = 0.99$). There was a trending effect of gender, $b = -0.17$, $se = 0.11$, $t(82.00) = -1.55$, $p = .125$, such that men ($M = 4.39$, $SD = 0.99$) were regarded as more powerful and dominant than women ($M = 4.05$, $SD = 0.98$). We did not observe a significant interaction between gender and location, $b = 0.01$, $se = 0.01$, $t(16840) = 0.50$, $p = .620$, suggesting that the effect of location on perceived power was similar for women and men. There was also a large and significant effect of rating type, $b = -0.22$, $se = 0.05$, $t(202.00) = -4.48$, $p < .001$, such that ratings of dominance were higher ($M = 4.44$, $SD = 0.91$) than ratings of power and status ($M = 4.00$, $SD = 1.16$). There was an interaction of target gender and rating type, $b = -0.02$, $se = 0.01$, $t(16840) = -2.00$, $p = .046$, such that men, $b = -0.40$, $se = 0.10$, $t(201.99) = -4.07$, $p < .001$, and women, $b = -0.48$, $se = 0.11$, $t(202.00) = -4.51$, $p < .001$, were rated as higher on dominance than power, though this effect was larger for women than men. Finally, there was a marginal interaction of target location and rating type, $b = 0.02$, $se = 0.01$, $t(16840) = 1.93$, $p = .054$, such that targets were rated as significantly more powerful, $b = 0.06$, $se = 0.01$, $t(8379) = 4.55$, $p < .001$, and non-significantly more dominant, $b = 0.02$, $se = 0.01$, $t(8382) = 1.61$, $p = .107$, when located high (power: $M = 4.06$, $SD = 1.16$; dominance: $M = 4.46$, $SD = 0.93$) than low (power: $M = 3.93$, $SD = 1.17$; dominance: $M = 4.41$, $SD = 0.90$) on the pages.

We conducted an additional analysis to examine participant gender as a moderator.[5] Ratings were analyzed as a function of target gender (woman (1) vs. man (−1); contrast-coded), target location (high (1) vs. low (−1); contrast-coded), participant gender (same as target on page (1) vs. different than target on page (−1); contrast-coded), and all possible interactions. The predicted effect of target location remained significant, $b = 0.04$, $se = 0.01$, $t(16760) = 4.24$, $p < .001$, such that targets were rated as more dominant and powerful when their images appeared high in space than when their image appeared low in space. The only other effect to emerge was a two-way interaction of target location and participant gender, $b = 0.02$, $se = 0.01$, $t(16760) = 1.98$, $p = .048$, such that the effect of vertical location on power and dominance ratings was larger when people rated targets of the same gender ($b = 0.06$, $se = 0.01$, $t(8239) = 4.40$, $p < .001$) than of the other gender ($b = 0.02$, $se = 0.01$, $t(8240) = 1.63$, $p = .104$). The three-way interaction of target location, participant gender, and target gender was not significant ($b = -0.005$, $se = 0.01$, $t(16760) = -0.46$, $p = .645$) suggesting that the verticality effect was similar for female and male participants' ratings of women and men on the pages.

4.3. Discussion

Perceivers attributed more power to individuals when those individuals were depicted high (versus low) in magazine pages. Thus, even amidst the considerable visual and social noise that exists within magazine pages and images, perceivers utilized vertical position to draw abstract inferences of power. Additionally, the effect of vertical spatial cues on perceptions of power was present even though only a single target appeared on each page. The vertical position of an image influenced perceivers' individual-level power attributions, and equally for images of women and images of men. An alternative hypothesis may have been that vertical location would only impact ratings of men because masculinity is traditionally associated with power and dominance (Hoyt & Burnette, 2013; Rudman & Glick, 2001). However, given evidence that manipulations of power and status impact perceptions of both women and men (Eagly & Steffen, 1984; Schmid Mast, 2010), we expected a main effect and we saw no evidence of a significant interaction. This study was especially important in that it provides support for the idea that—with images prevalent in mass media wherein a single person frequently appears—individuals presented higher in space are attributed greater power (Schubert, 2005). This study suggests that social-spatial associations influence perceptions of power independent of target gender. This is consistent with the expectation, drawn from CMT, that vertical location would be important to evaluating an individual's power even when those individuals are located in rich and noisy social environments. Furthermore, inferences of power were based on absolute vertical location suggesting that these effects may derive from more complex abstract associations between vertical location and power than previously thought (see General Discussion for more on this).

[5] One participant who identified as gender non-conforming was removed from these analyses.

5. Study 2

To identify cultural patterns (social patterns seen repeatedly by many people), we coded a large, representative sample of magazine pages. Years ago, Brunswik and Kamiya (1953) argued that images in popular magazines provide a convenient and representative sample of scenes from the universe of conditions to which people are often exposed. Even with regular access to the internet, the average US consumer reports reading magazines for about 18 min every day. In fact, 56% of the population report having read a print version of a magazine in the past week, and 92% of Americans aged 18 or older report regularly reading or looking through magazines (*Magazine release standards*, 2011; Rosenstiel & Mitchell, 2012; *US Media Audience Demographics, 4th Annual Edition*, 2017; Zenith, 2016). We used predetermined rules to sample pages from popular magazines targeting a range of audiences. For each page, we measured and coded a variety of variables for the target person, the target image, and the page itself. We hypothesized that, on average, images of women would be placed lower than images of men. Furthermore, we examined whether this pattern would arise across magazines targeted at different audiences and across different contexts, such as those associated with perceived race, work role (yes or no), perceived emotion expression, vertical posture (standing or not), page type (ad or story), and the section of the magazine.

5.1. Methods

5.1.1. Magazine selection

To select magazines, we limited our search to the 50 most widely-circulated US magazines in 2011. We eliminated magazines without a high availability of human images (e.g., we excluded *Better Homes & Gardens*), with age restrictions on subscriptions (e.g., we excluded *AARP The Magazine*), and without national American distribution (e.g., we excluded *AAA Going Places,* which is distributed in only 7 states). We categorized the remaining magazines based on readership: magazines with primarily female readership (i.e., > 65% of readers were women), magazines with primarily male readership (i.e., > 65% of readers were men), and magazines with a relatively even distribution (i.e., between 35% and 65% of readers were women/men). Within each readership category, magazines were chosen from various genres (e.g., lifestyle, celebrity news, business) to ensure breadth. Thus, a selection of magazines with primary female readership (*Oprah, Cosmopolitan, Parenting, People,* and *US Weekly*), magazines with primarily male readership (*Game Informer, Maxim,* and *Sports Illustrated*), and general interest magazines (*Entertainment Weekly*, *Money*, *National Geographic*, and *Time*) were selected. We would expect findings from this broad sample of magazines to therefore generalize to the population of popular American magazines.

5.2. Page and issue sampling

5.2.1. Time of sample

A complete year of magazines (2011) was selected for measurement. By using an entire year, we were able to avoid season-specific or magazine issue-specific phenomena while also collecting a large sample of images.

5.2.2. Issue sampling

Pages were sampled from the 12 above magazines using pre-determined rules. Six issues were selected (every other month) from each of the 12 magazines. Whether the even or odd months were selected was counterbalanced by magazine. If the magazine was weekly, only one issue was selected from any given month to equate the sampling process for the monthly magazines; in this case, the issue was randomly selected. The length of each issue ranged from 60 pages (e.g., *Entertainment Weekly*, *Sports Illustrated*) to 230 pages (e.g., *Cosmopolitan*, *Oprah*).

5.2.3. Page sampling

Each issue was then divided into five equal sections by page number to ensure that neither early nor late pages were oversampled and to examine any gender-location correlations across the magazine (i.e., whether gender-space correlations were smaller or larger depending whether the image appeared earlier or later in the magazine).[6] For example, if the January edition of *Oprah* had 150 pages, the magazine was split into five equal sections of 30 pages each (i.e., pages 1–30, pages 31–60, and so on). Within each section, a pair of pages was sampled. We sampled the first page on which a single image of a woman was shown and the first page on which a single image of a man was shown. If both images (i.e., woman and man) did not exist within a given section, we did not take measurements from that section for either gender. Instead, another issue from the year 2011 was selected and both images were measured from the same section of that issue. For some magazines (e.g., *Sports Illustrated, US Weekly*), issues were exhausted before the quota of measurements could be filled (see Results for detailed information on the magazine sample).

5.2.4. Measurement of location

Spatial elevation in magazines was measured in several ways. First, *overall vertical location* of a woman or a man on a page was measured in millimeters as the distance from the top of the page to the vertical center of the pictured person. The vertical center of the person was defined as half the distance from the top of the body (typically top of the head) to the bottom of the body (often the feet). Given variation in page dimensions among different magazines, overall vertical location is expressed as a proportion of page length. For example, a score of 0.47 would indicate that the target person is located a little less than halfway down the page from the top. This measure corresponds to the position of a woman or a man on a magazine page as a whole.

We also sought to examine the extent to which spatial elevation is reflected in (a) the position of an image on the page and/or (b) the position of a target person within an image. One or both may contribute to a gender-location association and thus be observed by magazine readers. To identify where an image featuring a woman or man appeared on the page (i.e., what we will refer to as *image location*) we measured the distance from the top of the page to the vertical center of the image and expressed this distance as a proportion of page length. To identify where a target appeared within the image (i.e., what we will refer to as *target location*) we measured the distance from the top of the image to the middle of the target and expressed this distance as a proportion of image length. Notably, the fact that men are taller than women—on average—may help to explain vertical target location but not vertical image location.

5.2.5. Vertical size and restriction of range

More generally, the fact that men are taller than women (on average) is typically offset by the tendency for female bodies to be emphasized over male bodies in magazines. Put differently, female bodies tend to be larger than male bodies when in magazines (Archer,

[6] A pretest on a randomly-selected 10% of magazine pages revealed that 72% of pages with images had only one image and 73% of images included a single person. The vast majority of images and pages thus contained a single person, which was fortunate for representative sampling purposes, as this type of image is free from factors that could interfere with data interpretation. For example, multiple-person images include both mixed-gender and same-gender groups (which may differ in their depiction), include anywhere from 2 to dozens of people (which women/men to measure?), and multiple-image pages introduce dependence (spatial placement of one person depends on other images and other people in the image). The year-long sample of magazine issues provided a large enough database of images for us to isolate the relationship between spatial location and individual gender, exclude the minority of pages with images of multiple people, and avoid some interpretive issues associated with dependence.

Iritani, Kimes, & Barrios, 1983; Dodd, Harcar, Foerch, & Anderson, 1989). However, the vertical size of an image or depicted person can restrict and even eliminate variability in vertical location, limiting the possibility that any variable (here, gender) influences vertical location. For example, an image that consumes 95% of the vertical length of a page can be moved up or down considerably less than an image that consumes 30% of a page. As images and bodies increasingly consume vertical space, they have less space to move up or down and therefore less variability in vertical location. Consequently, as images and bodies increase in size, restriction of range should decrease the likelihood that a gender difference is observed in vertical location. To examine this possibility, we coded the proportion of vertical page space consumed by the target person (*vertical size*; $M = 0.58$, $SD = 0.31$) and the image (*image size*; $M = 0.69$, $SD = 0.33$). We examine these variables as moderators.

5.2.6. Covariates and moderators

Ecological approaches emphasize the complexity of scenes and contexts, such that spatial location may be a valid cue to gender but only in specific contexts. We coded a number of variables that may impact or be associated with gender-location correlations. The following variables were all considered as covariates and moderators.

5.2.7. Magazine audience

We categorized each magazine according to whether the audience was primarily (> 65%) women, primarily (> 65%) men, or general.

5.2.8. Page location

The first pages of a magazine typically include an extended table of contents and large advertisements. The last pages of a magazine can often include extensive advertising and/or game sections that limit the size of images. Hence, different criteria may influence image placement on these pages. We thus referred to the original page selection criteria and coded whether a page was in the first 20%, second 20%, and so on.

5.2.9. Page context

Women are more likely than men to be pictured in the context of magazine advertisements whereas the reverse is true for magazine stories (Fink & Kensicki, 2002; Hatton & Trautner, 2011; Reichert & Carpenter, 2004; Reichert, Larnbiase, Morgan, Carstarphen, & Zuzwirn, 1999; Soley & Kurzbard, 1986). If story images appear higher in space than advertising images, page context would be a confound with gender, and could thus explain a correlation between gender and location. An advanced research assistant thus coded whether an image occurred in an advertisement or story.

5.2.10. Perceived race of target person

To the extent that different gender norms are associated with different racial identities (Browne & Misra, 2003; Landrine, 1985; Pyke & Johnson, 2003), it is possible that the apparent race of a target person would be confounded with gender and influence spatial location. Two independent coders separately identified the perceived race of each individual appearing in an image. The following codes were used: of African descent, of Asian descent, of American descent, of Hispanic descent, of European descent, of Middle Eastern descent, or of unclear descent. Percent agreement was calculated as an indicator of reliability (89%) and a third independent rater's codes were used to resolve disagreements. Any remaining disagreements in which all three coders provided different responses (2%) were resolved through discussion.

5.2.11. Work role of target person

Traditional gender roles regard men as wage-earners and women as homemakers (Eagly & Steffen, 1984; Stone & Lovejoy, 2004) and these gender roles may be exhibited in magazine images. If so, then to the extent that people in work settings are depicted higher in space than other people, work role might explain a gender-location correlation in which men are located higher in space than women (i.e., *male spatial elevation*). Indeed, a number of images in our sample included people in work roles. Consequently, each image was coded according to whether the target person was or was not depicted in a work role. Two independent coders separately identified whether each of the 634 targets appeared in an occupational role with the following codes: Yes, No, Unclear. Percent agreement was calculated as an indicator of reliability (91%) and independent codes from a third rater were used to resolve disagreements. Remaining disagreements in which all three coders provided different responses (1%) were resolved through discussion.

5.2.12. Target person affect

There is evidence that women tend to exhibit more positive affect than men (Hall, 1984; Hall, Carter, & Horgan, 2000; Hecht & LaFrance, 1998). To the extent that people exhibiting positive affect are depicted higher in space than other people (Lakoff & Johnson, 1999; Meier & Robinson, 2004; Schnall & Clore, 2004b; Wapner, Werner, & Krus, 1957) and to the extent that most of these joyous people are women, it is possible that affect would moderate male spatial elevation, causing *female* spatial elevation in images of happy people. Two independent raters identified each of the 634 individuals as expressing one of the following codes: Happy, Sad, Angry, Fearful, Disgusted, Neutral, Other. Due to low rates of several emotions, we simplified specific emotion ratings into valence (Positive, Neutral, Negative) and then percent agreement was calculated as an indicator of reliability (74%). Codes from a third rater were used to resolve disagreements and any remaining disagreements in which all three coders provided different discrete emotions (6%) were resolved through discussion. Most disagreements regarded the perception of neutrality (Knutson, 1996; Tomkins & McCarter, 1964).

5.2.13. Target person vertical posture

Of magazine images involving people, many are simple face shots. Among images that depict other parts of the body as well, it is often possible to determine whether the target person is standing, sitting, or lying down. We coded such vertical posture for several reasons. It is possible that the relationship between gender and vertical posture will be similar to that between gender and overall vertical location, in that both vertical location and posture are associated with power (Tiedens & Fragale, 2003; Weisfeld & Beresford, 1982; Weisfeld, Bloch, & Ivers, 1983) and both regard the vertical axis of space. However, we did not expect vertical posture to account for male spatial elevation because many magazine images include only faces and because we expected the location of the *image* (not just the target person within the image) to play a role in male spatial elevation. Nonetheless, it was important to test vertical posture as a covariate (and moderator). Two independent coders separately identified vertical posture of the 634 target persons as: Unclear (face/shoulders only), Standing, Sitting, Kneeling, Lying Down, Other. Due to low counts of individuals who were kneeling or lying down, we translated those into simplified codes (Standing, Not Standing, Unclear) and then percent agreement was calculated as an indicator of reliability (91%). Codes from a third rater were used to resolve disagreements and remaining disagreements in which all three coders provided different responses (1%) were resolved through discussion.

5.3. Results

The initial sample included 634 images (317 women). However, some of these images were of pre-adolescent children, including a number of infants whose gender could not be clearly identified. Although results do not meaningfully change with exclusion of these images, we excluded them to maintain a dataset that was not contaminated by gender ambiguity. Consequently, our conclusions are limited to images of adolescents and adults. The final sample included 561 images (283 images of a woman). No magazine contributed > 60

Fig. 2. An illustration of average vertical placement of women and men in magazines analyzed in Study 2.

images or < 20 images to this final sample. We report all measures, manipulations, and exclusions for this study.

5.3.1. Gender-location associations in American magazines

We hypothesized that men appear higher on magazine pages than women. To account for location variance in each magazine, mixed models were again estimated in R (R Core Team, 2017) with the lme4 package (Bates, Maechler, Bolker, & Walker, 2015) using Satterthwaite approximate degrees of freedom (i.e., lmerTest; Kuznetsova, Brockhoff, & Christensen, 2017). To examine whether gender impacted where a target appeared on the page, overall vertical location was analyzed as a function of target gender (women (1) vs. men (−1); contrast-coded). The random intercept of magazine was included in this model. Data were analyzed using linear mixed models with random intercept of magazine. Gender had a significant effect on overall vertical location ($b = 0.02$, $se = 0.01$, $t(554.10) = 2.70$, $p = .007$) such that women appeared significantly further from the top of the page ($M = 48\%$ from the top of the page, $SD = 16\%$) than did men ($M = 44\%$ from the top of the page, $SD = 17\%$) consistent with male spatial elevation (see Fig. 2).[7] This same pattern emerged after excluding the 47 images for which the target person's body consumed the entire vertical space of a page, $b = 0.02$, $se = 0.01$, $t(59.43) = 2.42$, $p = .019$. Within this smaller sample, male spatial elevation grew stronger as bodies consumed less page space, $b = -0.02$, $se = 0.01$, $t(513.99) = -2.03$, $p = .043$: the simple effect of gender on overall vertical location was strong when the target occupied a small amount of vertical space, $b = 0.03$, $se = 0.01$, $t(513.02) = 3.22$, $p = .001$, but absent when the target occupied a large amount of vertical space, $b = 0.004$, $se = 0.01$, $t(512.00) = 0.34$, $p = .736$. This interaction is consistent with the idea that range restriction presents a measurement obstacle to identifying male spatial elevation in magazines. More generally, male spatial elevation was observed in popular American magazines and became stronger with increases in the space available to move depicted men and women up or down.

5.3.2. Male spatial elevation: image location and body location

Male spatial elevation in magazines may owe to gender differences in where images of women and men are located within a page, or where women and men are located within images, or both. Similar to overall vertical location, a multilevel model revealed a significant effect of target gender on image location ($b = 0.02$, $se = 0.01$, $t(552.90) = 2.44$, $p = .015$) such that images of women appeared significantly lower on the pages ($M = 46\%$ from the top of the page, $SD = 14\%$) than images of men ($M = 43\%$, $SD = 16\%$). With respect to target location, gender did not have a significant effect on where a body was located within the *image*, $b = 0.003$, $se = 0.004$, $t(552.80) = 0.92$, $p = .357$. However, there was a significant effect of gender on image size ($b = 0.05$, $se = 0.01$, $t(553.89) = 3.44$, $p < .001$) such that, consistent with prior objectification studies (Archer et al., 1983; Dodd et al., 1989; Hatton & Trautner, 2011; Konrath & Schwarz, 2007), images of women were significantly larger ($M = 74\%$ of page height, $SD = 31\%$) than images of men ($M = 65\%$ of page height, $SD = 34\%$).

In summary, gender is not predictive of where a person appears within an image suggesting that male spatial elevation in magazines is driven more by image location within a page than body location within an image.

5.3.3. Male spatial elevation: is it redundant with other cues?

To examine whether or not a variable accounts for male spatial elevation, we entered the variable together with gender in a multilevel model predicting overall vertical location. If the variable accounts for male spatial elevation, the main effect of gender should be substantially reduced as compared to a multilevel equation without covariates [see above: $b = 0.02$, $se = 0.01$, $t(554.10) = 2.70$, $p = .007$].

None of the examined variables explained male spatial elevation. Specifically, in separate regression equations, gender remained a significant predictor of overall vertical location after accounting for (1) page type (story vs. ad): $b = 0.02$, $se = 0.01$, $t(556.10) = 2.71$, $p = .007$; (2) perceived race: $b = 0.02$, $se = 0.01$, $t(543.59) = 2.59$, $p = .010$; (3) work role: $b = 0.02$, $se = 0.01$, $t(551.60) = 2.90$, $p = .004$; (4) target person affect: $b = 0.02$, $se = 0.01$, $t(508) = 2.78$, $p = .006$[8]; (5) vertical posture: $b = 0.03$, $se = 0.01$, $t(361) = 3.39$, $p < .001$; (6) page number: $b = 0.02$,

[7] Computations run using the simR package (Green & Macleod, 2016) indicated that observed power was 80%, 95% CI [66.28, 89.97]. R code provided in supplementary online materials.

[8] We encountered singularity issues in the mixed effects models either controlling for or moderating by target affect and vertical posture that prevent us from using the estimates produced by the models. Therefore, we report analyses in these models as fixed effects models and exclude random effects.

se = 0.01, $t(552) = 2.70$, $p = .007$; or (7) magazine type: $b = 0.02$, *se* = 0.01, $t(553.12) = 2.70$, $p = .007$. Finally, we included all of these variables as covariates in a single mixed model equation. In this equation, overall vertical location remained a significant predictor of target gender, $b = 0.03$, *se* = 0.01, $t(312.10) = 3.54$, $p < .001$. In short, the gender-location correlation was not explained by any of the examined covariates.

5.3.4. Male spatial elevation: moderator variables

To examine whether or not a variable moderated male spatial elevation, we included the interaction between this variable and gender in a mixed model equation predicting overall vertical location. If the variable moderates male spatial elevation, the interaction term should be statistically significant. Male spatial elevation was not significantly moderated by (1) page type (story vs. ad): $b = 0.01$, *se* = 0.01, $t(554.50) = 1.34$, $p = .181$; (2) perceived race: $b = 0.003$, *se* = 0.01, $t(547.99) = 0.37$, $p = .711$; (3) work role: $b = 0.01$, *se* = 0.01, $t(538.20) = 1.30$, $p = .196$; (4) target person affect: $b = -0.01$, *se* = 0.01, $t(507) = -1.08$, $p = .281$; or (5) page number: $b = -0.01$, *se* = 0.01, $t(550.15) = -0.93$, $p = .355$; but was marginally moderated by (6) type of magazine: General vs. Women's: $b = -0.02$, *se* = 0.01, $t(552.13) = -1.88$, $p = .060$; General vs. Men's: $b = 0.003$, *se* = 0.01, $t(548.44) = 0.24$, $p = .812$; and (7) vertical posture: $b = 0.02$, *se* = 0.01, $t(360) = 1.98$, $p = .050$. Interested readers should see Supplementary Materials for more detailed description of these analyses.

The general pattern of data suggests that male spatial elevation is relatively robust to different types of scenes, such as stories and ads, targets of different races, targets with different emotions, early and late magazine pages, and so on. There were trends that suggested, however, that male spatial elevation may be stronger in contexts associated with high power and status. For example, male spatial elevation was non-significantly stronger in the context of stories than in ads, work-roles than non-work roles, and for people who are standing versus sitting, kneeling, or laying (interested readers see Supplementary Materials).

5.3.5. Additional data analyses

The supplementary materials contain descriptions of data that are of potential interest to readers. There we describe inferential tests of whether depictions of women and men differ on each of the moderator variables, provide descriptive statistics for the overall vertical location of women and men in each specific magazine, and detail the covariate/moderator analyses.

5.4. Discussion

Male spatial elevation was consistently observed across popular American magazines. Additionally, male spatial elevation could not be explained by a wide variety of other cues, such as the location of the image in the magazine issue, whether the image occurred in the context of a story or an ad, whether the person in the image appeared to be of a minority versus majority race, whether or not the person in the image was in an occupational setting, nor the emotion expression of the person in the image. In short, male spatial elevation was consistently observed in popular American magazines.

The effect size associated with male spatial elevation may be small (Chen, Cohen, & Chen, 2010), but it is not trivial, given its practical significance. Adult Americans report reading or looking at magazines regularly and frequently despite the prevalence of social media and internet-based information (*Magazine release standards*, 2011; Nicholas, 2018; Rosenstiel & Mitchell, 2012; *US Media Audience Demographics, 4th Annual Edition*, 2017; Zenith, 2016). In fact, beyond print magazine subscriptions—which become *more* likely once people visit a magazine website (e.g., Kaiser & Kongsted, 2012)—people purchase magazines at kiosks, read magazines in waiting rooms, and browse magazines at supermarkets and bookstores. Popular magazines average about 250 pages per issue, with images appearing on about 90% of those pages, so on average, any given magazine issue can be expected to have about 150 pages with a single image of a woman or man (see Footnote 2). The number of pages per magazine combined with the frequency of print magazine reading among Americans (2.72 issues monthly; Nicholas, 2018) suggest that in practical terms, Americans see a considerable amount of male spatial elevation monthly, even if only through magazines and despite the statistically-small effect size.

The design of Study 2 enabled us to collect data regarding male spatial elevation and to examine possible explanatory and moderating variables. Male spatial elevation accrued via the placement of images rather than the placement of people within images. Specifically, we observed an effect of image location but not of body location on target gender. Hence, male spatial elevation took place within the magazine page rather than within a magazine image. Second, male spatial elevation is independent of several other media-based gender biases, such as gender biases in depictions of emotion expression (Birnbaum & Croll, 1984; Masse & Rosenblum, 1988), work role (Bartsch, Burnett, Diller, & Rankin-Williams, 2000; Craig, 1992; Glascock, 2001; Signorielli & Bacue, 1999; Signorielli, Kahlenberg, Signorielli, & Kahlenberg, 2001), or prevalence in ads versus stories (Fink & Kensicki, 2002; Hatton & Trautner, 2011; Reichert et al., 1999; Reichert & Carpenter, 2004; Soley & Kurzbard, 1986). Finally, male spatial elevation may be stronger in some contexts than others, specifically those that may be associated with power and status.

We have argued that collective perception of covaration between gender and location leads to collective beliefs about the abstract traits of women and men. Study 1 provided evidence that seeing individuals high vs. low in space causes perceivers to regard them as powerful and dominant vs. powerless and submissive. Study 2 provided evidence for the collective perception of a pattern in which images of men are consistently located higher in space than images of women. It is thus plausible that repeated exposure to the gender-location cultural pattern (i.e., male spatial elevation) causes perceivers to believe that men are more powerful and dominant than women.

6. Studies 3A-3G

We test this hypothesis with an experimental model that has several key characteristics. First, given the vast array of visual features (e.g., color, texture), objects and artifacts, behaviors and expressions, and so on that characterize any scene and the context (magazine page), it cannot be assumed that perceivers spontaneously encode gender and location into long-term memory. For this reason, it was critical to expose people to gender-location associations amidst the noise in which those associations typically appear (in this case, magazine pages). Although these magazine pages were not presented in perceivers' homes, at grocery store lines, or other contexts, our paradigm can be compared to one in which perceptual and social noise is artificially removed from each scene, such that only a face and/or body is visible (for example) and located high versus low on a computer screen. In these contexts, the association between gender and location may be especially likely to be encoded: by simplifying the learning task from one that represents real scenes and context to one that isolates the person from scene and context, the less externally-valid method may be more likely to exert statistically-large effects on perceivers' beliefs. However, this method fails to approximate the challenges that perceivers face in learning from typical environments. By presenting women and men in-scene (image) and in-context (magazine page), we aim to model the complex statistical environments faced by perceivers. In so doing, we aimed to minimize methodological features that limit the generalizability of observed effects to typical environments.

A second feature of our experimental model is that it proscribes experimental methods and is therefore limited in its ability to approximate long-term exposure to magazine images. For practical reasons, exposure in the current experiment was decidedly short-term and limited to about 80 images. Given the thousands of images of people that

Table 1
Sample size details for Studies 3a-3g.

Study	*N*	Gender		Age			Race								Exclusions
		Women	Men	*M*	*SD*	Range	Asian	Black	HispanicLatinx	Middle Eastern	Native American	White	Multi- racial	No Response	*n*
3a	112	55	57	31	14	18–72	12	7	5	1	0	76	10	1	4
3b	174	123	51	20	3	18–46	20	6	19	1	2	118	4	4	3
3c	104 (153)	70	34	19	1	18–22	8	1	3	0	0	89	3	0	14
3d	238	165	73	20	1	18–29	29	3	17	1	1	173	10	4	23
3e	102 (153)	64	38	20	2	18–30	15	1	6	0	0	77	3	0	10
3f	59 (89)	42	17	19	1	18–23	8	0	2	1	1	40	3	4	4
3 g	84 (127)	65	19	19	1	18–22	4	3	5	0	1	65	4	2	8
Total	873 (1046)	584	289	21	3	18–72	96	21	57	4	5	638	37	15	66

Note. Participants were excluded if they a) did not complete the study, b) had completed the study previously, c) experienced extreme technical difficulties (e.g., completed dependent variables before, rather than after, independent variable), or d) were younger than 18. Numbers listed in parentheses refer to the sample size including the participants assigned to an exploratory control condition. All samples included university students with the exception of Study 3a which was comprised of both university students (27%) and local community members recruited via Craigslist (73%).

Americans see in media over a week or month and given that we present those very images in their original context, even statistically-small causal effects are likely to be indicative of meaningful, long-term influences on Americans' beliefs about women and men.

With these methodological features in mind, we set to test our hypotheses regarding reinforcement of gender stereotypes. Specifically, we examined whether repeated exposure to the gender-location cultural pattern could cause perceivers to believe that men are more powerful than women.

6.1. Internal meta-analysis

Experiment 3 is comprised of seven studies with the same experimental manipulation and a nearly-identical outcome measure. These studies were conducted over several years, due to practical limitations to subject pool size combined with avoidance of web-based samples (to ensure participants' sustained attention during magazine exposure). These limitations made it impractical to run individual studies that were fully powered for a small effect size. We elected instead to run individual studies that included slight variations to procedures and measures, in anticipation that a procedural change might yield a larger effect size. Ultimately, these seven studies revealed a reliable but statistically-small effect with the same outcome measure.

Following recent advice (e.g., Cumming, 2014; Goh, Hall, & Rosenthal, 2016), we thus report an internal meta-analysis of those studies. This advice is based on the observation that measurement error, common to all psychology studies, will lead to considerable variation in effect size across studies (e.g., Stanley & Spence, 2014), and other variables—including the use of separate samples—lead to further variation (Cumming, 2014). Internal meta-analyses are based on effect sizes from multiple samples and should therefore provide more reliable information about the true effect size. This approach may be especially useful for small (but practically-meaningful) effect sizes, for which attaining sufficient a priori power requires prohibitively large sample sizes. The internal meta-analysis presented below provides an approximate effect size for how exposure to the gender-location associations influences perceivers' beliefs about women and men.

6.1.1. Overview

Participants were randomly assigned to view multiple magazine pages, each with an image of a man placed high in space or an image of a woman placed low in space (*male spatial elevation* condition) or alternatively, to view magazine pages with an image of a woman placed high in space or an image of a man placed low in space (*female spatial elevation* condition). We refer to this manipulation as *gendered spatial elevation*. Following this manipulation, participants rated women and men (separately) for traits of powerfulness and dominance. In addition to this measure included in all studies, individual studies included idiosyncratic measures. All measures, manipulations, and exclusions in the studies are disclosed here or in the Supplementary Materials.

6.1.2. Participants and setting

Participants recruited from undergraduate psychology classes received extra credit. Community participants recruited from a classifieds-website received pay. The experiment was conducted on computers using MediaLab© software (Jarvis, 2012), with each computer located in its own room. Sample sizes ranged from 59 to 238 (67% women; 75% white; see Table 1).

6.1.3. Manipulation and procedure

Each experimental condition included a set of magazine pages (from Study 2) where targets of one gender were consistently displayed higher than targets of the other gender. In the male spatial elevation (MSE) condition, images of men were located high on the magazine pages and images of women low on magazines pages (manipulated as in Study 1; see Fig. 1). In the female spatial elevation condition (FSE), images of women were located high on magazine pages and images of men were located low on magazine pages. Each magazine page included only one image, and half of the images in each condition were of women and half were of men. The vast majority of the images were consistent with condition (e.g., images of men located high on MSE condition pages) but to introduce variability (as occurs in real magazines), a minority of the images were inconsistent with location (e.g., images of men located low on MSE condition pages). A critical aspect of the experimental manipulation was the degree of control—the same pages were shown in both conditions, and the only difference was whether the image appeared high or low on the page.

In each study, participants were randomly assigned to the female spatial elevation or male spatial elevation condition. Participants saw many magazine pages (for up to 5 s) and rated each on “aesthetic appeal” (most studies) or another dimension (see Table 2). After rating all of the magazine pages in their condition, participants were asked (via computer) to participate in a separate questionnaire study. All participants continued and completed the primary measure of gender stereotypes (described below). Finally, they completed demographics questions before being thanked and debriefed (and paid if community participants). There were minor departures from the standard procedure and manipulation in each study, and these are presented above in Table 2.

6.1.4. Primary outcome

In each of the seven studies, our primary outcome was a difference

Table 2
Experimental manipulation details.

Study	Total magazine pages	% of pages consistent w/condition	Cover story ratings	Page exposure time	Control condition[c]
3a	84	85	Aesthetic Appeal	2 s	No
3b	84	85	Aesthetic Appeal	2 s	No
3c	84	85	Aesthetic Appeal OR Target Dominance[a]	2 s	Yes
3d	80	100	Target Gender[b]	Until Response *(Median RT = 709 ms)*	No
3e	78	87	Aesthetic Appeal	5 s	Yes
3f	84	85	Aesthetic Appeal	5 s	Yes
3g	80	80	Target Gender[b]	Until Response *(Median RT = 723 ms)*	Yes

[a] In a study ostensibly on "impressions of people in magazines", participants rated targets in magazine pages for personality dominance.
[b] In a study ostensibly on "judgments of people in magazines", participants identified gender (woman/man) of targets in magazine pages.
[c] The control condition was intended to be a combination of MSE and FSE conditions but due to experimenter error, this balance was not achieved and several confounds (e.g., story vs. ad) remained.

score measure regarding gender stereotypes of power and dominance. These difference scores were computed by standardizing ratings of women and subtracting them from standardized ratings of men (i.e., higher scores = more stereotyping). Our difference score measure was modeled after the Bem Sex Role Inventory (Bem, 1974; BSRI). The BSRI includes 40 traits relevant to gender stereotypicality (20 feminine, 20 masculine) and 20 gender-neutral traits. Participants typically rate *themselves* on these traits but the BSRI has also been used to measure gender stereotypes, in which participants rate "women" and "men" (separately) on each of the 60 traits (e.g., Powell & Butterfield, 1979; Spence & Buckner, 2000; Weisbuch, Beal, & O'Neal, 1999). For each trait, a difference score is calculated between beliefs about women versus men. We followed this logic and thus computed difference scores for trait adjectives associated with power and dominance.

In two studies (Studies 3a and 3b), we drew those adjectives directly from the BSRI. In these studies, we selected the trait adjectives "submissive" and "yielding" (feminine), as well as "dominant" and "has leadership abilities" (masculine). Using a 7-point scale from 1, *Never or almost never true*, to 7, *Almost always true*, participants indicated the extent to which women or men behave in those ways (e.g., "Men, in general, are submissive."). Some BSRI traits, however, may not be regarded as indicative of power and dominance. For example, participants may interpret "leadership abilities" with respect to several traits including stereotypically feminine traits (e.g., nurturance, empathy). These traits need not be equivalent to personality dominance, and although "yielding" is an antonym of "dominant," it may not be understood as such by all participants due to its relative rarity. Thus, in all but one study (Study 3b), we focused more explicitly on the terms "dominant" and "powerful". Participants simply indicated the extent to which they believed women or men exhibit power and dominance (e.g., "women, in general, have dominant personalities") on a 7-point scale (from 1, *Never or almost never true*, to 7, *Almost always true*).

In some studies, the wording of the power/dominance questions was slightly altered. In Studies 3a and 3f, we added "in the United States" at the conclusion of the items (e.g., "Women, in general, have dominant personalities in the United States"). In Studies 3d, 3e, and 3 g, we aimed to limit any socially-desirable responding by requesting ratings of what "most people" think (e.g., "Most people think that women, in general, have dominant personalities"; see Krueger, 1996) and ratings of women and men were embedded among ratings of other groups (e.g., teachers, white people; see Eagly, Mladinic, & Otto, 1991). Finally, in Studies 3d and 3 g we *additionally* asked participants to provide summary ratings (on power and dominance) regarding the men and women they had actually seen in the magazine pages. These slight alterations in question wording did not produce significant heterogeneity across studies. A test of homogeneity (i.e., Q_{within}) suggest that the effect sizes observed in the seven samples fall within those expected from a normal sampling variation, $\chi^2(6) = 2.62$, $p = .854$.

In all studies, scores on the "woman" items were standardized and subtracted from standardized scores on the corresponding "man" items, and then aggregated. Positive difference scores indicated endorsement of gender stereotypes: the belief that men exhibit more power and dominance than do women.

6.1.5. The self and exploratory measures

Additional exploratory measures varied from study to study. In the initial study (Study 3a), an exploratory purpose was to examine if exposure to the gender-location association would extend to self-evaluations and a non-significant effect was consistent with this idea, leading to several other studies that included self-oriented measures. Additionally, in a few of the samples, we piloted new measures for use in future work and although those measures were not primary to the current work, we report the effects of the experimental manipulation on them. Details and analyses are presented in the Supplemental Materials. However, this article is focused on gender stereotypes and the primary dependent measure described above.

6.2. Results

We examined the extent to which gendered spatial elevation influenced participants' beliefs about women's and men's dominance and power in each of the studies. To do this, we meta-analyzed the seven experiments ($N = 873$) using random effects (Goh et al., 2016). Following procedures described by Goh et al. (2016) for combining and comparing effect sizes, we observed a small but reliable effect of gendered spatial elevation as indicated by a one-sample *t*-test of the mean effect size against zero, $M\ d = 0.20$, $t(6) = 3.59$, $p = .012$, two-tailed: exposure to male (vs. female) spatial elevation caused participants to endorse stronger gender stereotypes of power and dominance.[9] As illustrated in Fig. 3 and detailed in Table 3, effect sizes ($-0.04 < d < 0.42$) across studies yielded a relatively narrow 95% confidence interval [0.08, 0.32] centered on $d = 0.20$. Sensitivity analyses were conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) and indicate the minimum detectable effect (with 80% power) given sample size and alpha (i.e., .05; see Table 3). A fixed effects test of the overall effect was also significant, $d = 0.14$, $Z = 2.10$, $p = .035$, two-tailed. We report meta-analyses by rating type (i.e., ratings of power or dominance; ratings of women or men) and gender of participant (i.e., woman or man) in the supplementary analyses.

6.3. Discussion

A reliable but small effect emerged across seven samples. Seeing male spatial elevation in real scenes caused participants to endorse gender stereotypes of power and dominance. As we have argued, the small size of this effect should be considered against the context in

[9] An achieved power analysis in G*Power (Faul et al., 2007) revealed that meta-analytzed sample permitted 0.84 power.

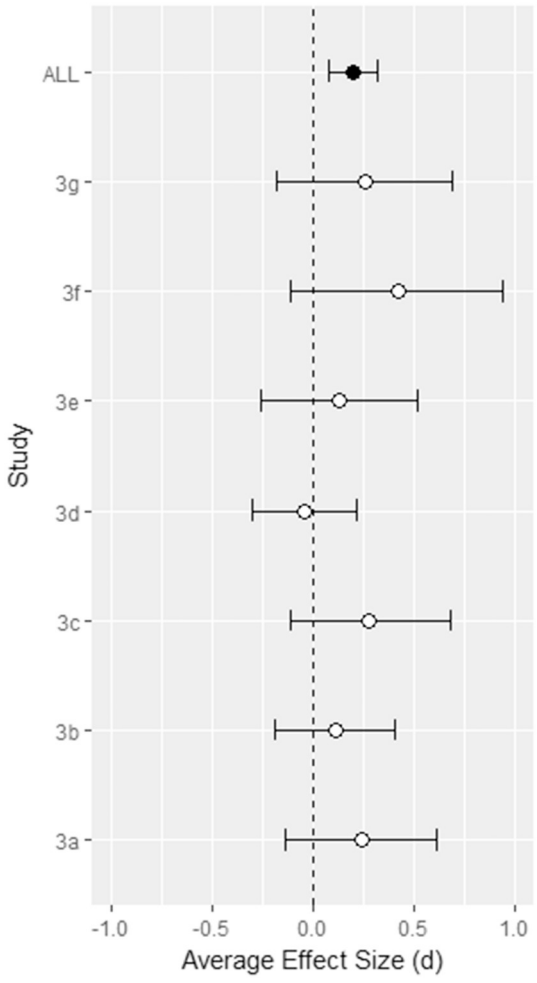

Fig. 3. Average effect size (i.e., Cohen's *d*) by study.

Table 3
Results for Studies 3a-3g.

	FSE		MSE		*d*	Minimum detectable *d*
	M	*SD*	*M*	*SD*		
3a	−0.10	(0.89)	0.11	(0.88)	0.24	0.53
3b	−0.08	(1.35)	0.07	(1.35)	0.11	0.43
3c	−0.15	(0.95)	0.15	(1.17)	0.26	0.55
3d	0.03	(1.44)	−0.03	(1.21)	−0.04	0.36
3e	−0.04	(0.68)	0.05	(0.65)	0.13	0.56
3f	−0.22	(1.06)	0.19	(0.90)	0.42	0.74
3g	−0.18	(1.40)	0.16	(1.24)	0.24	0.62

which it emerged. Any one magazine page includes a complex array of visual features, objects, behaviors, and expressions, and different pages have quite different arrays of features. Amidst the many potential sources of information in these pages, participants adapted their beliefs to the correlation between gender and location. Additionally, our experiments were necessarily limited in their ability to approximate long term exposure to magazine images and each participant saw no > 84 pages. Yet the average American is likely exposed to several print magazine *issues* in a given month, ensuring that they see hundreds or thousands of images. Given that male spatial elevation occurs across print magazines (Study 1), the statistically-small effect likely reflects a meaningful influence on Americans' beliefs about women and men.

Participants in each of the seven samples encountered the same experimental manipulation but the manipulation varied slightly in its details (e.g., number of pages, cover story). Inspection of those details did not reveal any obvious moderators (variations noted in Table 2). For example, samples that saw "distractor" pages which were counter to the conditional assignment did not exhibit smaller effects than samples that *only* saw condition-consistent pages. We therefore did not conduct more formal tests of these moderators but broader studies of those features (e.g., participants see only 2 pages versus 840 pages) might provide important information about the nature of these effects.

There was an important limitation to Experiment 3. The use of an active task during exposure (participants always rated something) prevents us from concluding that effects we observed were goal-independent. We only have evidence these effects emerge when participants are evaluating something about each page, though in our view perceivers are typically evaluating *something* when they see images or read pages. The limited exposure time for each page was included to limit overall exposure (always < 10 min in total for all pages), to model the experience of magazine readers who flip through pages (e.g., in supermarket lines), and to avoid overexposing participants to paid advertisements (half of the images were ads). Nonetheless, it is a limitation that brief by-page exposure times did not model the experiences of people who read articles and spend considerable time reading each page.

Study 3 also had unique design components which should aide interpretation of the results. First, the use of real mass media content in experimental manipulations typically includes an inherent lack of experimental control. To address this potential lack of control, we used the same media content in both experimental conditions. Moreover, we matched each image of a woman with an image of a man and confirmed that there were no differences in theoretically relevant variables (e.g., race, affect, posture) on the basis of target image gender (see Supplementary Materials). In short, the two experimental conditions were well-controlled with respect to eliminating potential confounding factors. By referring to data from Study 1, we can also confirm that the people shown in Study 3 were regarded as more powerful when their magazine-based image was placed high (versus low) in space. These findings thus suggest that the spatial pattern that characterizes gender in real magazine pages can cause magazine readers to strengthen their gender stereotypes through social-spatial associations.

7. General discussion

In centuries past – and even in the modern era - it has been common for people to believe that men were more dominant and powerful than women. Although modern American magazines do not typically verbalize this sentiment they do depict men in positions that are literally superior to those of women (Study 2). Thus, when encountered in magazines, readers see men in more powerful locations than women (Study 1). Repeated exposure to such socially-prevalent covariation causes perceivers to believe that men, in general, have more powerful and dominant personalities than women (Study 3).

Vertical Space and Social Judgment: Generalizable Effects.

In our view, causal effects are most accurately described and evaluated at the level of operational definitions, rather than at the level of conceptual definition. The latter form of interpretation obscures important contextual features of the methodology that might increase, decrease, or moderate a given effect size. In this case, a magazine picture's vertical location led to changes in perceivers' self-reported judgments of the pictured person's power. Although similar results have been regarded as empirical support for the theory that people draw from spatial concepts to *understand* and *use* power concepts (Landau et al., 2010), we sought to test the more modest hypothesis that a higher (vs. lower) spatial location causes people to be judged as powerful—even when those people are located in rich and complex contexts. This hypothesis is more modest in the sense that it corresponds to an effect, rather than a theory that explains the effect. Though more modest, empirical support for this latter hypothesis has been subject to questions of generalizability from one participant sample to another

(Klein et al., 2018; Lakens et al., 2011; L. Schubert et al., 2013). Yet because the larger body of evidence supports the hypothesis across different paradigms, laboratories, and decades (Dai & Zhu, 2018; Giessner et al., 2011; Giessner & Schubert, 2007; Holmgren et al., 2018; Jiang, Sun, & Zhu, 2015; Lakens et al., 2011; Lu et al., 2017; Meier & Dionne, 2009; Moeller, Robinson, & Zabelina, 2008; Quadflieg et al., 2011; Robinson, Zabelina, Ode, & Moeller, 2008; Schoel, Eck, & Greifeneder, 2014; T. W. Schubert, 2005; Von Hecker et al., 2013; Wu et al., 2016; Zanolie et al., 2012), we sought to test the hypothesis that participants' judgments of power would be influenced by the locations of people in real magazine pages, finding support for this hypothesis and thus for the generalizability of the effect.

We interpret these results as support for the view that the effects of vertical location on power judgments are likely to extend to real-world visual contexts. Of course, it is notable that this study occurred in a psychological laboratory and the magazine pages in Study 1 were presented outside of the context in which they are typically read. We acknowledge that the laboratory setting limits the overall generalizability of the study. However, important elements of the study *were* high in generalizability. First, the Study 1 materials were images that had each been seen by thousands of people (at least) outside of the laboratory. Thus, people commonly seen in magazine images were rated as more powerful and dominant when their image was higher versus lower on the page. Second, the critical stimuli in most prior studies were isolated from the rich and complex visual and social cues typically available to social perceivers. In the current study, the people in the images varied in the clothes they wore, the scenes they appeared, and the bodily postures they exhibited, and the images themselves varied in size, color, lighting, and so on. The images located in real magazine pages, often surrounded by text in varied fonts, discussing varied topics, or else not surrounded by text at all (usually ads). Perceivers of such magazine pages have a tremendous amount of social information available to them, just as they do whenever they perceive other people outside of the laboratory. In these respects, the conditions of the study conform strongly to Brunswik's (1955) guidelines for *representative design*, whereby visual stimuli should not be robbed of their natural context when presented to participants in studies of visual perception, social judgment, and other areas. We thus claim that the current results provide the strongest evidence to date that the influence of vertical position on social judgments extends to typical environments.

It is also our view that scholarly discussions about the generalizability of psychological science have underweighted the importance of each study's external validity. For example, people do not typically see isolated words on computer screens so although studies which use those stimuli may provide valuable internally-valid evidence for theories of social-spatial associations, these studies cannot provide evidence that social-spatial associations play a role in perceivers' judgments of people in *typical* social environments. In fact, some have argued that the importance of theory-testing ultimately rests with how well principles derived from those theory-tests describe how people typically perceive, think, and behave (Mook, 1983). In this respect, the generalizability of the study environment may be an important criterion against which to weight the importance of replications. In fact, generalizability can be achieved largely without reductions in internal validity (e.g., see Cultural Snapshots; Weisbuch et al., 2017) and we believe the current study is a step in that direction.

7.1. Beyond linguistic metaphors: visual metaphor in American magazines

Conceptual Metaphor Theory suggests that linguistic metaphors should be ubiquitous and indeed, research in corpus linguistics suggests that relationships between words are frequently non-literal (Deignan, 2008). However, corpus linguists have been critical of other cognitive-linguistic approaches to examining conceptual metaphor theory. For example, Deignan (2008) writes,

> *From the perspective of the applied corpus linguist, there is a central problem with the language data that many researchers use either to support or refute CMT: they are often invented. The data are generally of two types: they are produced from the researcher's or participants' intuitions, or they are gathered from psycholinguistic experiments, such as testing and comparing participants' reactions to various metaphorical and non-metaphorical language items in invented texts. This applies to many researchers who work tightly within the CMT paradigm, and also more widely to cognitive linguistic research into metaphor. Applied and corpus linguists have known for some years that intuition is not a good guide to language use (for example, Sinclair, 1991, 2004), and it has been shown that sentences invented for the study of metaphor often contain atypical word meanings and lexico-grammatical structures (for example, Deignan, 2005). A further problem is that the invented data tend to consist of single sentences or at best short paragraphs, lacking in context, and therefore sometimes suggesting ambiguity that is rarely present in natural discourse. (*p. 151*).*

Corpus linguists address these issues through quantitative analyses of text databases which can be used to identify linguistic metaphors that are actually common in texts, rather than those assumed to be common by scientists' intuition. Further, corpus analyses can reveal the natural contexts of linguistic metaphors—after all, linguistic metaphors that appear in texts must be part of a broader narrative within a paragraph or section. This quantitative approach can thus be used to examine if, as suggested by Conceptual Metaphor Theory, a given concrete concept (vertical location) is typically used in linguistic metaphor to convey a specific abstract concept (power). Yet this approach is limited in that it applies only to language and may only reflect how people think about language rather than how people think more generally (e.g., McGlone, 2007).

We therefore used an approach analogous to corpus linguistics to examine the metaphorical contents of visual environments created by humans. We theorized that cognitive mappings between abstract and concrete concepts would be reflected in the layout of images in American magazines, just as those cognitive mappings may be reflected in the layout of words in English texts. Specifically, we expected culturally-common visual layouts to locate more powerful people (men) higher in space than less powerful people (women). We analyzed a large representative sample of American magazine pages, measured where a picture of a woman or man was located on the page, and examined several contextual variables that might constrain visual metaphor usage. We found that women's images were placed lower on magazine pages than were men's images, consistent with the theory that the visual layout of magazines reflects metaphorical thinking in the construction of those layouts.

There was little evidence that the gender-location relationship was constrained to specific contexts (e.g., ad vs. story), and as a result, alternative explanations cannot be ruled out. Another possibility is that metaphor played no role whatsoever, and magazine editors simply layout magazines according to their knowledge of height differences between women and men. These competing explanations are currently being examined in experiments examining how people construct environments to contain visual metaphors along the vertical plane (Caccioppoli, Suitner, Lamer, & Maass, 2017). Evidence from these experiments suggests that when threatened, highly identified men put images of masculine objects (e.g., soccer player, lizard) higher than images of feminine objects (e.g., ballerina, kitten; Caccioppoli et al., 2017). Thus, male spatial elevation may occur in typical environments because men put masculine things higher in space when their gender identity it threatened. Indeed, although the sample size of magazines was $N = 12$, the Study 2 data indicates that male spatial elevation was larger in magazines that had male editors ($n = 9$ magazine e.g., *Entertainment Weekly, Money;* $b = 0.03$, $se = 0.01$, $t(58.63) = 3.03$, $p = .004$) than female editors ($n = 3$ magazines e.g., *People, Parenting;* $b = 0.002$, $se = 0.01$, $t(19.78) = 0.18$, $p = .861$).

Another possible explanation for the prevalence of male spatial elevation in magazines is that people or editors simply recreate the patterns that are familiar to them. Indeed, there is evidence that perceptual representations of men and women include spatial locations, such that people literally see more masculinity in faces that are higher in space. People may simply elect to recreate these perceptual representations in their physical space. One measure from Study 3a provides preliminary support for this idea: participants who had recently seen women low on the pages (i.e., in the male spatial elevation condition) placed the names of female CEOs lower in an organizational chart than did those who had recently seen men low on the pages (i.e., in the female spatial elevation condition; see Supplementary Materials for analysis). Thus, it is possible that men are located higher than women in magazines simply because people create physical environments that reflect what they have seen (i.e., they recreate their perceptual representations). It seems likely that multiple mechanisms—perhaps gender-role threat and preferences for familiarity—account for the effects noted in Study 2, though more research is needed to test this idea formally. More generally, this is some of the first (not *the* first) evidence that the visual layout of constructed environments are consistent with the principles of Conceptual Metaphor Theory. We look forward to continued research on if and how people use visual metaphors to construct social environments.

7.2. Cultural reinforcement of gender stereotypes through social-spatial associations

Conceptual Metaphor Theory suggests that people draw from concrete source concepts, like physical location, to understand more abstract target concepts, such as power (Landau et al., 2010). Consistent with this theory, we used the Cultural Snapshots paradigm (Pauker et al., 2019; Weisbuch et al., 2017) to examine whether more powerful people (men) are located higher in space than less powerful people (women) in constructed social environments, and if study participants would respond to this environment by thinking of men as more powerful than women. The findings were consistent with the principles of Conceptual Metaphor Theory: men were depicted higher in space than women in popular magazine pages (Study 2), and Study 3 participants who observed this pattern were more likely (than those who observed the opposite pattern) to believe that men are more powerful than women. These findings suggest that participants' beliefs about gender differences in power were influenced by their recent perceptions of gender differences in vertical locations.

The results of Study 3 are broadly consistent with the theory that people *routinely* draw from conceptions of vertical space to think about power. Most participants (Studies 3a, 3b, 3d, 3e, 3f, and 3 g) were not instructed to encode the magazine pages in terms of dominance or power, and yet seeing men in higher page locations than women caused them to strengthen their belief that men are more powerful than women. Participants did not judge power until after all the magazine pages had been evaluated, and these judgments were about women and men in general (rather than any one exemplar). Accordingly, it seems safe to suggest that participants either encoded women's and men's vertical location (on magazine pages) in terms of power *or* retrieved information about women's and men's vertical locations in order to judge women's and men's power. Either way, women's and men's vertical locations in magazines influenced participants' judgments of women's and men's power *because* these participants spontaneously recruited representations of vertical space to think about power. These findings, coupled with the generalizability of the paradigm, are thus consistent with the theory that participants routinely recruit from representations of vertical space to judge the power of people in general and social groups in particular.

7.3. The vertical plane of space and judgments of power: relative and absolute space?

The findings of Study 1 are consistent with the hypothesis that people can make inferences about power based on absolute (rather than just relative) vertical location—that is, when only a single target is visible at a time. This is a notable departure from prior research. Past studies on the topic have usually employed designs in which a powerful and powerless target appear simultaneously (e.g., “king” above “servant”) on the computer screen (Giessner & Schubert, 2007; T. W. Schubert, 2005). In Study 1 and Study 3, participants saw multiple magazine pages that each featured a single target and their judgments of individual power (Study 1) and group-based power (Studies 3a-3 g) were consistent with the absolute vertical location of images on magazine pages. It is nonetheless possible that participants made implicit comparisons across trials, as each participant rated some pages with images located high and some pages with images located low. Indeed, Lakens et al. (2011) found that it was necessary to have *both* kinds of trials (powerful and powerless) for vertical location to have an effect. Vertical location only influenced judgments of power if, for example, participants judged targets who were located high in space on some trials *and* targets who were located low in space on other trials. The concrete source concept of vertical location was used to infer power, but only when location varied across targets. Given the variation in where people, images, and objects appear along the vertical plane in typical settings, this research suggests that it is likely that vertical location is used as a cue to infer power in these settings.

7.4. Culture and gender stereotypes

Much has been written about the relationship between culture and gender but we were specifically interested in how gender stereotypes are communicated and transmitted. The literature on the transmission of stereotypes often focuses on linguistic communication (e.g., (Lyons & Kashima, 2001, 2003; Maass, Milesi, Zabbini, & Stahlberg, 1995; Wigboldus, Semin, & Spears, 2000). We contribute to this literature by examining nonverbal cues. Further, we examined images likely to be encountered by thousands or millions of people whereas prior work on social transmission has focused on interpersonal communication in which only two or three people directly perceive the available social cues (Kashima, 2000; Lyons & Kashima, 2003). For example, people are more likely to communicate stereotypic than counterstereotypic information when reproducing a story that they have heard—by the time the story has been reproduced by 3 separate people in a chain, it becomes quite stereotypic (e.g., Lyons & Kashima, 2001, 2003). Interpersonal communication clearly helps people to maintain stereotypical knowledge, by interpersonal communication is not the only means through which people communicate with each other. We aimed to examine cultural communication more broadly, by examining the influence of images encountered frequently by many people. This methodological feature is important in that existing research on the socialization of gender stereotypes has focused on either content-analyses of media or closely-controlled experimental studies, but not both. Hence prior studies are limited in their ability to draw conclusions about the *causal* influence of widespread cultural practices on the gender stereotypes of a broadly-distributed population. This is an important limitation, as many feminist theories link those widespread practices to broadly-distributed stereotypes. In the current work we began to address this limitation. The evidence presented in Studies 1–3 is consistent with the theory that gender stereotypes are subtly communicated to a widely-distributed population through vertical locations *and* that this subtly-communicated bias shapes perceivers' endorsement of gender stereotypes—even when the bias is presented in the complexity of its environmental niche (magazine pages).

7.5. An ecological approach to gender stereotypes: the importance of space

When people see women and men, they always see textures, contrast, edges, spatial locations, and other visuospatial features. We broadly reasoned that if any of these cues are utilized by perceivers to infer traits *and* are actually associated with target gender, perceivers may learn that the relevant traits are associated with gender. We focused our efforts here on vertical location and found that vertical location is an ecologically-valid cue to gender (Study 2) that is utilized by perceivers to infer power (Study 1), such that perceivers ultimately learn that men are more powerful than women (Study 3). In this way, we extend prior work on spatial biases (Hegarty, Lemieux, & McQueen, 2010; Maass, Suitner, Favaretto, & Cignacchi, 2009; Maass, Suitner, & Nadhmi, 2014) by reporting evidence that the presence of spatial biases in constructed environment may not *only* reflect stereotypes but also help to transmit them.

The current work also illustrates a theoretically-relevant advance in methodology. At the broadest level, and in agreement with other ecological theories in psychology, Brunswik's insistence that minds adapt to their environment (Brunswik, 1949) is analogous to feminist principles regarding the influence of mass media and other cultural settings on human beliefs about women and men. Yet Brunswik's ideas have rarely been applied to the emergence of stereotypes. This is unfortunate, given that Brunswik's ecological approach (1956) has received considerable interest in several domains of psychological science. For example, judgment and decision-making scholars refer to Brunswik's principles in arguing that an individual's ecology can explain their use of judgment heuristics (Bullock & Todd, 1999; Gigerenzer, 2004). Brunswik is also frequently cited in research on interpersonal communication, where his lens model (Brunswik, 1943, 1952, 1955) is used to explain how proximal cues (e.g., body motion) may be associated with some distal trait (e.g., sexual orientation) and with a perceiver's inference (e.g., of sexual orientation; e.g., Johnson, Gill, Reichman, & Tassinary, 2007). Yet as we've illustrated herein, Brunswik's theorizing can also be used to inform methodologies for examining cultural influences on gender stereotypes and gender roles. Hence, Social Role Theory (Eagly & Steffen, 1984) and other similar theories might be explored through the use of methodologies similar to those employed here.

The second key contribution of Brunswik's theorizing is an understanding of how visual cues, such as spatial location, are situated within a complex and probabilistic landscape of visual and social cues, sometimes referred to as a multi-cue environment (Hammond, 1955; Hursch et al., 1964). Within this environment it is no easy task for minds to adapt to any valid cue to gender (e.g., hair, vertical location), given the attentional and capacity limitations of perception and cognition. For this reason, and to model how people *typically* perceive social scenes, it was important to examine cues in the context in which they systematically vary with gender. We have thus presented a method for accomplishing broad goals of the endeavor to examine how culture shapes gender.

8. Limitations

The environmental association between vertical space and gender may take different forms in different contexts and thus generate rather complex beliefs for frequent visitors to those contexts. Although we observed only two marginally significant moderators in Study 2 (i.e., posture and magazine audience, see Supplementary Materials), some contexts seem less likely than others to include male spatial elevation. For example, male spatial elevation was (non-significantly) stronger in contexts emphasizing power (e.g., occupational contexts). Alternatively, domains in which women are stereotypically superior to men may even reverse the typical gender-location correlation. For example, women's bodies are generally regarded as more aesthetically appealing than men's bodies (Israel & Strassberg, 2009; Rhodes, Hickford, & Jeffery, 2000) and contexts which emphasize the visual appeal of a body might eliminate or reverse the typical gender-location correlation (e.g., ads for lingerie or other contexts in which bodies are objectified; Baker, 2005; Kang, 1997; Lindner, 2004). There were relatively few images with sexually-revealing clothing in Study 2, making a reliable comparison difficult but differences in male spatial elevation across contexts may generate relatively complex belief patterns in observers. The current work should foreshadow research on how three-way interactions between perceptual cues, social categories, and context inform relatively complex belief patterns about women, men, and other social categories.

Another potential limitation in the current study is the small but reliable effect sizes in Study 3. At a superficial level, a reader may interpret these small effects as evidence that the cultural influence of the gender-location association on stereotype transmission is minimal, if reliable. As noted earlier, however, the frequency with which people read magazines suggests that people likely see a large number of images containing women or men on a regular basis, ensuring that a relatively small difference in their vertical placement accumulates over a lifetime, year, month, or week. Study 3 experimentally modeled how accumulated exposure to this pattern might influence viewers' stereotypes. Although this effect was small, a change to viewers' explicit stereotypes after seeing 80 images suggests that exposure accumulated over a longer period of time may have a more substantial influence. Thus, although these studies yielded small effect sizes we believe that these effects have more practical significance than similar studies using less ecologically-valid materials.

Finally, it is possible that participants' tacit beliefs about verticality center on valence. High vertical locations are related to positive mood and affect (Crawford, Margolies, Drake, & Murphy, 2006; Meier & Robinson, 2004, 2006). Therefore, to the extent being powerful is considered more positive than being powerless, participants may rate people in high vertical positions to be powerful. Indeed, there was a tendency to rate pages with targets high as more aesthetically pleasing than pages with targets low (e.g., Study 3a: $t(109) = 2.34$, $p = .021$). However, this bias was unrelated to gender stereotyping in either the female spatial elevation ($r(55) = 0.01$, $p = .955$) or male spatial elevation ($r(51) = -0.18$, $p = .211$) condition suggesting that associations between valence and verticality cannot account for the stereotyping effects observed here. It is therefore possible that social-spatial associations of positivity and power operate independently. It is also possible that people do not perceive power as a positive attribute given that perceptions of dominance tend to elicit negative affect (Driskell & Salas, 2005). Thus, this evidence is most consistent with the theory that what people learn about targets' dominance based on their vertical location is guided by social-spatial associations with power. However, there may be complex interactions of vertical location with other learned associations that render it important to examine the interactive effects of social-spatial associations in future work.

9. Conclusion

The results of these studies are consistent with our hypotheses that (1) people recruit from spatial representations to make power judgments of other people in rich and complex visual environments; (2) Americans are exposed to a pattern in which men are depicted higher in space than women; and (3) exposure to this pattern influences how perceivers think about women and men. Male spatial elevation may be both prevalent and influential in American culture.

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Appendix A. Supplementary online materials

Supplementary online material for this article can be found online at https://doi.org/10.1016/j.jesp.2019.103828.

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