High Cognitive Load During Attention to Images of Models Reduces Young Women's Social Comparisons: Further Evidence Against Cognitive Efficiency

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Abstract

Mental processes that are conducted frequently can become highly cognitively efficient, meaning they can be carried out while we are doing other tasks (i.e., under high cognitive load). Given that young women report frequently comparing their appearance to models in media images, we examined whether such social comparisons are cognitively efficient. Our sample (N = 227) consisted of young women who felt above-average pressure from the media regarding appearance. Cognitive load was manipulated by memorizing either a simple (low load) or complex (high load) sequence of colours from attractive-model or control images. Participants who viewed models under low load compared themselves with the models, and significantly decreased in appearance satisfaction (but experienced no statistically significant change in negative affect). Participants under high load made fewer comparisons and their appearance satisfaction did not significantly decrease. These results suggest that social comparisons are not highly cognitively efficient and instead require cognitive effort.

Keywords: Social comparison; Media images; Body image; Cognitive efficiency; Automaticity; Cognitive load

Introduction

When it comes to evaluating the self, it has been argued that most, perhaps even all, of what we really want to know is relative (Alicke, 2007; Gilbert, Giesler, & Morris, 1995; Mussweiler & Rüter, 2003). A full understanding of how much of some personal quality we have – say, intelligence, happiness, or beauty – or how successful we are – as might be measured by popularity, social status, or wealth – involves knowing what others have and comparing our lot to theirs. So, understandably, making a social comparison, where we compare some aspect of the self to another person (Festinger, 1954), is a common experience. Social comparisons are described as upward when made with those who have more of something than we do, downward when with those who have less, and lateral when with our approximate equals.

Studies using Ecological Momentary Assessment (EMA) show that most young women compare their personal qualities and lifestyles with other people on a daily basis (McKee et al., 2013). With regard specifically to their physical appearance, EMA studies find that, on average, young women make social comparisons several times a day (Fardouly, Pinkus, & Vartanian, 2017; Ridolfi, Myers, Crowther, & Ciesla, 2011), although there is considerable variation in this. Young women who spend a lot of time thinking about, or wanting to be, thin (those high on thin-ideal internalization) and women with higher body dissatisfaction – either as a persistent trait or a temporary state – make upward appearance comparisons more often than other women (Leahey, Crowther, & Ciesla, 2011; Rogers, Fuller-Tyszkiewicz, Lewis, Krug, & Richardson, 2017).

When we do something frequently, it is possible that the process of doing it becomes highly cognitively efficient (Bargh, 1994). A highly cognitively efficient mental process requires few cognitive resources, meaning it can be conducted relatively effortlessly and with little

attention (Payne, 2012). Consider reading, for example. At first, reading takes time, mental effort, and conscious attention. But with practice a skilled reader need only briefly glance at words and their meaning becomes almost effortlessly apparent. Even so, these efficient mental processes can still influence our thoughts and feelings. For instance, a fully literate person effortlessly reading unpleasant things about herself might well experience changes in her self-evaluation and affect.

The present study is the latest in a series assessing the cognitive efficiency of young women's appearance comparisons with media images of physically attractive models. Do these social comparisons ever become effortless, as reading seems to? We examined comparisons with model images for three reasons. Firstly, comparisons with media images of models are relatively common among young women (Fardouly et al., 2017; Ridolfi et al., 2011). Secondly, claims that comparisons with media images are highly cognitively efficient (see Want, Botres, Vahedi, & Middleton, 2015 for examples) outnumber studies that have directly tested this claim. Finally, and most importantly, comparing with such images is thought to be detrimental to young women's satisfaction with their own appearance (Want, 2009), although perhaps only, or especially so, for women already prone to dissatisfaction with their appearance (Ferguson, 2013). How cognitively efficient such comparisons are may have implications for interventions designed to reduce their frequency and effects. In short, the more cognitively efficient comparisons are, the harder they will be to mitigate, just as it is hard to avoid reading words once we have become skilled readers (Stroop, 1935).

If social comparisons are highly cognitively efficient then people ought to make them just as easily whether or not they are currently mentally preoccupied with other tasks (i.e., under high cognitive load). Thus, Payne (2012) argued that evidence of a highly cognitively efficient

process comes when the effects of that process are seen just as strongly, if not more strongly, under high cognitive load as under full, undivided, attention. Gilbert et al. (1995) provided evidence of just this sort for young women's social comparisons with peers. In Gilbert et al.'s Study 1, participants' self-evaluations of ability were affected by seeing a peer perform better or worse than themselves despite participants being under high cognitive load from memorizing an eight-digit number. Gilbert et al. concluded that social comparisons can be conducted "without conscious effort" (p. 234), and in their Study 2 found evidence suggesting that these highly efficient social comparisons can have emotional consequences as well.

However, in other studies (Want et al., 2015; Want & Saiphoo, 2017), young women placed under similarly high cognitive load – again by memorizing a complex eight-digit number (e.g., 59368724) – while viewing media images of models showed no evidence of having compared with them. Specifically, while participants placed under low cognitive load (by remembering the simple eight-digit number, 11111111) experienced an increase in negative affect and a decrease in satisfaction with their own appearance after viewing models, participants under high cognitive load showed no such effects. These later studies suggest that social comparisons with attractive models in media images are inhibited by high cognitive load and are therefore not highly cognitively efficient. However, limitations of these studies may have led to an underestimation of the cognitive efficiency of young women's social comparisons with media images. We address these limitations here.

Limitations of Previous Studies

Participants in the high-load conditions of Want et al. (2015) and Want and Saiphoo (2017) may have been unaffected by the images because they were not paying attention to the images. In those studies, participants memorizing either the simple or complex number were

instructed to pay attention to images of models, but their attention was not directly measured. It is possible that to avoid being distracted while memorizing the complex number, participants in the high-load conditions ignored the images. In the present study, we manipulated cognitive load by asking participants to remember a complex or simple sequence of colours of clothing items worn by the models in the images, effectively forcing participants to pay at least some attention to the images to learn the sequence. An additional benefit of this method is that thinking about an aspect of the models' appearance (i.e., the colour of their clothes) while viewing them may be a more externally valid method of inducing high cognitive load than remembering numbers.

The second limitation of previous studies (Want et al., 2015; Want & Saiphoo 2017) is that the participants came from diverse ethnic backgrounds, yet the models to which they were exposed were all Caucasian women. This potentially underestimated the cognitive efficiency of appearance comparisons because comparisons to Caucasian models may be highly cognitively efficient only for Caucasian women. There is evidence suggesting that non-Caucasian women are less likely to compare themselves with Caucasian models (DeBraganza & Hausenblas, 2010; Jefferson & Stake, 2009; Warren, Gleaves, Cepeda-Benito, Fernandez, & Rodriguez-Ruiz, 2005), meaning that these comparisons are less likely to become highly cognitively efficient for non-Caucasian women. In the present study, we looked for evidence of the cognitive efficiency of social comparisons with media images of models in a sample exclusively of Caucasian women.

Finally, neither Want et al. (2015) nor Want and Saiphoo (2017) included a direct measure of whether social comparisons to models were reduced under high-load conditions compared to low-load conditions. Instead, differences in the amount of comparison were inferred from the differing effects of the images on negative affect and appearance satisfaction between

the conditions. To assess more directly whether high cognitive load inhibits social comparisons with media images, the present study included a self-report measure of the extent to which participants compared themselves to the models.

Thus, in the present research, Caucasian participants were exposed to media images of models (or control images) and asked to memorize either a complex or simple sequence of colours from the images. As in previous studies (Want et al., 2015; Want & Saiphoo 2017), participants' negative affect and appearance satisfaction were measured pre- and post-exposure. Participants also reported how much they compared themselves to the images during exposure. We tested only young women who reported feeling a higher-than-average amount of pressure from the media regarding their appearance, given that these are the young women who most frequently make upward social comparisons to media images in their daily lives (Rogers et al., 2017). They are therefore the people most likely to make comparisons with media images efficiently.

Research Question

If social comparisons are highly cognitively efficient then social comparisons should be unimpeded by high cognitive load and there should be no significant differences between the high- and low-load conditions. That is, participants should report making similar levels of comparisons to, and be similarly detrimentally affected by, the models in the high- and low-load conditions. Alternatively, if comparisons are not highly efficient then only participants in the low-load condition should make comparisons to, and be affected by, the model images.

Method

Participants

The final sample included 227 Caucasian female undergraduate students. To maintain

comparability with samples from previous studies (Want et al., 2015; Want & Saiphoo, 2017) all participants were between 17 and 27 years old and scored 3.75 or above on the Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ-4) Pressures: Media subscale (Schaefer et al., 2015). An additional 43 participants were tested, but their data were excluded. Twenty-two were excluded for failing a manipulation check (see below), and 21 for scoring below the SATAQ-4 cut-off at the end of the study. Demographic information and SATAQ-4 Pressures: Media scores are displayed in Table 1.

Materials and Procedure

Participants proceeded through the study in the following order.

Pre-screen. Early in the semester, potential participants completed the SATAQ-4 (Schaefer et al., 2015) during a pre-screen administered with participant management software. This 22-item scale measures the importance respondents place on appearing thin and athletic, as well as the extent of pressure they feel from peers, family, and the media regarding their appearance. The scale demonstrates good internal consistency and convergent validity with measures of body satisfaction (Schaefer et al., 2015). The Pressures: Media subscale includes four items (e.g., "I feel pressure from the media to improve my appearance") that are rated on a scale ranging from 1 = *Definitely Disagree* to 5 = *Definitely Agree*. The participant management software automatically calculated each respondent's mean score on the Pressures: Media subscale and only those who scored 3.75 or above could sign up for an in-person testing session. This means that, at the time of the pre-screen, all participants felt more than the average amount of pressure from the media regarding their appearance (3.70 for North American women; Schaefer et al., 2015). Participants completed this scale again at the end of their in-person testing session (see below) to double-check they still felt this level of pressure at the time of testing.

Table 1

Mean (SD) age, body mass index (BMI), and SATAQ-4 Pressures: Media subscale score, by condition

Condition	Age	BMI	SATAQ-4 Pressures: Media subscale[a]
Model images, High-load (*n* = 57)	19.21 (2.20)	23.26 (4.72)	4.61 (0.47)
Control images, High-load (*n* = 58)	18.93 (2.17)	22.99 (4.11)	4.55 (0.48)
Model images, Low-load (*n* = 55)	19.00 (2.05)	23.11 (3.17)	4.74 (0.43)
Control images, Low-load (*n* = 57)	18.84 (1.57)	23.89 (4.52)	4.62 (0.46)
One-way ANOVA between conditions	$F(3, 223) = 0.35$, $p = .79$, $\eta_p^2 = .01$	$F(3, 223) = 0.52$, $p = .67$, $\eta_p^2 = .01$	$F(3, 223) = 1.65$, $p = .18$, $\eta_p^2 = .02$

[a] SATAQ scores are from the end of the study, not the pre-screen.

Table 2

Mean (SD) pre- and post-test negative affect and appearance satisfaction scores, by condition

Condition	Pre-test negative affect	Post-test negative affect	Tests of simple effects within condition – negative affect	Pre-test appearance satisfaction	Post-test appearance satisfaction	Tests of simple effects within condition – appearance satisfaction
Model images, High-load (*n* = 57)	34.26 (17.93)	37.06 (15.52)	$p = .09$ $d = 0.17$ [-0.01, 0.35]	46.03 (22.37)	45.26 (23.59)	$p = .34$ $d = -0.03$ [-0.10, 0.03]
Control images, High-load (*n* = 58)	35.56 (19.07)	39.60 (18.79)	$p = .01$ $d = 0.21$ [-0.01, 0.44]	46.75 (20.89)	47.02 (21.53)	$p = .74$ $d = 0.01$ [-0.06, 0.08]
Model images, Low-load (*n* = 55)	36.08 (16.42)	38.12 (15.84)	$p = .23$ $d = 0.13$ [-0.06, 0.31]	43.00 (16.70)	38.68 (17.36)	$p < .001$ $d = -0.25$ [-0.35, -0.15]
Control images, Low-load (*n* = 57)	34.42 (15.95)	33.83 (14.18)	$p = .72$ $d = -0.04$ [-0.21, 0.13]	43.42 (18.62)	44.54 (19.76)	$p = .17$ $d = 0.06$ [-0.04, 0.15]

Cover story and online shopping questionnaire. To reduce demand characteristics, at the start of their in-person testing session, participants were told that the study concerned the effects of mood on memory during online shopping. This gave participants a plausible alternative explanation for the presentation of the measures, the model images, and the cognitive load manipulation. To support the cover story, participants first completed a questionnaire about their online-shopping behaviour and attitudes (based on Jarvenpaa & Todd, 1996). Data from this questionnaire were not analysed.

Visual analogue scales (pre-test). Visual Analogue Scales (VASs; Heinberg & Thompson, 1995) then measured participants' negative affect and appearance satisfaction before exposure to the images. Participants rated how they felt "right now" by moving a slider on a line between 1 and 100, with the end- points anchored with opposing terms. Three negative affect VASs ($\alpha = .73$) were anchored with happy – unhappy, angry – calm (reverse scored), and confident – insecure. Four appearance satisfaction VASs ($\alpha = .90$) asked them to rate their satisfaction with their facial appearance, their weight, and their overall appearance (very dissatisfied – very satisfied) as well as to rate their attractiveness (very unattractive – very attractive). (Three other VASs, measuring alertness, relaxation, and energy, were included but not analysed.) The exact same VASs were used in Want et al. (2015) and Want and Saiphoo (2017).

Images and cognitive busyness manipulation. After the pre-test VASs, participants viewed screenshots from online shopping websites, and were asked to remember the colour of a "target item," indicated with an arrow, from each image. There were four different conditions. In the *model images high-load* condition, participants saw nine screenshots (10 seconds each) from a clothing retailer's website, each showing an attractive, thin, model and the target items were

pieces of clothing worn by the models. For these participants, the target items were each a different colour (e.g., red bandana, yellow dress). In the *model images low-load* condition, participants saw the same nine models wearing the same target items but all the items were the same colour (black bandana, black dress, etc.). In the *control images high-load* condition, the nine screenshots were of accessory items, presented without models, and varying in colour (e.g., red shoes, yellow bag). Finally, in the *control images low-load condition*, the same accessories were shown, each in the same colour (black shoes, black bag, etc.).

The nine models in the images were pre-rated by 15 female graduate psychology students on 1-100 scales (1 = *extremely unattractive compared to the average young female*; 100 = *extremely attractive compared to the average young female*) for the attractiveness of their faces (M = 69.06, SD = 4.92) and bodies (M = 69.71, SD = 3.98). The models were also rated for the thinness of their bodies (1 = *much larger than the average young female*; 100 = *much thinner than the average young female*) (M = 76.71, SD = 6.96).

Manipulation check. Following the images, participants were asked to report the sequence of colours. Because participants from the low-load conditions who mistakenly thought the colours had varied (e.g., black shoes, brown bag) were likely under some cognitive load from trying to remember the sequence, data from participants in these conditions were only included if they reported just a single, repeated colour. Data from 22 participants were thus excluded. In addition, examining the number of errors that participants made in the model images high-load condition served as an exploratory check of the level of the cognitive load they were under.

Visual analogue scales (post-test). Participants then completed the same negative affect (α = .74) and appearance satisfaction (α = .92) VASs as before the images.

Social comparison questions. In the two model-image conditions, participants were

asked to indicate on a 1-100 point line how often they had compared themselves to the models they saw (from *not at all* to *very much*).

Demographic questionnaire. Participants provided their age, height, and weight.

Sociocultural Attitudes Towards Appearance Questionnaire-4 (SATAQ-4). Finally, to confirm their SATAQ-4 subscale scores from the pre-screen, participants completed this scale again ($\alpha = .80$). As previously noted, 21 participants had scores below 3.75 at the end of the study and their data were excluded.

Results

All data are available at https://osf.io/9dz8s/. Descriptive statistics for the dependent variables are presented in Table 2.

Manipulation Check: Model Images High-Load Condition

Of the 57 participants in this condition, 29 (50.9%) reported the sequence of all nine colours without error. Eighteen (31.6%) made one error, such as leaving out one of the colours or transposing it. Ten (17.5%) made more than one error.

Negative Affect

A 4 (Condition) × 2 (Time: pre- vs. post-test) mixed ANOVA, with repeated measures on the second factor, on the mean of the three negative affect VASs, revealed a significant effect of Time, $F(1, 223) = 6.26$, $p = .01$, $\eta_p^2 = .03$. Neither Condition, $F(3, 223) = 0.57$, $p = .64$, $\eta_p^2 = .01$, nor the two-way interaction, $F(3, 223) = 1.41$, $p = .24$, $\eta_p^2 = .02$, were significant.

Appearance Satisfaction

A 4 (Condition) × 2 (Time: pre- vs. post-test) mixed ANOVA on the mean of the four appearance satisfaction VASs revealed a significant main effect of Time, $F(1, 223) = 5.32$, $p = .02$, $\eta_p^2 = .02$, but not Condition, $F(3, 223) = 0.96$, $p = .41$, $\eta_p^2 = .01$. The two-way interaction

was significant, $F(3, 223) = 8.67$, $p < .001$, $\eta_p^2 = .10$. Tests of simple effects revealed a significant decrease in appearance satisfaction from pre- to post-test in the model images low-load condition, but no significant changes in the other three conditions (see Table 2).

Level of Social Comparison

Participants in the model images low-load condition reported comparing themselves significantly more ($M = 57.53$, $SD = 29.74$), than participants in the model images high-load condition ($M = 39.40$, $SD = 32.00$), $t(110) = 3.10$, $p = .002$, $d = 0.58$.

Discussion

Only participants in the model images low-load condition experienced a statistically significant decrease in satisfaction with their own appearance from before to after exposure to the images. This result, in line with Want et al. (2015) and Want and Saiphoo (2017), suggests that social comparisons with media images of models are *not* highly cognitively efficient, and require young women to expend at least some cognitive effort. Participants in the model images high-load condition, mentally preoccupied with memorizing a complex sequence of colours while viewing the models, were less likely to report making social comparisons with them, and showed no significant decrease in appearance satisfaction.

Participants' negative affect did not follow the pattern found in previous studies. Instead of an increase in negative affect in the model images low-load condition (as in Want et al., 2015; Want & Saiphoo, 2017), negative affect appeared to increase most in both of the high-load conditions (see Table 2). Given that this increase in negative affect occurred in both the model images and control versions of the high-load condition, the most parsimonious explanation is that it was the result of the high cognitive load imposed by having to remember the complex sequence of colours, rather than being caused by exposure to media models. In other words,

participants in the two high-load conditions likely felt stressed and unhappy at having to remember the complex sequence of colours.

While partially replicating previous studies, the present study overcomes several of their limitations. Firstly, in the present study, social comparisons to models seemed not to be highly cognitively efficient even though all participants' ethnicity matched that of the models. Secondly, we included an additional direct measure of participants' social comparisons and found they were reported less frequently under high cognitive load. Finally, the manipulation of cognitive load in the present study represents an advance over those from previous studies. In the model images we used here, all models wore clothes that either hugged the model's body (e.g., a bikini or tight dress) or were in close proximity to the model's face (e.g., a bandana). Consequently, asking participants to memorize the colours of the model's clothes entailed attention to at least some aspect of the model's appearance (part of her figure or her face). This helps to diminish differences in attention between the high- and low-load conditions as an explanation for the differing effects of the model images. Nevertheless, attention to the models' clothes is not identical to attention to the model. A future study might complement the present one by encouraging attention to the models more directly. However, using a manipulation of cognitive load in which participants are explicitly told to attend to the whole of the model would likely entail increased demand characteristics. Thus, additional measures to reduce demand, such as the use of more distracting questionnaires or dependent variables, would likely have to be included.

It is worth emphasizing that we imposed a high level of cognitive busyness on participants in the model images high-load condition, as indicated by the fact that only half the participants correctly recalled the exact sequence of nine colours. Memorizing this sequence

meant that participants probably had limited mental capacity left to compare with the images. So, the present research only speaks against a strong version of the claim that social comparisons are cognitively efficient; the claim that they are "effortless" (Gilbert et al., 1995, p. 228; see also Mussweiler & Rüter, 2003, p. 468). We assessed this strong claim because Gilbert et al. (1995) found evidence for it with comparisons to peers and because it has been made for social comparisons specifically with media images (see Dalley, Buunk, & Umit, 2009, p. 47 and Want, 2009, p. 266 for examples). On the present evidence, such a strong claim seems unwarranted. At least some cognitive effort seems necessary for young women to make social comparisons with media images. Future research manipulating cognitive load to varying degrees might determine more precisely the specific amount of effort that is needed. Different degrees of cognitive load might be induced by varying the length and complexity (e.g., number of repetitions) of several sequences of digits or colours to be memorized.

Conclusion

In the present study, we found no evidence that social comparison is an effortless process, at least for young women viewing media images of models. This is despite the fact that all women in the present study reported feeling more than the average amount of pressure from media images regarding their appearance (as measured by the SATAQ-4 Pressures: Media subscale). The implication of the present research is that media images of models only detrimentally affect young women when they devote mental effort to comparing themselves with the models.

People devote mental effort to make social comparisons even when, as is the case with upward comparisons to attractive media models, they sometimes cause lowered self-evaluations. One reason we do so is because comparing ourselves with people we view as relevant –

including people who represent a gold standard of ability or quality that we personally endorse – is one way of understanding our own personal qualities (see arguments in Alicke, 2007; Gilbert et al., 1995; Mussweiler & Rüter, 2003). Given that the young women in the present study all felt above average pressure from the media regarding their appearance, they likely saw the media images of models as relevant exemplars of their personal standards of appearance. It is perhaps no surprise then, that when they were able to (i.e., when not encumbered by high cognitive load), they compared themselves with the models, despite the cognitive effort required to do so.

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