ZOOM USAGE AND COGNITVE LOAD

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Abstract

Self-evaluation during Zoom meetings is suspected to contribute to cognitive load. The current experimental study investigated the effects of having access to view oneself during a Zoom meeting on cognitive load, where participants either did or did not have access to view themselves, while on camera. During the call, cognitive load was assessed through performance on a task. Women in comparison to men, and those high on public self-consciousness, were expected to experience more cognitive load, especially when they could see themselves. The results found that at a low level of public self-consciousness, participants who could see themselves experienced higher cognitive load. Unexpectedly, the opposite occurred at a high level of public self-consciousness; participants who could *not* see themselves experienced higher cognitive load. Further investigation is required to determine the factors contributing to these results. Nonetheless, this work adds to the limited understanding of the psychological consequences of Zoom usage.

Keywords: cognitive load, gender, public self-consciousness, self-evaluation, self view, video conferencing, Zoom, Zoom Fatigue

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It has become appallingly obvious that our technology has exceeded our humanity.

- Albert Einstein

Video conferencing technology became integral in helping individuals continue to work, learn, and socially connect from remote locations during the Coronavirus Disease 2019 (COVID-19) pandemic (Bailenson, 2021). Daily users of Zoom, the leading video conferencing platform, vastly increased from 10 million in December 2019 to 300 million in June 2020 (Iqbal, 2020). The ubiquity of the application has led many to use the word "Zoom" as if it is a verb that is synonymous with the term "video conferencing" (Bailenson, 2021). Thus, for the purpose of this research, Zoom is examined as the video conferencing platform of interest.

Contributors of Zoom Fatigue

Although video conferencing has allowed people to socially connect throughout the pandemic, many feel exhausted from using it (Bailenson, 2021; Massner, 2021; Supiano, 2020). In fact, the term "Zoom Fatigue" has emerged, describing the exhaustion felt from video conferencing (Bailenson, 2021). From this, nonverbal mechanisms have been theorized to be characteristics of Zoom meetings and explanations of Zoom Fatigue, including cognitive load and self-evaluation (Bailenson, 2021).

Cognitive Load

Sweller's (1988) cognitive load theory suggests that working memory has a limited capacity. Moreover, tasks become difficult when the total cognitive effort required to successfully complete them, exceeds available cognitive resources. For example, one study found that the more items to be memorized by participants, the worse their recall performance

was (Backs & Selios, 1994). This study provides a clear example that tasks requiring many attentional resources can overload cognition.

In line with cognitive load theory, it is suspected that communication methods that overload memory likely lead to fatigue. Communication technologies increase cognitive load by transmitting information simultaneously through multiple channels, such as through audio and visual channels (Hinds, 1999). For example, video conferencing allows for various visuals to be displayed, including a live feed of users and/or a shared screen, all while transmitting audio (Hinds, 1999). In contrast, audio-only communication, such as the radio, solely relies on the auditory channel to distribute information (Hinds, 1999).

One study emphasized how multimodal technology increases cognitive load more so than single-modal technology, as it found that those participating in audiovisual calls performed worse on a recognition task, measuring cognitive load, than those on audio-only calls (Hinds, 1999). From these results, it is suspected that those participating in the audiovisual calls had less cognitive resources to distribute to the task, as their attentional resources were used by competing audio and visual stimuli. Similarly, a review on single versus multiple channel media concluded that audiovisual technology requires more effort to process relevant information than media featuring a single channel (Lang, 1995).

In the context of video conferencing, users put in a lot of effort to send signals to other attendees on a call (Bailenson, 2021). This is because nonverbal behaviour is harder to transmit and detect over video conferences than when individuals are in-person (Bailenson, 2021). For instance, individuals on Zoom often exaggerate their behaviour to ensure other attendees on the call both notice and capture their meaning, such as exaggerating a head nod in agreement (Bailenson, 2021). From this, it is suspected that audio-only calls would require less effort on the

part of the users in comparison to video conferencing calls, as nonverbal behaviour is unnecessary in the context of audio calls as individuals do not have access to see one another's physical appearances. From the work mentioned above, it is hypothesized that audiovisual Zoom meetings are associated with higher cognitive load than audio-only calls.

Self-Evaluation

Apart from cognitive load, another nonverbal mechanism that is theorized to relate to Zoom Fatigue is self-evaluation, which is presumably increased on Zoom as users can view themselves on camera while they interact with other attendees (Bailenson, 2021). This increased self-evaluation is likely contributing to cognitive load, as Zoom users' attentional resources are being consumed by evaluating oneself, through their live video feed, thus making it difficult to attend to competing information.

Early theories discussed self-evaluation in forms not limited to technology. Cooley's (1902) looking-glass self theory describes that individuals base their self-worth on how they believe others perceive them. Similarly, Goffman's (1959) self-presentation theory suggests that individuals alter their behaviours to match others' expectations of them. Recently the desire to present oneself in a favourable light was discovered to be cognitively demanding (Vohs et al., 2005) as this requires hyper-monitoring of the self. Fixation on the self divides available attentional resources amongst other important stimuli, in turn leading to exhaustion (Klotz et al., 2018). Similarly, self-presentation, as part of self-control, takes much effort and energy and thus is found to be a precursor of fatigue (Johnson et al., 2018).

Mirror Anxiety. Decades ago, Duval and Wicklund (1972) suggested that individuals are inclined to evaluate themselves when viewing a mirror. Later, Ingram and associates (1988) experimentally manipulated self-focused attention using mirrors and live camera feeds. During

their several experimental studies, women were discovered to be more self-focused than men when given the opportunity to view the self in the various mediums (Ingram et al., 1988). The heighted self-focused attention for women was also found to be linked with increased negative affect (Ingram et al., 1988).

Gender. More recently, evaluating oneself during a Zoom meeting relates to mirror anxiety, the anxiety that results from seeing one's reflection (Fauville et al., 2021). Through surveys and linguistic analyses, women reported higher levels of mirror anxiety than men from video conferencing (Fauville et al., 2021). Moreover, mirror anxiety mediated the relationship between gender and Zoom Fatigue, suggesting that women are more self-focused during Zoom meetings. Additionally, a study using eye tracking technology indicated that women spend more time looking at themselves than men during Zoom sessions (George et al., 2022). More specifically, women spent 7.7% of their time during a video conference staring at themselves, while men spent only 1.3% of their time looking at themselves (George et al., 2022). In fact, another measurement used within the same study found that the women on the video call moved their eyes back and forth to the frame consisting of their own video feed on average 133 times, whereas men looked to their frame on average only 17 times (George et al., 2022). Similarly, another study featuring surveys found that Zoom Fatigue was 14.9% higher for women than for men, and this gender difference was mediated by facial dissatisfaction (Ratan et al., 2021). Moreover, a month-long within-person experience sampling field experiment manipulated camera use during video conferences used for workplace meetings (Shockley et al., 2021). In this field study, participants' cameras were instructed to either be on or off during their scheduled meeting times (Shockley et al., 2021). The results of the study found that women in the workplace reported more fatigue than men when their camera was turned on during video

conferencing meetings (Shockley et al., 2021). In addition, the fatigue caused by being on camera could last into the next calendar day for participants, negatively affecting their workplace engagement (Shockley et al., 2021). All in all, the above studies emphasize how women are disproportionately and negatively affected by video conferences when their camera is turned on and they have access to see themselves, in comparison to men.

Public Self-Consciousness. Apart from gender and its relation to mirror anxiety, another factor that may increase self-evaluation during Zoom meetings is public self-consciousness. Public self-consciousness is the tendency to evaluate aspects of the self that are subject to public display, such as overt behaviours and stylistic quirks (Fenigstein et al., 1975; Scheier & Carver, 1985). Moreover, those who are high in the dispositional trait of public self-consciousness are found to be especially concerned about how others perceive them (Carver & Scheier, 2012). Thus, they will expend more cognitive resources as they hyper-monitor the self to control their behaviours during social interactions (Carver & Scheier, 2012). From this, it has been suspected that those who are high in public self-consciousness would feel cognitively overloaded when viewing their own video feed during video conferences, while simultaneously recognizing they are also being viewed by others on the call (Kuhn, 2021). Moreover, with use of two studies, both individuals from workplace organizations and students were investigated to determine whether viewing their own faces during their calls contributes to negative attitudes towards their meetings (Kuhn, 2022). The results indicated that the relationship between frequency of viewing oneself during video conferences and aversion to virtual meetings was contingent on participants' dispositional trait: the user's degree of public self-consciousness (Kuhn, 2022). Additionally, those high on public self-consciousness experienced more aversion to virtual meetings when viewing the self a lot on video conference (Kuhn, 2022). Similarly, another study

found that mirror exposure increases individuals' level of public self-consciousness, as participants exposed to a mirror reported more statements about their appearance than those without exposure (Hofmann & Heinrichs, 2002). From this, it is argued that being on camera during video conferences may not in itself associate with aversion to virtual meetings, but paying close attention to one's public features is what may relate to negative attitudes towards audiovisual calls.

Hide Self View

The default setting on Zoom is to present users with their live video feed when on camera (Bailenson, 2021). This makes Zoom users susceptible to staring at themselves throughout their video conferencing meetings (Bailenson, 2021). Thus, this design decision is in question due to its suspected negative psychological consequences (Bailenson, 2021).

In fact, a method to lessen the psychological burdens of seeing oneself during Zoom meetings has been suggested involving Zoom's "Hide Self View" feature (see Bailenson, 2021; Hadavas, 2020). "Hide Self View" is a Zoom option that allows users to remain visible to other attendees on Zoom, while a user is on camera, but not to themselves (Kuhn, 2022). By hiding one's self view, the Zoom experience becomes more similar to in-person interactions and conversations, as individuals do not typically have access to a live camera feed where they can evaluate their appearance as they interact with other people (Hadavas, 2020). Removing one's self view is suspected to be useful when users are expected to be on camera on Zoom, such as when giving a presentation or engaging in a job interview (Bailenson, 2021). However, they do not want to bear the psychological consequences that arise from viewing oneself, which could include increased cognitive load, fatigue, mirror anxiety, and negative attitudes towards the meeting (Bailenson, 2021).

Study Overview

The purpose of this study was to investigate the effects of having access to view the self during a Zoom meeting on cognitive load. The current study extends past literature that focuses on the effects of having one's camera turned on or off during video conferences. Moreover, this work refines camera manipulation to focus on the psychological consequences of having versus not having access to view one's live camera feed (i.e., their self view), when Zoom users are on camera. In addition, the study adds onto past literature by exploring individual differences, such as gender and public self-consciousness.

Design

This study utilized an experimental between-subjects design consisting of two conditions, the Show Self View condition and the Hide Self View condition. In both conditions, a participant took part in a one-on-one Zoom meeting with themselves and the experimenter, both who were on camera. In the Show Self View condition participants could see a live video feed of themselves, whereas, in the Hide Self View condition participants could not see a live video feed of themselves. By controlling for other factors (e.g., hosting a call with only the experimenter and participant present, keeping their cameras turned on across conditions, and keeping the experimenter consistent across calls), it could be determined whether having access to view oneself during a Zoom meeting contributes to cognitive load, as measured by a task assessing cognitive load (i.e., the Serial Sevens task; Hayman, 1942) and a self-report measure of the perceived difficulty of the task (i.e., the NASA Tax Load Index; Hart & Staveland, 1988).

Hypotheses

The experiment used in the current study allowed for the investigation of the following hypotheses:

Hypothesis 1: There will be a three-way interaction between condition, gender, and public self-consciousness on cognitive load. More specifically, women compared to men, and those high on public self-consciousness compared to those who are low, are expected to experience higher cognitive load (i.e., will perform worse on a cognitive load task), especially when in the Show Self View condition than those in the Hide Self View condition.

Hypothesis 2: There will be a three-way interaction between condition, gender, and public self-consciousness on perceived difficulty of a task assessing cognitive load. More specifically, women compared to men, and those high on public self-consciousness compared to those who are low, are expected to perceive more difficulty on the cognitive load task, especially when in the Show Self View condition than those in the Hide Self View condition.

All hypotheses, proposed methods, and proposed statistical analyses for the study were preregistered on the Open Science Framework (OSF), prior to the data being collected and have been posted at https://osf.io/4qwdh/?view_only=f14ae98b417f440e9d8ad183c936b1c4.

Participants

Participants were recruited from York University's Undergraduate Research Participant Pool (URPP) in October and November of 2022. For their participation, students were granted 1 URPP credit, translating to 1% of their final grade for a psychology course. Both time and costs were considered when pre-registering the intended sample size for the study, such as the maximum allotted URPP credits that are available for a single study to distribute amongst participants. In addition, the experimenter's time was considered, as the same experimenter was intended to host each experiment to eliminate the confound of having different experimenters.

Thus, after considering the resources needed to gather participants as well as the reasonable amount of time the experimenter could allocate towards the study, the maximum number of participants that was presumed to be feasible and thus pre-registered was 80 participants.

Participants were evenly distributed to each of the two conditions (i.e., 40 participants in the Show Self View condition and 40 participants in the Hide Self View condition). Participants were randomly assigned to one of the two conditions.

Data Deletion

According to pre-registration, participants were to be removed if they identified as random responders (1.90%, $n = 2$), did not pass a Self View manipulation check (8.57%, $n = 9$), or did not pass a Serial Sevens manipulation check (0.95%, $n = 1$). However, post pre-registration, during the conduction of experiments and before data analysis, other unanticipated but necessary reasons for removing participants became apparent to the researchers. To begin, five participants did not give consent to participate in the study or revoked their consent during or after the study occurred (4.76%, $n = 5$). In addition, three participants guessed the true purpose and/or hypotheses of the study (2.86%, $n = 3$), thus running the risk of response bias, where participants who guess the true purpose of the research may bias their behaviour to try to satisfy the expectations set by the researcher for the study (McCambridge et al., 2012). Additionally, two participants did not complete the required post experiment survey (1.90%, $n = 2$), thus not allowing researchers to assess variables, such as gender or public self-consciousness which are needed to examine the pre-registered and main hypotheses in focus. Two participants also identified as gender diverse (1.90%, $n = 2$), thus not being eligible to be examined as part of the main hypotheses for the study that build on past findings analyzing differences between the binary genders (i.e., male and female). Lastly, one participant stated that they could not

understand the instructions of the task to be performed during the experiment, even after several additional explanations given verbally by the experimenter (0.95%, *n* = 1).

In summary, the data from 23.8% (*n* = 25) of the participants were removed and replaced on a rolling basis to maintain the pre-registered and desired sample size of 80 participants. The attrition rate for this current study is assessed as reasonable, given that attrition rates tend to be around 20% for most studies (see Marjanovic et al., 2014). Thus, the proportion of deleted data was *not* considered a confounding variable in the current study.

Demographics

The final sample consisted of 52 females (65%) and 28 males (35%), who were predominantly young adult undergraduate students (*M*age = 19.26, *SD*age = 3.48, range = 16 to 42 years old). More than half of the sample were Asian (62.5%, *n* = 50), with the remainder being Caucasian (15%, *n* = 12), Black (8.75%, *n* = 7), Latin American (5%, *n* = 4), or of another undisclosed ethnicity (8.75%, *n* = 7). Additionally, just over half of participants were first-year undergraduate students (61.25%, *n* = 49), with the remainder being in their second year (28.75%, *n* = 23), third year (3.75%, *n* = 3), or fourth year (6.25%, *n* = 5). Lastly, most participants indicated that they were unemployed (55%, *n* = 44) or employed on a part-time basis (41.25%, *n* = 33), with only one participant indicating that they worked full-time (1.25%) and the other two participants indicating another undisclosed employment status (2.5%).

The proportion of females and males were relatively similar when comparing the two conditions to one another; where the Show Self View condition consisted of 28 females and 12 males, and the Hide Self View condition consisted of 24 females and 16 males.

Method

Procedure

Instructions

At the outset, participants were told that the study would be held on video conference through the description of the study posted on URPP. Instructions were also emailed to the participant by the URPP system, once they signed up for study, consisting of the Zoom link, and the date and time for the meeting. As soon as a participant joined the Zoom meeting, they were greeted by the experimenter who had their camera turned on. The experimenter immediately told the participant to follow a URL link sent via the Zoom chat to the online informed consent form, held on Qualtrics (see Appendix). The informed consent form explained that the study consists of a Zoom meeting featuring an arithmetic task (i.e., the experiment), followed by an online survey. Within the consent form, slight deception was employed, as participants were told that the purpose of the study is to examine "how working memory is affected by an arithmetic task." This deception was used in attempt to divert participants from suspecting the true purpose of the study (i.e., to assess how cognitive load is impacted when participants have versus do not have access to view themselves while on camera on Zoom). Deception was necessary to conceal the true purpose of the study.

Manipulations. Standardized instructions for manipulations were explained vocally by the experimenter to each participant on the one-on-one Zoom meeting (see Appendix).

Self View Instructions. Standardized instructions subjecting participants' camera use and self view, were explained vocally by the experimenter to each participant on the one-on-one Zoom meeting. The set of instructions depended on the condition for which the participants were assigned to (i.e., the Hide Self View vs. Show Self View condition), although each participant

was not aware of the conditions. As part of the instructions, and regardless of the participant's condition, the experimenter said, "Since we are not in person, it is important that we run through some Zoom etiquette for the study." This statement was used as part of the deception strategy to deflect participants from the true purpose of the experiment, focusing on the impacts of Zoom usage.

Moreover, as part of the standardized instructions, participants who were assigned to the Hide Self View condition were told by the experimenter that their Zoom camera must be turned on and that they must remain in view of their camera. However, they must turn on Zoom's Hide Self View feature so that they cannot see themselves (i.e., their video feed) for the entire duration of the call. In other words, participants in the Hide Self View condition were explicitly told that they are to be on camera and thus the experimenter will see them, but that *they are not to see themself during the Zoom meeting.* In contrast, participants who were assigned to the Show Self View condition were told by the experimenter that their Zoom camera must be turned on, that they must remain in view of their camera, and to assure that Zoom's Show Self View feature is turned on, which is the default setting on Zoom, so that they could see themselves (i.e., their video feed) for the entire duration of the call. In other words, those in the Show Self View condition were explicitly told that they are to be on camera and thus the experimenter will see them, and *they should also be able to see themselves*. At the end of the instructions, participants were asked if they had any questions about the instructions, and if so, the experimenter would provide additional explanation before moving on.

Serial Sevens Instructions. Following the instructions pertaining to self view, the experimenter stated another set of standardized instructions regarding a task to be completed during the Zoom meeting. Participants were instructed to perform a task called the Serial Sevens

(Hayman, 1942), where they must vocally and clearly subtract the number seven serially from the number 999 as quickly and accurately as they could in the span of three minutes in which they would be timed (see the Appendix for instructions). After the experimenter explained the task during each call to the participant, participants were then asked if they have any questions. Once questions were answered by the experimenter, the task began.

Online Questionnaire. Following task completion, participants were asked to click on a URL link embedded in the Zoom chat, leading them to an online questionnaire that was hosted on Qualtrics. Participants were asked whether the link opened well for them. Once they confirmed the link opened to the questionnaire, they were told to end the Zoom meeting, and that they must complete the questionnaire immediately following the termination of the call. Once the questionnaire was completed, participants were shown a debriefing form directly on Qualtrics (see the Appendix). As part of the debriefing, participants were made fully aware of the true purpose of the study and explained how and why deception was employed. To ensure participants still felt comfortable being a part of the research, even after learning about the deception used and true purpose of the study, post-debriefing consent was obtained (see the Appendix). As part of the post-debriefing consent form, participants were given the option to withdraw their original consent.

Measures

Cognitive Load

Cognitive load was assessed through participants' performance on the Serial Sevens task (Hayman, 1942). Performance was determined based on the number of correct subtractions participants verbally made of the number seven, serially, from the number, 999. In the case of an error subtracting seven from the preceding number, subsequent responses were scored as

accurate if the subsequent number was correct in relation to the previous number. A higher number of correct subtractions indicates *lower* cognitive load, whereas a lower number of correct subtractions indicates *higher* cognitive load. The reason for this is that those who experienced high cognitive load are overloaded with information. Thus, they could not allocate as many cognitive resources to complete the Serial Sevens task (Hayman, 1942) as those who experienced low cognitive load, as they had more available attentional resources to allocate to the task leading them to better performance (i.e., determined through more correct subtractions).

In terms of validity, the Serials Sevens task has been used in various forms, including the assessment of cognitive impairment (see Hale et al., 1982; Hayman, 1942; Kannape et al., 2014; Taylor & Rachman 1988), cognitive load in relation to glucose administration (Kennedy & Scholey, 2000), and cognitive load in relation to breakfast cereal (Defeyter & Russo; 2013). Not to mention, the Serial Sevens (Hayman, 1942) has been used with various populations (e.g., from individuals who have cognitive impairments to adolescents without health issues; Kennedy & Scholey, 2000; Defeyter & Russo; 2013). Moreover, in comparison to other tasks that measure cognitive performance, such as the Serial Threes and a word retrieval task, the Serial Sevens task (Hayman, 1942) was found to be the most cognitively demanding (see Kennedy & Scholey, 2000). In fact, in the current study, the scores on Serial Sevens task (Hayman, 1942) were moderately correlated with perceived difficulty of the task (i.e., measured by the NASA Tax Load Index; Hart & Stavelnad, 1988), r = -.55, providing construct validity for the use of the Serial Sevens Task in this work.

Perceived Difficulty of the Cognitive Load Task

Perceived difficulty of the Serial Sevens task (Hayman, 1942) was assessed by the NASA Task Load Index (NASA-TLX; Hart & Staveland, 1988), consisting of six items as part of the

questionnaire. A sample item is, “How mentally demanding was the task?” Items were measured using a scale that has 21 increments ranging from “Very low” to “Very high”. The NASA-TLX is found to have internal consistency reliability, $\alpha = 0.80$ (Xiao et al., 2005). See the Appendix for the index.

Self View Manipulation Check

To ensure participants followed instructions according to their condition, they were asked, “For the majority of the call, did you see yourself displayed on Zoom (i.e., your self view)?” Those in the Show Self View condition should have responded “Yes” and those in the Hide Self View condition should have responded “No”. If participants did not answer according to what is expected from them based on their condition assignment, they were excluded from the study. See the Appendix for this item.

Serial Sevens Check

To ensure participants did not use external help to perform the Serial Sevens task (Hayman, 1942), participants were asked, “During the task, when subtracting seven from preceding numbers, did you use anything external to help you (e.g., another person, calculator, phone, Google, or another search engine, etc.)? You will not be penalized, regardless of your response.” Those who responded “Yes” were excluded from the study. See the Appendix for this item.

Public Self-Consciousness

Public self-consciousness was assessed using the Public Self-Consciousness Subscale, which is part of the Self-Consciousness Scale (SCS; Fenigstein et al., 1975; Scheier & Carver, 1985). This subscale features seven items. A sample item is, “I’m concerned about my style of doing things.” Items were assessed on a 4-point Likert scale, ranging from 0 = “Not like me at

all" to 3 = "A lot like me". This scale has acceptable internal consistency reliability, $\alpha = 0.84$ (Scheier & Carver, 1985). See the Appendix for the scale.

Demographics

Relevant demographic questions were assessed, such as asking participants to indicate their gender, age, ethnicity, year of study, and employment status. See the Appendix for the items.

Data Quality

Conscientious Responders Scale. Random responders of the questionnaire were screened using the Conscientious Responders Scale (CRS; Marjanovic et al., 2014). The scale consists of five items, which explicitly instructs participants as to how they should respond to each item (e.g., "Please answer this question by choosing number 1, 'Strongly disagree'"). When a participant incorrectly responded to three or more items, this indicates that they likely randomly responded to the contents of the questionnaire. Thus, they were excluded from the study. The five CRS items were dispersed throughout the questionnaire, as they were embedded between the items of other scales. See the Appendix for these items, dispersed at the same order placement that they would have been found during the questionnaire.

Demand Characteristics. Demand characteristics were also assessed since deception was used for the study. Two short-answer questions were asked to determine participants' perception of the study's purpose. Participants' responses to the questions allowed researchers to examine whether the participants guessed the true purpose of the study (see Orne, 1962). The two short-answer questions that were asked of participants included, "What do you think is the purpose of this study?" and "What do you think are the specific hypotheses being investigated in this study?" (See the Appendix). Those who answered correctly (i.e., suspected the true purpose

and hypotheses) were excluded from the study, as their responses to other measures may have been biased to align with the expectations set for the research and/or to please the researchers involved by helping them prove their desired hypotheses (see Nicholas & Maner, 2008).

Data Analysis Plan

Data analyses were conducted using the R Programming language (R Core Team, 2019). Both pre-registered hypotheses of the current study were examined using respective simultaneous regression models. The statistical assumptions of linearity, normality, and homogeneity of variance, as well as collinearity and outliers were evaluated prior to conducting null hypothesis statistical testing.

Results

Descriptive Statistics

Descriptive statistics of the study variables, including cognitive load (i.e., measured by performance on the Serial Sevens task; Hayman, 1942), perceived difficulty of the Serial Sevens task, and public self-consciousness, are displayed by condition and gender, and are recorded in their respective tables (see Tables 1 to 3).

A boxplot illustrates the performance on the Serial Sevens task (Hayman, 1942) for each gender by condition (see Figure 9). In this plot, the Serial Sevens score shares an inverse relationship with cognitive load; the higher the Serial Sevens score would indicate lower cognitive load, whereas the lower the Serial Sevens score would indicate higher cognitive load. The boxplot's appearance portrays that males performed better than females on the Serial Sevens task, irrespective of their assigned condition. The same boxplot also portrays that both males and females outperformed their same-gender counterparts when in the Hide Self View condition, compared to those in the Show Self View condition.

Another boxplot illustrates the perceived difficulty on the Serial Sevens task (Hayman, 1942) by gender and condition (see Figure 10). The boxplot's appearance portrays that females compared to males reported greater difficulty on the Serial Sevens task, irrespective of the condition. The same boxplot also portrays that both males and females reported more difficulty on the Serial Sevens task in the Show Self View condition than their same-gender counterparts in the Hide Self View condition.

Lastly, a boxplot depicted public self-consciousness for gender by condition (see Figure 11). In this plot, females reported higher public self-consciousness than males, irrespective of the condition. In addition, both males and females reported higher public self-consciousness, compared to their same-gender counterparts when in the Show Self View condition, in comparison to the Hide Self View condition.

Additionally, the means, standard deviations and a correlation matrix consisting of Pearson product moment correlations were computed for the study's variables of interest, including for the Serial Sevens Score (Hayman, 1942), the Perceived Difficulty of the Task, Self View Condition, Gender, and Public Self-Consciousness (see Table 4).

Assumption Checks

Linearity Assumption

For the first hypothesis, linearity was evaluated for the factors contributing to cognitive load as measured by performance on the Serial Sevens task (Hayman, 1942), including condition, gender, and public self-consciousness. Since condition and gender are dichotomous variables, their respective associations with cognitive load are necessarily linear. Moreover, a scatterplot of the model's residuals against public self-consciousness shows a relatively linear

pattern (see Figure 1). Overall, the assumption of linearity was determined to be as met for this model.

Similarly, for the second hypothesis, linearity was evaluated for the factors contributing to the perceived difficulty of the cognitive load task, including condition, gender, and public self-consciousness. Since condition and gender are dichotomous variables, their respective associations with perceived difficulty of the cognitive load task are necessarily linear. Moreover, a scatterplot of the model's residuals against public self-consciousness shows a relatively linear pattern (see Figure 2). Overall, the assumption of linearity was determined to be met for this model.

Normality Assumption

To assess whether the errors from the model associated with the first hypothesis were normally distributed, a quantile comparison plot of the model's studentized residuals against the hypothetical *t*-distribution, along with a pointwise 95% confidence envelope was examined (see Figure 3). Since all but two data points are contained within the confidence envelope, thus the assumption of normally distributed errors is tenable for this estimated model.

The same procedure was used to assess whether the errors from the model associated with the second hypothesis were normally distributed (see Figure 4). Like that of the first model, all but two data points are contained within the confidence envelope, thus the assumption of normally distributed errors is assessed as tenable.

Homogeneity of Variance Assumption

To assess if the variance of the errors from the model associated with the first hypothesis is constant across predictors (i.e., are homoscedastic), a scatterplot of studentized residuals against all predictors of the model, which is enhanced by a Locally Weighted Scatterplot

Smoothing (LOWESS) curve and nonparametric confidence envelope is evaluated (see Figure 5). From this plot, the residuals are evaluated as inconsistently spread out, where the LOWESS curve present several curves, thus indicating that the homogeneity of variance assumption does *not* appear to be satisfactory. As a result, a robust regression model was instead implemented to test the associated hypothesis.

The same procedure was used to assess if the variance of the errors from the model associated with the second hypothesis is constant across predictors (see Figure 6). From this plot, the residuals are consistently spread out, thus indicating that the homogeneity of variance assumption is satisfactory.

Collinearity

Collinearity was assessed to ensure there is not a considerable amount of redundancy among predictors of each of the two models. To assess collinearity, the variance inflation factor (VIF) scores were calculated using the car package in R (Fox & Weisberg, 2019), for each of the two hypotheses' respective models. Since the predictors for both models were the same, the VIF scores were identical, where the VIF for condition is 1.03, gender is 1.13, and public self-consciousness is 1.15. Since none of the VIF values were much larger than 1, an extremely conservative cut-off, collinearity is not extreme, and thus the models remain tenable.

Outliers

Lastly, the possibility of influential cases was assessed through Cook's Distance to ensure that no datapoints dramatically distorted the results of either model. No influential cases were found (see Figure 7 and 8), as none of the hat values were close to surpassing the very conservative cut-off of 1.00 (see Cook, 1977).

Pre-Registered Predictions

Hypothesis 1

Unstandardized coefficients, parameter estimates, standard errors, and inferential statistics for the model pertaining to hypothesis 1 can be found in Table 5.

Condition, Gender, and Public Self-Consciousness on Cognitive Load. Contrary to expectations set as part of the first pre-registered hypothesis, there was no statistically significant three-way interaction between condition (Hide Self View vs. Show Self View), gender (female vs. male), and public self-consciousness on cognitive load (i.e., performance on the Serial Sevens task; Hayman, 1942), $t(72) = -1.82$, $p = 0.08$, $\omega^2 = 0.02$, $b = -18.90$, (95% CI = -39.23, 1.43).

Condition and Public Self-Consciousness on Cognitive Load. However, there was a statistically significant two-way interaction between condition and public self-consciousness on cognitive load (i.e., performance on the Serial Sevens task; Hayman, 1942), $t(72) = 2.84$, $p = 0.01$, $\omega^2 = 0.04$, $b = 24.10$, (95% CI = 7.49, 40.70).

The interaction between condition and public self-consciousness on cognitive load (i.e., performance on the Serial Sevens task; Hayman, 1942), can be further understood through the evaluation of a plot featuring the model-implied regression lines (see Figure 12). From this figure, the nature of the interaction is such that at a low level of public self-consciousness, participants in the Show Self View condition performed *worse* on the Serial Sevens task (Hayman, 1942), indicating *higher* cognitive load, than those in the Hide Self View condition. However, as participants reported high levels of public self-consciousness, the opposite result occurred. More specifically, those in the Show Self View condition, in comparison to those in the Hide Self View condition, performed *better* although similarly on the task, indicating *lower* cognitive load, as they report high public self-consciousness.

Additionally, no other two-way interactions were statistically significant for the model pertaining to hypothesis 1, including gender and condition on cognitive load, nor gender and public self-consciousness on cognitive load (see Table 5).

Gender. However, there was a statistically significant main effect of gender on cognitive load (i.e., performance on the Serial Sevens task; Hayman, 1942), $t(72) = -2.95$, $p < 0.001$, $\omega^2 = 0.24$, $b = -14.57$, (95% CI = -24.22, -4.92). This indicates that females made on average 14.57 *less* subtractions on the Serial Sevens (Hayman, 1942) than males, thus experiencing *higher* cognitive load.

Additionally, no other main effects were statistically significant for the model pertaining to hypothesis 1, including condition or public self-consciousness on cognitive load (see Table 5).

Hypothesis 2

Unstandardized coefficients, parameter estimates, standard errors, and inferential statistics for the model pertaining to hypothesis 2 can be found in Table 6.

Condition, Gender, and Public Self-Consciousness on Cognitive Load. Contrary to expectations set as part of the first pre-registered hypothesis, there was no statistically significant three-way interaction between condition (Hide Self View vs. Show Self View), gender (female vs. male), and public self-consciousness on perceived difficulty of the cognitive load task (i.e., the Serial Sevens task; Hayman, 1942), $t(72) = 0.59$, $p = 0.56$, $\omega^2 = 0.00$, $b = 1.37$, (95% CI = -3.22, 5.95).

Public Self-Consciousness. However, there was a statistically significant main effect of public self-consciousness on the perceived difficulty of the cognitive load task (i.e., the Serial Sevens task; Hayman, 1942), $t(72) = 2.36$, $p = 0.02$, $\omega^2 = 0.05$, $b = 2.95$, (95% CI = 0.49, 5.40).

This means that for every one unit increase of public self-consciousness, perceived difficulty of the task also increased by 2.95 units.

Additionally, no two-way interactions or any other main effects were statistically significant for the model pertaining to hypothesis 2 (see Table 6).

Discussion

The project investigated how having access to view the self during Zoom meetings effects cognitive load. The first pre-registered hypothesis was that there would be an interaction between condition, gender, and public self-consciousness on cognitive load. More specifically, women compared to men, and those high on public self-consciousness compared to those who are low, were expected to experience higher cognitive load (i.e., will perform worse on a Serial Sevens task; Hayman, 1942), especially when they were in the Show Self View condition than those in the Hide Self View condition. At a low level of public self-consciousness, participants who saw themselves experienced higher cognitive load. However, unexpectedly, the opposite occurred at a high level of public self-consciousness, whereby participants who did *not* see themselves experienced higher cognitive load. Additionally, there was a statistically significant main effect of gender on cognitive load. However, contrary to expectations, no statistically significant interactions were found involving gender.

The second pre-registered hypothesis was that there would be an interaction between condition, gender, and public self-consciousness on perceived difficulty of the task assessing cognitive load (i.e., the Serial Sevens task; Hayman, 1942). More specifically, women compared to men, and those high on public self-consciousness compared to those who are low, were expected to perceive more difficulty on the task, especially when they were in the Show Self View condition than those in the Hide Self View condition. There was a statistically significant

main effect of public self-consciousness on perceived difficulty of the Serial Sevens task, which partially aligns with the expectations set by the pre-registered hypothesis (i.e., the higher the public self-consciousness, the greater the perceived difficultly on the task assessing cognitive load). Surprisingly although, there were no statistically significant differences involving condition, nor gender.

Public Self-Consciousness and Psychological Implications of Zoom Usage

Public Self-Consciousness and Condition on Cognitive Load

The current study found that cognitive load decreased as public self-consciousness increased for participants who could see themselves (i.e., in the Show Self View condition). In fact, the difference in cognitive load between those in the two conditions (i.e., the Hide Self View condition vs. the Show Self View condition) was largest when public self-consciousness was low (see Figure 12). This finding was expected from much of cognitive load theory (see Sweller, 1988) that states working memory has a limited capacity. Thus, communication methods that overload memory lead to an increase in cognitive load. Communication technologies that transmit information through multiple channels, such as the audio and visual channels, are more cognitively overloading than technologies transmitting information from a single channel (see Hinds, 1999; Lang, 1995). From this, it was expected that participants in the Show Self View condition would experience higher cognitive load than those in the Hide Self View condition, as they were presented with all the same information during the Zoom meeting as those in the Hide Self View condition, but with the additional exposure to their live video feed. Thereby the finding was expected that those in the Show Self View condition would experience higher cognitive load than those in the Hide Self View condition, including for those low in public self-consciousness.

What was unexpected is that the study found that cognitive load increased as public self-consciousness decreased, for those who could *not* see themselves (i.e., in the Hide Self View condition). However, the difference in cognitive load between those in the two conditions (i.e., the Hide Self View condition vs. the Show Self View condition) was similar when public self-consciousness was high (see Figure 12). Nonetheless, this finding contradicts a major expectation set by the study, which was that highly self-conscious individuals would experience greater cognitive load when they could see themselves on Zoom, as they would have especially focused on the self, distracting themselves from the Serial Sevens task (Hayman, 1942) used to measure cognitive load.

The current project recognized that it is not just having access to view oneself that contributes to increased self-evaluation and thus cognitive load, but dispositional factors would also exacerbate self-focused attention. More specifically, public self-consciousness, has been found to increase hyper-monitoring of the self. For example, the relationship between frequency of viewing oneself during video conferences and aversion to virtual meetings is contingent on public self-consciousness (Kuhn, 2022). In another study, those who reported higher Zoom Fatigue, also reported higher facial dissatisfaction (Ratan et al., 2021). Similarly, concerns about one's appearance while on video conferencing was positively associated with paying attention to the self (Pikoos et al., 2021). These studies suggest that public self-consciousness augments self-focused attention, especially when individuals are given access to technology displaying a live video feed of the self. From the mentioned literature, we expected those high in public self-consciousness would have been especially cognitively overloaded when in the Show Self View condition, in comparison to those in the Hide Self View condition.

However, the current study unexpectedly found that those high on public self-consciousness experienced greater cognitive load when they did *not* have access to their live video feed than those who did have access to their live video feed, although differences on cognitive load were similar (see Figure 12). Nonetheless, plausible explanations can be made for this unexpected finding. To begin, the self view window is the default setting on most video conference applications (Balogová & Brumby, 2022). This means that when a user turns their camera on during a video conference, they are automatically presented with their live video feed. Moreover, a minority of video conferencing users make a deliberate effort to disable their self view (Balogová & Brumby, 2022). Thus, being instructed to hide one's self view during the current study, could have exacerbated anxiety in participants who are accustomed to having access to their video feed and especially use their feed to hyper monitor the self (i.e., likely those high on public self-consciousness). From this it is suspected that those in the Hide Self View condition who were high on public self-consciousness may have experienced intrusive thoughts that distracted them from the cognitive load task (i.e., the Serial Sevens; Hayman, 1942), leading to their poor performance.

Although the above reasoning is only speculation, it is in line with an eye-tracking study followed by a survey that found that 71% of participants indicated that they would prefer to see their live feed during video conferences (de Vasconcelos Filho et al., 2009). These participants voiced their main reasoning for wanting access to view their video feed is to ensure that they look favorable to the others on the call (de Vasconcelos Filho et al., 2009). Similarly, another study's participants reported that the self view feature provides a sense of reassurance to users that they are presenting themselves well to others (Balogová & Brumby, 2022).

From the literature mentioned, it is very possible that those high on public self consciousness could have experienced more discomfort not being able to see themselves than those who could see themselves. In turn, potentially the suspected anxiety resulting from not being able to self-monitor, may have expended more cognitive resources than the actual act of evaluating the self during the Zoom meeting. Thus, this could have led to the study's unexpected finding that participants who reported a high level of public self-consciousness experienced greater cognitive load (i.e., perform worse on the Serial Sevens task; Hayman, 1942) when they could not see themselves, than when they could. From this, future studies should explore the effect of anxiety when video conferencing, as well as self view preference.

Public Self-Consciousness on Perceived Difficulty of the Cognitive Load Task

In addition to performance on the task assessing cognitive load (i.e., the Serial Sevens; Hayman, 1942), the study also evaluated participants' self-reported difficulty on the cognitive load task, as measured by the NASA Task Load Index (Hart & Staveland, 1988). The current study found that as public self-consciousness increased, individuals self-reported more difficulty on the task assessing cognitive load (i.e., the Serial Sevens; Hayman, 1942).

Since those high on public self-consciousness are hyper self-critical (Fenigstein, 1975), it is possible that they were harsher on themselves about their performance on the cognitive load task (i.e., the Serial Sevens; Hayman, 1942) than those low on public self-consciousness. In fact, there is a line of reasoning that suggests those high on public self-consciousness would interpret video conferencing experiences more negatively. For instance, one study found viewing oneself during video conferences and aversion to virtual video conference meetings was contingent on public self-consciousness (Kuhn, 2022). From this, it is expected that those high on public self-consciousness would perceive their performance on the cognitive load task more negatively. For

example, for the NASA-TLX (Hart & Staveland, 1988) item, “How successful were you in accomplishing what you were asked to do?”, those who are highly self-critical would likely respond closer to the side of the scale indicating “Failure” than “Perfect”, despite performance.

Gender and Psychological Implications of Zoom Usage

Another expectation set as part of the pre-registered hypotheses was that women, in comparison to men, would perform worse on the cognitive load task (i.e., the Serial Sevens task; Hayman, 1942), and that they would self-report more difficulty on the task (i.e., as measured by the NASA-TLX; Hart & Staveland; 1988). However, only a statistically significant main effect of gender on cognitive load was found. The findings of the current work suggesting that women are more cognitively overloaded on video conferences than men, align with much of the recent literature that reports women are disproportionately negatively affected by video conferencing, such as experiencing higher fatigue and dissatisfaction (see Fauville et al., 2021; Ratan et al., 2021; Shockley et al., 2021).

However, the current study did not find any statistically significant interactions with gender and the self view condition, nor public self-consciousness. Thus, the work does not align with recent literature suggesting that women are disproportionately negatively affected by video conferencing *because of* camera and self-view usage, and/or a specific moderating variable. In the literature, for instance, a survey found that women compared to men reported higher levels of mirror anxiety, the anxiety that results from seeing one’s reflection, during video conferences (Fauville et al., 2021). Moreover, mirror anxiety mediated the relationship between gender and Zoom Fatigue, suggesting that women are more self-focused during video calls which could lead to their fatigue after calls (Fauville et al., 2021). Additionally, one survey found that Zoom Fatigue was nearly 15% higher for women than for men, as mediated by facial dissatisfaction

(Ratan et al., 2021). Moreover, after having their camera turned on during online calls, women in the workplace were more fatigued than men (Shockley et al., 2021). These studies emphasize how gender differences on video conferencing occur due to the camera and self view usage, and/or a moderating variable, which is unlike that of what was found in the current work.

Similar to the current study, limited data concludes non-statistically significant interactions between gender and self view on psychological outcomes due to video conferencing. For example, a field experiment examined the effect of the self view window during video conferencing on self-focused attention for employees (van Meelen, 2021). This study focused on whether there was an interaction between being able to see oneself through a video feed (i.e., having access to the self view) and gender on self-awareness. The results of the study did not find an interaction between gender and self view on self-awareness. However, the study did find a main effect of gender on public self-awareness (van Meelen, 2021).

Despite the recent literature suggesting that women are more negatively affected by video conferencing due to self-view usage and several moderating variables, our study and few others did not align with this conclusion. Therefore, more research is needed to understand whether gender differences from video conferencing truly exist and why. Firstly, researchers should continue to investigate the interaction between gender and self view usage on negative psychological outcomes during video. Secondly, moderators and mediators should be explored that could explain why women are consistently found to be more negatively impacted by video conferencing than men, which could help in explaining the main effect of gender on cognitive load in the current study.

General Limitations and Future Directions

As mentioned above, the results of the current study were largely unexpected and consist of important implications, however they are not without limitations.

Ecological Validity

The Zoom Meeting. A limitation of the current study surrounds ecological validity. During the study, participants were asked to join a Zoom meeting, featuring the participant and the experimenter. Participants were instructed to manipulate their video feed (i.e., their self view) and asked to perform a task assessing their cognitive load (i.e., the Serial Sevens; Hayman, 1942). The Zoom meeting likely was not representative of participants' everyday video conferences.

Participants may be accustomed to different video conferencing experiences than what occurred during the experiment. For example, some participants may regularly keep their cameras off (a setting which was not used in the current study). Moreover, the Hide Self View condition likely felt abnormal for the majority of participants, as research finds that few users deliberately hide their self view (Balogová & Brumby, 2022). However, the researchers did not gather participants' video conference setting preferences, such as how frequently they keep their camera and self view on. Additionally, it was not recorded whether participants joined the call with their camera on, nor their self-view setting prior to the experimenter voicing the self view standardized instructions, manipulating participants' self-view use.

Lastly, the participants may be used to having more stimuli to attend to than that featured in the current experiment (especially in the Hide Self View condition where only the experimenter's live video feed is displayed to the participant). For example, participants may be used to attending to multiple Zoom users, including their video feeds displaying their faces,

movements, and backgrounds. Thus, participants' preferences and experiences with video conferences may limit the ecological validity of the study and sensitivity of the cognitive load task.

From this, a future field-experiment could help in assessing participants' typical and preferred video conference settings and how it impacts cognitive load. Eye-tracking technology would also be useful to objectively measure self-evaluation, especially based on the individual differences focused within the current study (i.e., gender and public self-consciousness).

Additionally, the Zoom meeting may have felt unnatural for participants because of the purpose of the call (i.e., participating in an experiment). In fact, the intensity of the call, in which participants are being told how to act (i.e., to manipulate their self view and perform a task), all while being evaluated by the experimenter, may have made them uncomfortable. Since the Zoom meeting was likely unnatural for participants, it is reasonable to suggest that a field-study would capture a more realistic evaluation of cognitive load during Zoom sessions.

The Task. Moreover, the task performed during the Zoom meeting, also does not come without limitations. To assess cognitive load, participants were instructed to perform the Serial Sevens task (Hayman, 1942), where they vocally subtracted the number seven serially from the number 999, as quickly and accurately as they could, in three minutes. The lower the number of correct subtractions, the higher the level of cognitive load; whereas the higher the number of correct subtractions, the lower the level of cognitive load.

Above all else, to decrease response biases the Serial Sevens task (Hayman, 1942) was chosen as an objective measure of cognitive load, extending video conferencing literature that often uses subjective measures of cognitive load and/or fatigue. Additionally, this task was chosen for the study as it is one of the most cognitively demanding tasks (see Kennedy &

Scholey, 2000), as well as a reliable measure of cognitive load as it has been used in various forms in the past (see Hale et al., 1982; Kennedy & Scholey, 2000; Taylor & Rachman 1988). Additionally, the task is quick to administer (i.e., less than one minute to explain instructions and three minutes to perform the task itself), as well as very simple to evaluate cognitive load (i.e., the experimenter counts how many correct subtractions participants made of the number seven), which were helpful given the constraints for the current work (e.g., only one experimenter to administer the task and measure performance). In addition, the findings of the present study found that perceived difficulty (using the NASA-TLX; Hart & Staveland, 1988) of the Serial Sevens task correlated moderately highly with scores on this task (-.55) attesting to the test's validity as a measure of cognitive load.

However, studies examining the ecological validity of neuropsychological tests find inconsistent and weak-to-moderate correlations between the scores on standardized measures and real-world behavioural performance (e.g., Chaytor et al., 2006; Cicerone et al., 2006; Constantinidou et al., 2012). Thus, the use of Serial Sevens (Hayman, 1942) may not be the most ecologically valid way to assess cognitive load. It is possible the three-minute task (i.e., the Serial Sevens task; Hayman, 1942), did not accurately capture the cognitive load that may be experienced in everyday life. For instance, participants may engage in a variety of video conferences that soak up varying levels of cognitive load based on frequency and duration of calls, as well as contents and purpose of the call. Not to mention, the task primarily measures sustained attention and basic arithmetic abilities. Therefore, it may not be an adequate measure of overall cognitive function or executive functioning (see Karzmark, 2000; Young et al., 1997).

Another argument one might make against the current study's use of the Serial Sevens task (Hayman, 1942) to assess cognitive load, subjects the relationship between gender and math

performance. However, there is no established evidence of any inherent relationship between the Serial Sevens task (Hayman, 1942) and skewed performance based on gender. In fact, numerous studies and meta-analyses have found females do not inherently perform differently on math related exercises (e.g., Else-Quest et al., 2010; Hyde et al., 1990; Wang & Degol; 2017). Despite this, what has been found is that societal expectations related to gender may impact an individual's self-perception, confidence, or motivation, which in turn could affect their performance on math related tasks (see Spelke et al., 2020; Valla & Ceci; 2011). From this, it possible in the current study, females performed worse on the Serial Sevens task (Hayman, 1942) due to the task's relation to math, ultimately inducing anxiety in females due to societal pressures leading to their poorer performance than males, rather than cognitive load itself.

Given the above concerns, future research should examine the effects of having access to view oneself during video conferences on cognitive load using different measures and more ecologically valid methods to determine whether results would replicate. For instance, diary studies could be used to capture how participants are impacted by their video conferencing calls in real-world settings, such as logging the purpose of their video conferencing call (e.g., for work), the duration of the call, the amount of people on the call, the camera usage including that of their self view use, and feelings during and after the call (e.g., cognitive load).

Generalizability

The current study is limited in its generalizability. From the demographics assessed, it was discovered that participants were predominantly young adult first-year undergraduate students. The sample are likely very comfortable with video conferencing, given the educational paradigm shift to online learning during the pandemic (Hodges et al., 2020). Thus, their experience with Zoom may not resemble that of participants who largely use Zoom for other

purposes, such as employment, or those who are not accustomed with video conferencing. For instance, a field experiment manipulated camera use during video conferences used for workplace meetings and found that women in the workplace reported more fatigue than men when their camera was turned on during video conferencing meetings (Shockley et al., 2021). This study sheds light as to how it is very possible that a more ecologically valid study (i.e., a field experiment) may be better equipped to assess the differential impacts of video conferencing. Moreover, the purpose and content of video conferencing calls may affect cognitive load. For example, an educational lesson on a Zoom meeting may require more attentional resources than a call to socialize with a friend. Overall, the current study does not generalize to diverse populations who have various experiences with Zoom usage.

Conclusion

Video conferencing has helped individuals connect from remote locations during the pandemic (Bailenson, 2021). From this, a phenomenon emerged known as "Zoom Fatigue"; the exhaustion experienced from video conferencing, including on Zoom (Bailenson, 2021). Cognitive load and self-evaluation are theorized to be characteristics of Zoom meetings and explanations of Zoom Fatigue (Bailenson, 2021). Moreover, multimodal technologies are found to be more cognitively exhausting than single modal technologies, as they transmit information simultaneously through multiple channels, absorbing competing cognitive resources (see Bailenson, 2021; Hinds, 1999; Lang, 1995). Thus, video conferencing using both audio and visual channels is hypothesized to heighten cognitive load (Bailenson, 2021; Havadas, 2020). Additionally, self-evaluation is heightened on video conferences as users have access to view themselves through their live video feeds (Bailenson, 2021). Time and time again, self-evaluation has been found to soak up attentional resources, increasing cognitive load (Johnson et

al., 2018; Klotz et al., 2018; Vohs et al., 2005). Thus, it is hypothesized that viewing oneself on video conferencing is cognitively exhausting (Bailenson, 2021). Nonetheless, a method to lessen the burden of seeing oneself during Zoom meetings involves Zoom's "Hide Self View" feature, (see Bailenson, 2021; Hadavas, 2020), where users can present themselves on camera to others, however they do not have access to their own video feed.

The current study examined the effects of having access to view the self on cognitive load using an experiment. Participants during a Zoom meeting either did or did not have access to their self view video, while they present themselves on camera to an experimenter. From this, it could be determined whether having access to view oneself during a Zoom meeting contributes to cognitive load. As expected from cognitive load theory (see Sweller, 1988), the results of the study found at lower levels of public self-consciousness, individuals were more cognitively overloaded when they could view their video feed on Zoom. However, what was unexpected was that at high levels of public self-consciousness, individuals were more cognitively overloaded when they could *not* view their video feed on Zoom. In addition, contrary to expectations, only a main effect of gender on cognitive load was discovered, and not any interactions between gender and self view, nor public self-consciousness.

This study is among the first to experimentally and empirically examine the impact of having access to one's self view on cognitive load during Zoom meetings, while also examining gender and public self-consciousness. The results of this study shed light as to how video conferencing technology can disproportionately affect users based on individual differences. Since video conferencing continues to be prominent in today's very remote and hybrid world, it is important for research to further examine the implications of this method of communication for users.

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Tables

Table 1. *Descriptive Statistics for the Performance on the Serial Sevens Task for Gender by Condition*.

Condition	**Gender**	***n***	***M***	***SD***	**Median**	**IQR**	**Min**	**Max**	**Skewness**	**Kurtosis**
Hide Self View	Male	16	38.90	21.70	39.50	24.80	10.00	89.00	0.47	-0.48
	Female	24	18.50	10.10	19.00	12.20	0.00	43.00	0.10	-0.29
Show Self View	Male	12	31.90	26.40	27.50	27.00	1.00	84.00	0.75	-0.82
	Female	28	14.90	9.73	12.50	8.50	1.00	41.00	0.93	0.35

Table 2. *Descriptive Statistics for the Perceived Difficulty on the Serial Sevens Task for Gender by Condition*.

Condition	**Gender**	***n***	***M***	***SD***	**Median**	**IQR**	**Min**	**Max**	**Skewness**	**Kurtosis**
Hide Self View	Male	16	10.50	3.38	10.80	3.54	3.17	16.70	-0.20	-0.42
	Female	24	12.30	3.49	11.90	4.12	6.00	19.70	0.40	-0.53
Show Self View	Male	12	9.93	3.95	9.17	3.62	4.33	18.30	-0.66	-0.60
	Female	28	13.20	2.50	13.50	3.62	8.83	17.20	-0.33	-1.09

Table 3. *Descriptive Statistics for Public-Self Consciousness for Gender by Condition*.

Condition	**Gender**	***n***	***M***	***SD***	**Median**	**IQR**	**Min**	**Max**	**Skewness**	**Kurtosis**
Hide Self View	Male	16	2.57	0.65	2.33	0.82	1.57	4.00	0.60	-0.67
	Female	24	2.95	0.68	3.00	1.04	1.71	4.00	-0.31	-1.10
Show Self View	Male	12	2.65	0.66	2.79	0.79	1.57	3.57	-0.31	-1.33
	Female	28	3.20	0.65	3.36	0.89	1.86	4.00	-0.66	-0.71

Table 4. *Means, Standard Deviations, and the Pearson Product Moment Correlations for the Serial Sevens Score, the Perceived Difficulty of the Task, Self View Condition, Gender, and Public Self-Consciousness*.

Variable	***M***	***SD***	**1**	**2**	**3**	**4**
1. Serial Sevens Score	23.32	18.47				
2. Perceived Difficulty on the Task	11.89	3.41	-.55*			
3. Self View Condition	1.50	0.50	-.18	.09		
4. Gender	1.65	0.48	-.50	.35	.10	
5. Public Self-Consciousness	2.92	0.69	-.15	.34	.17	.33

Note. M and *SD* are used to represent mean and standard deviation, respectively. * indicates $p < 0.05$.

Table 5. *Inferential Statistics of Model 1 (i.e., Condition, Gender, and Public Self-Consciousness on Cognitive Load*).*

Variable	***B***	***SE(B)***	***t***	***p***	**95% CI**
(Intercept)	33.18	4.00			
Condition	1.61	5.93	0.27	0.81	(-10.02, 13.24)
Gender	-14.57	4.92	-2.95	< 0.001	(-24.22, -4.92)
Public Self-Consciousness	-10.16	5.55	-1.83	0.07	(-21.05, 0.72)
Condition x Gender	-6.32	7.20	-0.88	0.42	(-20.43, 7.78)
Condition x Public Self-Consciousness	24.10	8.47	2.84	0.01	(7.49, 40.70)
Gender x Public Self-Consciousness	6.65	7.02	0.95	0.35	(-7.10, 20.40)
Condition x Gender x Public Self-Consciousness	-18.90	10.37	-1.82	0.08	(-39.23, 1.43)

*Cognitive load was measured using the Serial Sevens task (Hayman, 1942).
The higher the score indicates lower cognitive load and the lower the score indicates higher cognitive load.

Table 6. *Inferential Statistics of Model 2 (i.e., Condition, Gender, and Public Self-Consciousness on Perceived Difficulty of the Task).*

Variable	***B***	***SE(B)***	***t***	***p***	**95% CI**
(Intercept)	11.56	0.90			
Condition	-1.27	1.34	-0.95	0.35	(-3.89, 1.35)
Gender	0.69	1.11	0.62	0.54	(-1.49, 2.86)
Public Self-Consciousness	2.95	1.25	2.36	0.02	(0.49, 5.40)
Condition x Gender	2.05	1.62	1.26	0.21	(-1.13, 5.23)
Condition x Public Self-Consciousness	-1.57	1.91	-0.82	0.41	(-5.31, 2.17)
Gender x Public Self-Consciousness	-2.19	1.58	-1.39	0.17	(-5.29, 0.91)
Condition x Gender x Public Self-Consciousness	1.37	2.34	0.59	0.56	(-3.22, 5.95)

$R^2 = 0.218$, $F(7, 72) = 2.87$, $p < 0.05$

Figures

Figure 1. *Linearity Assumption – Model 1*.

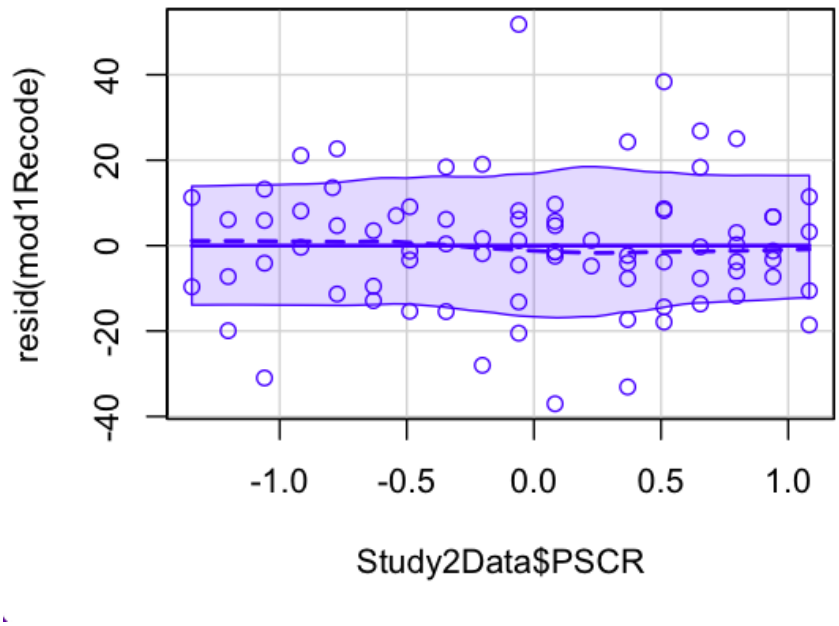


Figure 2. *Linearity Assumption – Model 2*.

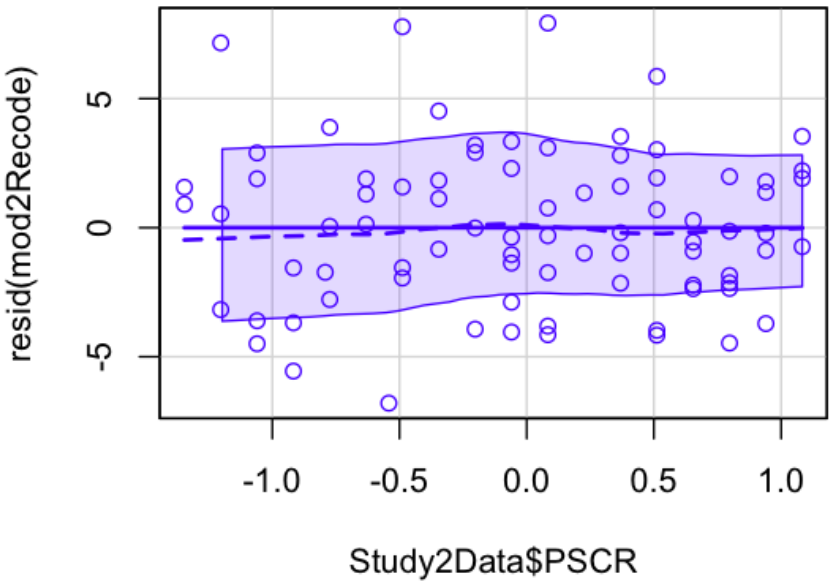


Figure 3. *Normality Assumption – Model 1*.

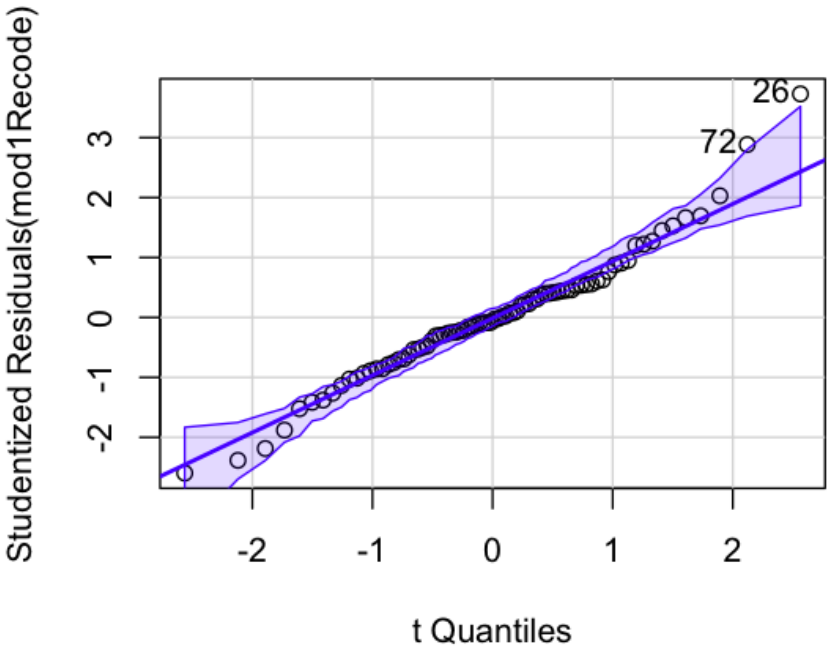


Figure 4. *Normality Assumption – Model 2*.

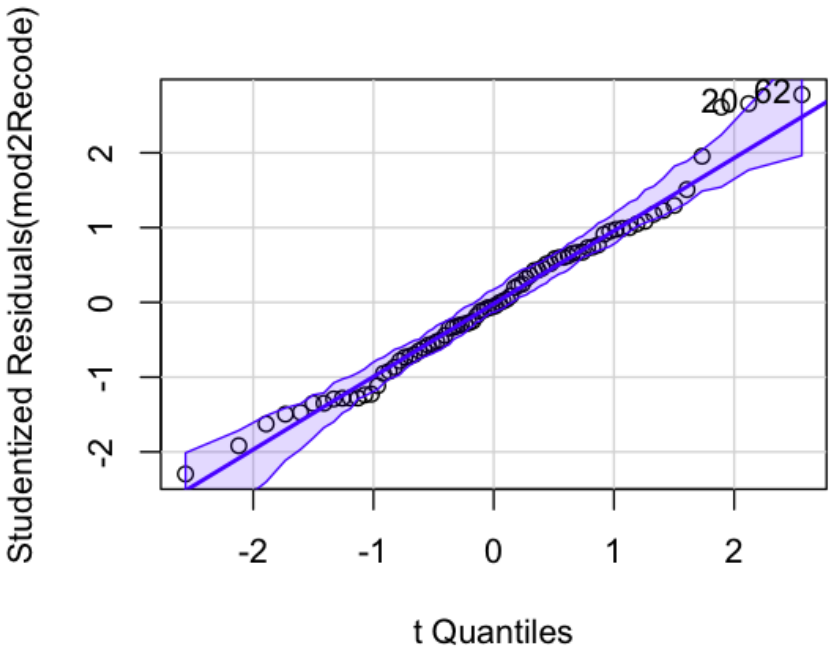


Figure 5. *Homogeneity of Variance Assumption – Model 1*.

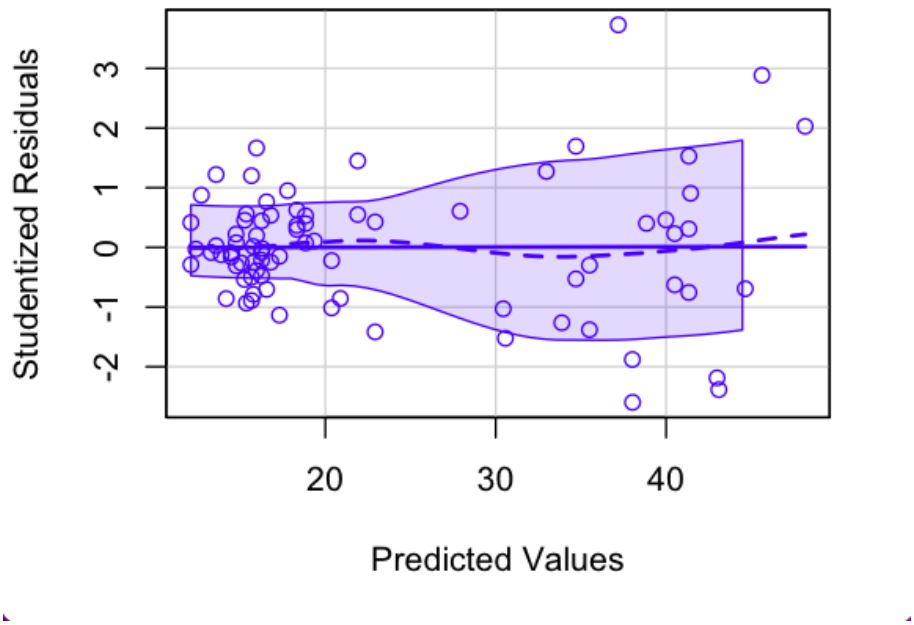


Figure 6. *Homogeneity of Variance Assumption – Model 2*.

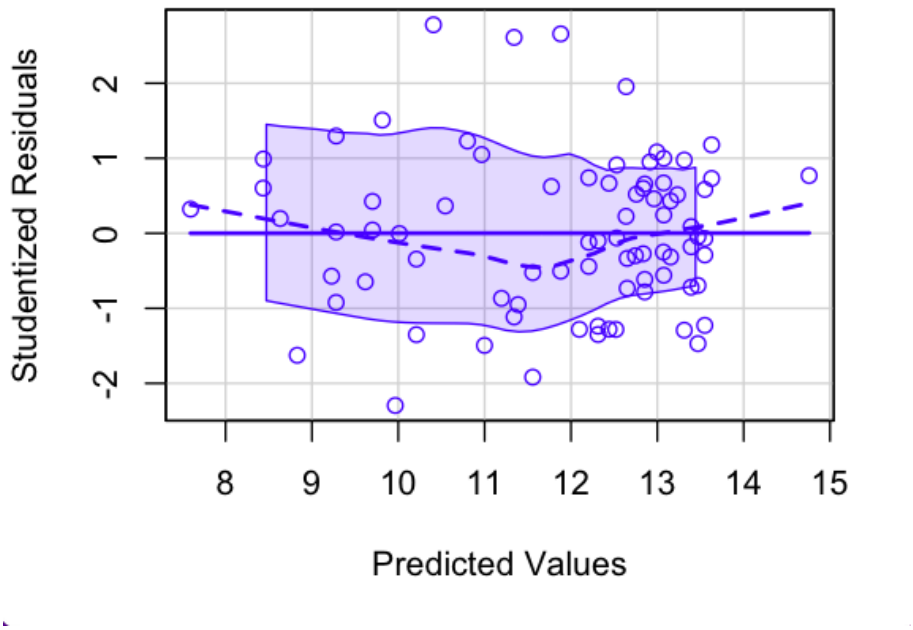


Figure 7. *Outliers – Model 1.*

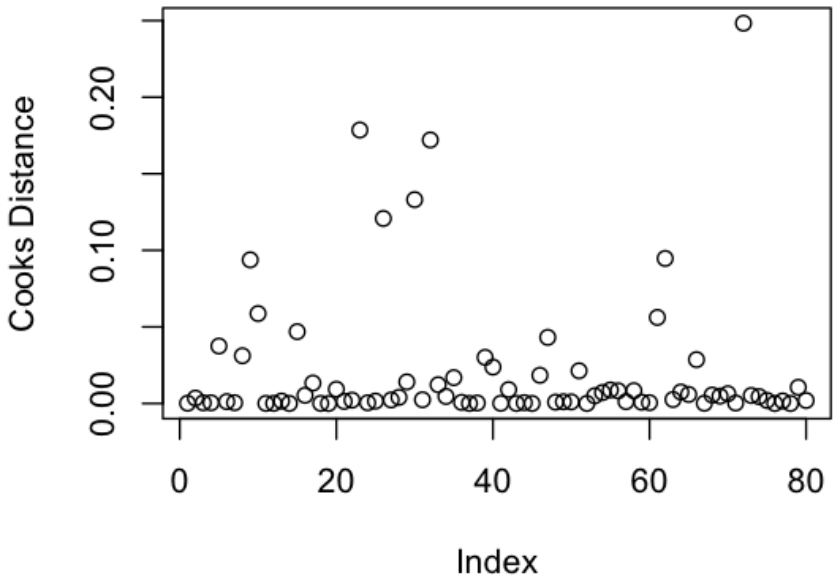


Figure 8. *Outliers – Model 2*.

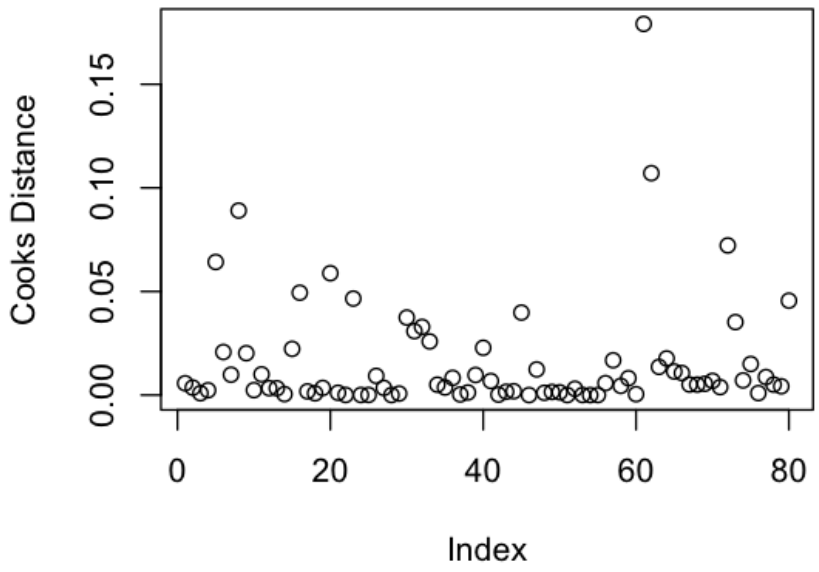


Figure 9. *Boxplot on the Performance on the Serial Sevens Task for Each Gender by Condition*.

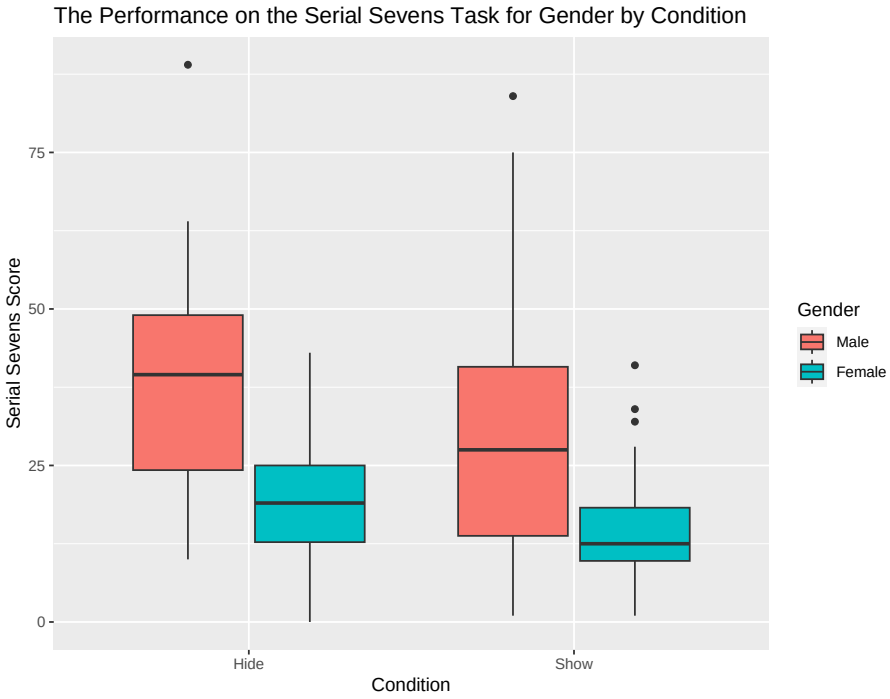


Figure 10. *Boxplot on the Perceived Difficulty on the Serial Sevens Task for Gender by Condition.*

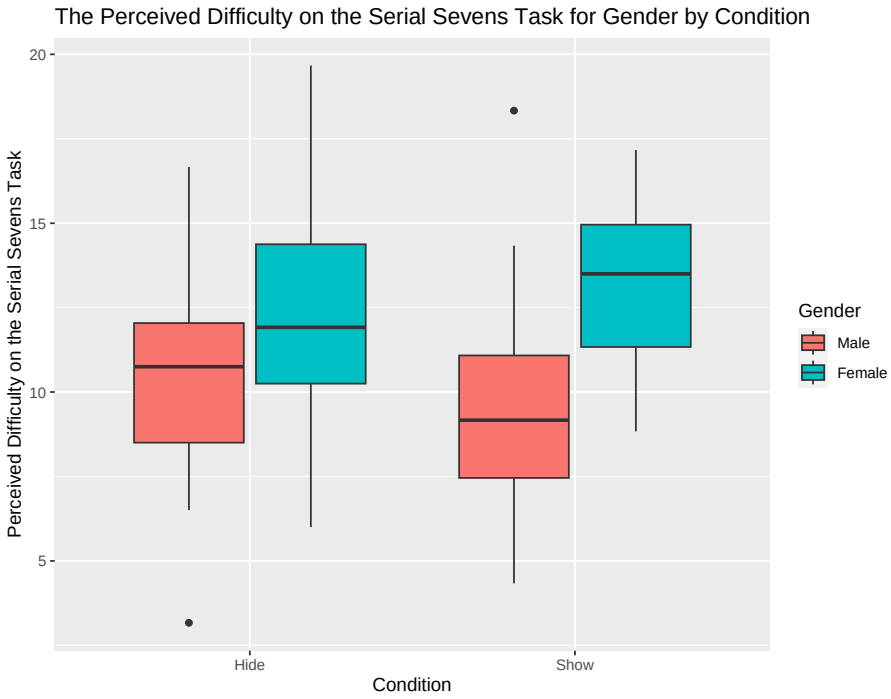


Figure 11. *Boxplot on Public Self-Consciousness for Gender by Condition*.

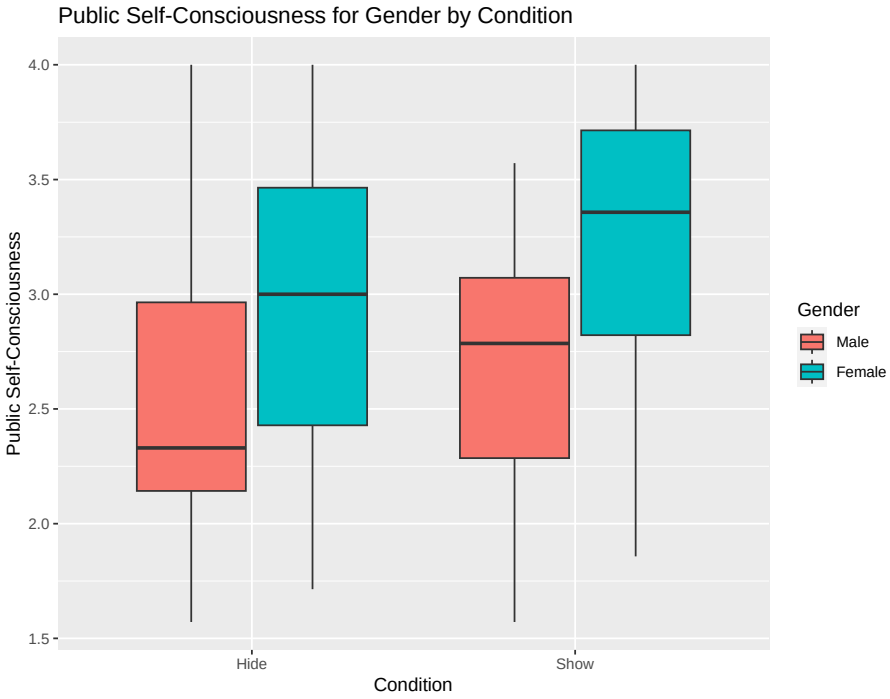
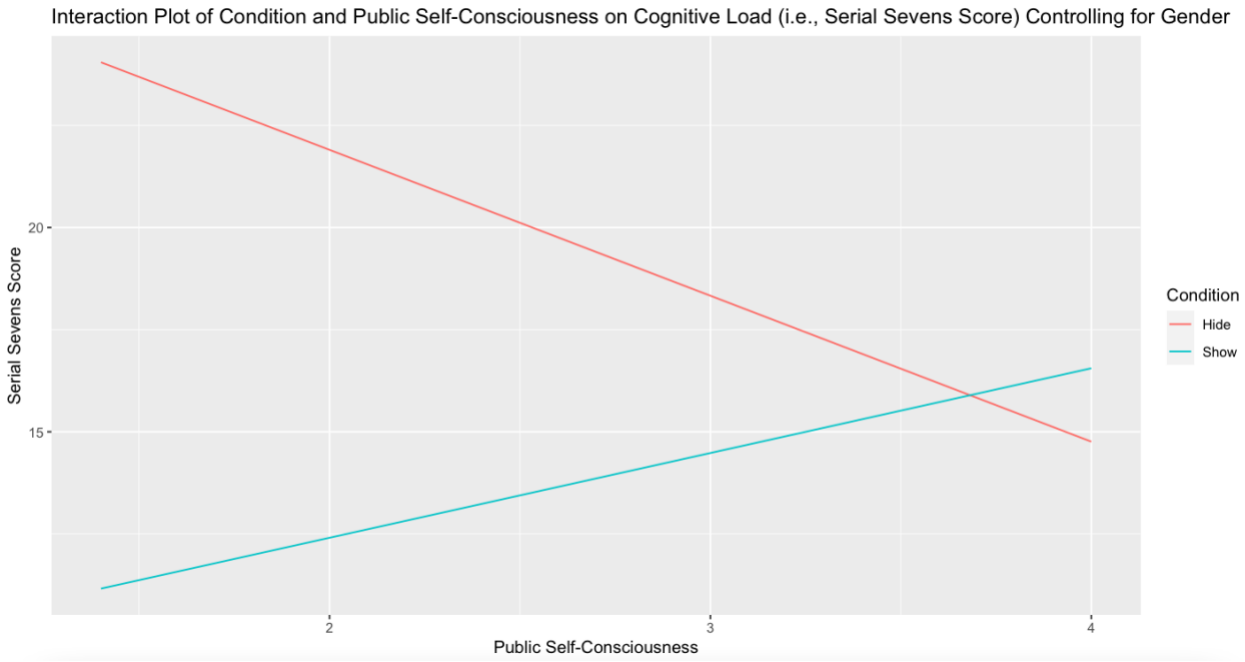


Figure 12. *Interaction Plot of Condition and Public Self-Consciousness on Cognitive Load* (i.e., Serial Sevens Score) Controlling for Gender*.



*Cognitive load was measured using the Serial Sevens task (Hayman, 1942).
The higher the score indicates lower cognitive load and the lower the score indicates higher cognitive load.

Appendix

Study Protocol and Materials

1. Informed Consent Form
    - 4 minutes
2. Zoom Call (10 minutes)
    - The Zoom call consisting of the participant and experimenter, both with their camera on.
    - The experimenter verbally provides standardized instructions to the participant, regarding their camera and self view use, depending on their condition:
        2a. Standardized Instructions for Those in the Show Self View Condition
        2b. Standardized Instructions for Those in the Hide Self View Condition
    - After, the experimenter verbally provides standardized instructions to participants subjecting a task they are to perform:
        2c. Standardized Instructions for the Task (i.e., a Modified Version of the Serial Sevens task; Hayman, 1942)
3. Self View Manipulation Check
    - 1 item; 1 minute
4. Serial Sevens Check
    - 1 item; 1 minute
5. Perceived Difficulty of the Serial Sevens Task (Hayman, 1942; NASA Task Load Index; Hart & Staveland, 1988)
    - 6 items; 3 minutes
6. Public Self-Consciousness (Public self-consciousness subscale; Fenigstein et al., 1975; Scheier & Carver, 1985)
    - 7 items; 3 minutes
7. Demographics
    - 5 items; 2 minutes
8. Data Quality
    - Conscientious Responders Scale (CRS; Marjanovic et al., 2014)
        - 5 items (dispersed throughout the questionnaire, indicated by a footnote); 2 minutes

    8a. Demand Characteristics
        - 2 items; 2 minutes
9. Debriefing Forms
    9a. Debriefing Form; 3 minutes
    9b. Post-Debriefing Consent Form; 3 minutes

TOTAL TIME: ~ 35 minutes

1. Informed Consent Form

Date: X

Study Name: Counting and Psychological Outcomes

Researcher name: My name is Alecia Carolli. I am a Master of Arts student in the Social and Personality area of York University's Psychology graduate program. I am the Principal Investigator and the experimenter for this research. Please feel free to contact me at acarolli@yorku.ca.

Purpose of the Research: This study aims to examine how working memory is affected by an arithmetic task. The study will be conducted online. This research project is a partial requirement for my master's thesis and will be written up and presented for a committee.

What You Will Be Asked to Do in the Research: During the study, you will be asked to participate in a recorded Zoom call where you will be asked to complete a short arithmetic task. The Zoom call will consist of yourself and the experimenter only. During the call, you will be asked to have your camera and audio turned on and to ensure you are in view of your camera and can be heard. After you receive the instructions for the arithmetic task, you will complete the task during the call. Following the call, you will be asked to complete an online survey to assess your experience with the task. The study should take approximately 45 minutes or less to complete and you are eligible to receive 1 experiment credit from the URPP for your participation.

Risks and Discomforts: There may be minimal risk of discomfort from your participation in this research. If any of the materials in this study are personally uncomfortable and you wish to discuss it, you may contact the Counseling and Development Centre (CDC) at York University. The CDC provides free, confidential counseling about personal issues on an individual basis. You can contact the CDC by telephone at 416-736-5297 or visit the Centre in person in Room N110, Bennett Centre for Student Services. More detailed information on the CDC is available at www.yorku.ca/cdc.

Benefits of the Research and Benefits to You: Your participation in this study provides you with an opportunity to reflect on your behaviour and feelings, as well as at the same time learn more about the process of psychological research. You will also help advance scientific understanding in social psychological research.

Voluntary Participation and Withdrawal: Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer, to stop participating, or to refuse to answer particular questions will not influence the nature of the ongoing relationship you may have with the researchers or study staff, or the nature of your relationship with York University either now, or in the future. If you decide to stop participating, you may withdraw without penalty, and you will still receive the promised credits. In the event you withdraw from the study, all associated data collected will be destroyed immediately, wherever possible. Should you wish to withdraw after the study, you will have the option to also withdraw your data up until the analysis is complete.

Confidentiality: All information you supply during the research will be held in confidence and your name will not appear in any report or publication of the research.

The principal investigator will keep a link that identifies you to your coded information, but this link will be kept secure and available only to the principal investigator and/or selected members of the research team. Any information that can identify you will remain confidential.

Data will be collected both through audio and video recorded Zoom meetings, as well as using online surveys (i.e., Qualtrics). Your data will be collected online and will be safely stored electronically in a locked computer file, and only research staff will have access to this information. Your name or any identifying information is not stored with your data. The data will be archived in a publicly accessible electronics repository on the Open Science Framework (osf.io). Researchers will have access to your data though your data will be anonymous. Confidentiality will be provided to the fullest extent possible by law.

The researcher(s) acknowledge that the host of the online survey, Qualtrics, may automatically collect participant data without their knowledge (i.e., IP addresses.) Although this information may be provided or made accessible to the researchers, it will not be used or saved without participant's consent on the researchers' system. Further, "Because this project employs e-based collection techniques, data may be subject to access by third parties as a result of various security legislation now in place in many countries and thus the confidentiality and privacy of data cannot be guaranteed during web-based transmission.

This study will use the Zoom to collect data, which is an externally hosted cloud-based service. When information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). Further, while York University researchers will not collect or use IP addresses or other information which could link your participation to your computer or electronic devices without informing you, there is a small risk with any platform such as this of data that is collected on external servers falling outside the control of the research team. Please contact Alecia Carolli, acarolli@yorku.ca, for further information.

Recordings (audio/video) will be saved in a password protected file to research team members' local computer, not the cloud-based service.

Please note that it is the expectation that participants agree not to make any unauthorized recordings of the content of a meeting / data collection session.

The data collected in this research project may be used in an anonymous by members of the research team in subsequent research investigations exploring similar lines of inquiry. Such projects will still undergo ethics review by the HPRC, our institutional REB. Any secondary use of anonymized data by the research team will be treated with the same degree of confidentiality and anonymity as in the original research project.

All of the research data collected within this study will be destroyed by October 31st, 2023.

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact the principal investigator, Alecia Carolli at acarolli@yorku.ca, or the principal investigator's supervisor, Dr. Esther Greenglass, at estherg@yorku.ca.You may also contact the Graduate Program in Psychology at gradpsyc@yorku.ca and/or 416-736- 5290, and/or the Faculty of Graduate Studies at fgsnews@yorku.ca and/or 416-736-5521.

This research has received ethics review and approval by the Delegated Ethics Review Committee, which is delegated authority to review research ethics protocols by the Human Participants Review Sub-Committee, York University's Ethics Review Board, and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 5th Floor, Kaneff Tower, York University (telephone 416-736-5914 or e-mail ore@yorku.ca).

Legal Rights and Consent:

I, consent to participate in the Arithmetic and Working Memory Study study conducted by Alecia Carolli and Dr. Esther Greenglass. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by agreeing to participate in this study. Clicking 'I agree' below indicates my consent to participate. Clicking 'I do not agree' indicates that I do not agree to participate.

- o I agree to participate (this includes agreeing to be audio recorded during the study through Zoom and agreeing to be video recorded during the study through Zoom).
- o I do not agree to participate.

2a. Standardized Instructions for those in the Show Self View Condition

Thank you for joining the Zoom call and agreeing to participate in this study.

Since we are not in person, it is important that we run through some Zoom etiquette for the study. To begin, I would like you to ensure that your Zoom application is set to full screen. This means that your Zoom application should take up the entire screen of your computer, and you should not see any unrelated matter, such as another webpage. Please remain on the Zoom application for the entire duration of the call. This means you should not view another webpage or application at any point.

In addition, I would like you to change your view to "Gallery". This is a display option on Zoom that allows you to see all participants at the same time. In order to change your display to "Gallery", if you are not already on "Gallery" view, you must go to the top right corner of the Zoom screen with your mouse. You will see a button that says "View". Please click on "View". A drop down will appear. Please click on the option in the drop down, called "Gallery". Can you please now confirm that you have selected "Gallery"?

> [Those who say "Yes" will continue to hear the instructions to follow, whereas those who say "No" will receive additional support and instructions from the experimenter].

In addition, please have your camera turned on for the entire duration of the call.

> [If the participant's camera is not already on, the experimenter will say, "Please turn your camera on now. You can turn on your camera by clicking the camera icon that says, 'Start Video' at the bottom left corner of the screen" and will wait for the participant to do so].

In addition to having your camera on for the entire duration of the call, you must ensure that you *can* see yourself. Can you please confirm that you are able to see yourself on Zoom?

> [Those who say "Yes" will continue to hear the instructions to follow, whereas those who say "No" will first hear the experimenter say, "To be able to see yourself, you must go to the top right corner of the Zoom screen with your mouse. You will see a button that says "View". Please click on "View". A drop down will appear. Please click on the option in the drop down, called "Show Self View". Can you please now confirm that you have selected "Show Self View" and are able to see yourself? [Those who say "Yes" will continue to hear the instructions to follow, whereas those who say "No" will receive additional support and instructions from the experimenter].

Please remain in view of your camera for the entirety of the call. Thank you for putting your Zoom to full screen, turning your camera on, and ensuring you cannot see yourself. Do you have any questions about the Zoom etiquette before we move on to the next part of the study?

> [Allow time for questions]

2b. Standardized Instructions for those in the Hide Self View Condition

Thank you for joining the Zoom call and agreeing to participate in this study. Before we begin, I would like to kindly ask if I can record this session?

> [If the participant says "Yes" experimenter will record, and if they say "No" the experimenter will not record].

Since we are not in person, it is important that we run through some Zoom etiquette for the study. To begin, I would like you to ensure that your Zoom application is set to full screen. This means that your Zoom application should take up the entire screen of your computer, and you should not see any unrelated matter, such as another webpage. Please remain on the Zoom application for the entire duration of the call. This means you should not view another webpage or application at any point.

In addition, I would like you to change your view to "Gallery". This is a display option on Zoom that allows you to see all participants at the same time. In order to change your display to "Gallery", if you are not already on "Gallery" view, you must go to the top right corner of the Zoom screen with your mouse. You will see a button that says "View". Please click on "View". A drop down will appear. Please click on the option in the drop down, called "Gallery". Can you please now confirm that you have selected "Gallery"?

> [Those who say "Yes" will continue to hear the instructions to follow, whereas those who say "No" will receive additional support and instructions from the experimenter].

In addition, please have your camera turned on for the entire duration of the call.

> [If the participant's camera is not already on, the experimenter will say, "Please turn your camera on now. You can turn on your camera by clicking the camera icon that says, 'Start Video' at the bottom left corner of the screen" and will wait for the participant to do so].

In addition to having your camera on for the entire duration of the call, I would like to introduce you to a Zoom feature called Hide Self View. You may have heard of this feature before; however, I will explain it to you. By turning the feature Hide Self View on, you will remain on camera, however you will not be able to see yourself. In other words, I will be able to see you, but you will not be able to see yourself. I will now explain how to turn Hide Self View on. You must hover your mouse over the box that displays your name. You will see options appear at the top right corner of the box displaying your name. Please click on the three horizontal dots, and a dropdown menu will appear. Please click the option that says, "Hide Self View". Can you please now confirm that you have selected "Hide Self View" and you are no longer able to see yourself?

> [Those who say "Yes" will continue to hear the instructions to follow, whereas those who say "No" will receive additional support and instructions from the experimenter].

Please remain in view of your camera for the entirety of the call. Thank you for putting your Zoom to full screen, turning your camera on, and ensuring you cannot see yourself. Do you have any questions about the Zoom etiquette before we move on to the next part of the study?

[Allow time for questions]

2c. Standardized Instructions for the Task
(i.e., a Modified Version of the Serial Sevens task; Hayman, 1942)

I am now going to ask you to perform a task involving counting. Before doing so, I will explain how to complete the desired task.

I am going to state out loud a number between 900 and 1000. From the number that I state verbally, I would like you to verbally count down, serially, by the number, seven. In other words, I will state a number out loud to you, between the number 900 and 1000, and you are to count backwards from that given number by sevens and out loud for me to hear you. Please do this as quickly and accurately as you can, with the objective to make as many correct subtractions as you can in the span of 3 minutes, in which I will time you.

In addition, let's say you make an error subtracting seven from a preceding number. For instance, you are at the number 600 and then say 592, and quickly realize you should have said 593, please continue to subtract the number seven from the error. In other words, do not try to correct an error, as once you make a mistake, it will be counted as an error despite any corrections. Essentially, in the case of an error subtracting seven from the preceding number, subsequent responses will be scored as accurate if the subsequent number is correct in relation to the previous number.

Lastly, I kindly ask you not to use anything external to help you during this task. This means that you cannot use a calculator, a search engine, another person, or any other resources to help you subtract seven, serially.

That is all of the instructions I have for this task. Please do let me know if you have any questions about the task before we begin.

[Allow time for questions]

I am now going to state the number you should start subtracting seven from. As soon as I state the number, the 3-minute timer will begin. I will let you know when your time is up and you can stop subtracting by sevens. So, let's begin. Please start subtracting as soon as I state the starting number. The starting number is 999.

After the Serial Sevens Task:

Your time is now up. Thank you for completing that task.

Now, I am going to send you a link to a survey. Can you please confirm you see the link in the Zoom chat and please also click on it, and let me know that it opens to the beginning of the survey.

[Those who say "Yes" will continue to hear the instructions to follow, whereas those who say "No" will receive additional support and instructions from the experimenter].

Now, that you have your webpage open to the survey, I would like to ask that you complete it immediately following this call. In other words, we can now end the Zoom call, however in order to complete the entire study, you will need to complete the survey now. Do you have any questions?

[Allow time for questions]

Thank you for your time.

3. Self View Manipulation Check

For the majority of the call, did you see yourself displayed on Zoom (i.e., your self view)?

- Yes
- No

4. Serial Sevens Check

During the task, when subtracting seven from preceding numbers, did you use anything external to help you (e.g., another person, calculator, phone, Google, or another search engine, etc.)? You will not be penalized, regardless of your response.

- Yes
- No

5. Perceived Difficulty of the Serial Sevens Task (Hayman, 1942; NASA Task Load Index; Hart & Staveland, 1988)

Please answer the following questions with regards to the task that you completed during the Zoom call, where you had to continuously subtract seven starting from the number 999.

1. How mentally demanding was the task?

2. How physically demanding was the task?

3. For this question, please place the slider on gradient 21, "Very High".[1]

4. How hurried or rushed was the pace of the task?

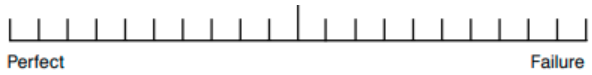
5. How successful were you in accomplishing what you were asked to do?

6. How hard did you have to work to accomplish your level of performance?

7. How insecure, discouraged, irritated, stressed, and annoyed were you?

[1] Conscientious Responders Scale (CRS; Marjanovic et al., 2014) item 1.

8. For this question, please place the slider on gradient 1, “Perfect”.[2]



[2] Conscientious Responders Scale (CRS; Marjanovic et al., 2014) item 2.

6. Public Self-Consciousness (Public self-consciousness subscale; Fenigstein et al., 1975; Scheier & Carver, 1985)

Please indicate how much each statement is like you.

0	1	2	3
Not like me at all	A little like me	Somewhat like me	A lot like me

1. For this question, please select the option, "Somewhat like me".[3]
2. I'm concerned about my style of doing things.
3. I care a lot about how I present myself to others.
4. I'm self-conscious about the way I look.
5. For this question, please select the option, "A lot like me".[4]
6. I usually worry about making a good impression.
7. I'm usually aware of my appearance.
8. For this question, please select the option, "Somewhat like me".[5]

[3] Conscientious Responders Scale (CRS; Marjanovic et al., 2014) item 3.
[4] Conscientious Responders Scale (CRS; Marjanovic et al., 2014) item 4.
[5] Conscientious Responders Scale (CRS; Marjanovic et al., 2014) item 5.

7. Demographics

1. Which of the following best describes your gender?

- Male
- Female
- Gender diverse

2. What is your age? _____

3. Which of the following best describes your ethnicity?

- Aboriginal (e.g., Inuit, Metis, North American Indian)
- Arab/West Asian (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan)
- Black (e.g., African, Haitian, Jamaican, Somali)
- Chinese
- Filipino
- Japanese
- Korean
- Latin American
- South Asian (e.g., East Indian, Sri Lankan)
- South East Asian (e.g., Vietnamese, Cambodian)
- White
- Other

4. What is your year of education?

- First year of undergrad
- Second year of undergrad
- Third year of undergrad
- Fourth year of undergrad
- Fifth year or greater of undergrad

5. Which of the following best describes your current employment status?

- Employed full time
- Employed part time
- Unemployed
- Other (please specify): _____

8. Data Quality

8a. Demand Characteristics

1. What do you think is the purpose of this study?

2. What do you think are the specific hypotheses being investigated in this study?

9a. Debriefing Form

Counting and Psychological Outcomes Study

Now that you have completed the study, you might be curious to know more about the purpose of the study and what we hope to find. The term "Zoom Fatigue" has emerged, describing the exhaustion felt from video conferencing (Bailenson, 2021). From this, nonverbal mechanisms have been theorized to be explanations of Zoom Fatigue, including cognitive load and self-evaluation (Bailenson, 2021). In fact, a review on single versus multiple channel media concluded that audiovisual technology requires more effort to process relevant information than media featuring a single channel (i.e., the audio-only channel; Lang, 1995). In addition, past research has shown that evaluating oneself during a Zoom call relates to mirror anxiety, the anxiety that results from seeing one's reflection (Fauville et al., 2021). Through surveys and linguistic analyses, women reported higher levels of mirror anxiety than men from video conferencing (Fauville et al., 2021). Moreover, mirror anxiety mediated the relationship between gender and Zoom Fatigue, suggesting that women are more self-focused during Zoom calls. Apart from gender and its relation to mirror anxiety, another factor that may increase self-evaluation during Zoom calls is public self-consciousness. Public self-consciousness is the tendency to evaluate aspects of the self that are subject to public display, such as overt behaviours and stylistic quirks (Fenigstein et al., 1975; Scheier & Carver, 1985). Moreover, mirror exposure increases public self-consciousness, as during a study, participants exposed to a mirror reported more statements about their appearance than those without exposure (Hofmann & Heinrichs, 2002). The current study sought to investigate the effects of viewing oneself during a Zoom call on cognitive load, using a controlled experiment consisting of two conditions, where participants on Zoom calls either can or cannot see themselves, while they present themselves on camera to an experimenter. By keeping all other factors constant, it can be determined whether viewing oneself on camera contributes to cognitive load, as measured by a cognitive load task (i.e., subtracting the number seven, serially, from 999) and a self-report measure of the perceived difficulty of the task. It is expected that women in comparison to men, and those high rather than low on public self-consciousness will experience more cognitive load, especially when they can evaluate their self-image during the Zoom call. The findings of the study address the psychological costs of Zoom usage, which is important as video conferencing has become a prominent method of communication.

If any of the materials in this study are personally uncomfortable and you wish to discuss it, you may contact the Counseling and Development Centre (CDC) at York University. The CDC provides free, confidential counseling about personal issues on an individual basis. You can contact the CDC by telephone at 416-736-5297 or visit the Centre in person in Room N110, Bennett Centre for Student Services. More detailed information on the CDC is available at www.yorkuca/cdc.

If you would like, you still have the option of withdrawing your consent at this point in time by asking us to destroy your data. Rest assured that you will still receive the participation credit that you have earned through your participation in the study. On the following screen you will be asked to affirm your continued consent to participate in this study. If you have any questions or concerns about this research, please feel free to contact Alecia Carolli (Master's Thesis

Researcher) at acarolli@yorku.ca or Dr. Esther Greenglass (Project Supervisor) at estherg@yorku.ca. Thank you.

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9b. Post-Debriefing Consent Form

Counting and Psychological Outcomes Study

Principal Investigator: Alecia Carolli

During the debriefing session, I learned that it was necessary for the researchers to disguise the real purpose of this study. I realize that this was necessary since having full information about the actual purpose of the study might have influenced the way in which I responded to the tasks and this would have invalidated the results. Thus, to ensure that this did not happen, some of the details about the purpose of the study initially were not provided (or were provided in a manner that slightly misrepresented the real purpose of the study). However, I have now received a complete verbal and written explanation as to the actual purpose of the study and have had an opportunity to ask any questions about this and to receive acceptable answers to my questions.

I have been asked to give permission for the researchers to use my data (or information I provided) in their study and agree to this request. I am aware that I may withdraw this consent by notifying the Principal Investigator.

This study has been reviewed and received ethics clearance through the Human Participants Review Committee (HPRC). If you have questions for the Committee contact the Sr. Policy Advisor, Research Ethics, Office of Research Ethics, at 416-736-5914 or ore@yorku.ca.

For all other questions contact Alecia Carolli, acarolli@yorku.ca.

Please select the option that indicates your response, and select next to confirm your response, and receive credit for your participation. Again, credit will be awarded to you regardless of your response to the following item.

- o Yes, I agree to include my information in the study.
- o No, I wish to withdraw my consent.