Champion or Globetrotter? Investigating the Relationship Between Global/ Local Bias and Open-World Video Game Behaviour

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Abstract

Despite research identifying relationships between attention, perception, and video game behaviours, no studies have examined gameplay in relation to attentional breadth – whether one sees "the forest" or "the trees". Drawing on attentional breadth research, I conducted an observational study investigating the relationship between global/local bias and gameplay behaviour. I hypothesized that global bias, as calculated by global scores on the hierarchical shapes task (HST), would be positively correlated with the breadth of game exploration in an open-world computer game, as calculated by the range of activity attempts, area visits, and character interactions. Twenty university students participated remotely by playing a 75-minute screen-recorded computer game. Additionally, participants completed the HST, a computerized cognitive task measuring naturally-occurring attentional breadth, followed by questionnaires assessing extraversion, openness to experience, and attitudes of horizontal/vertical individualism and collectivism. As predicted, there was a positive correlation between global bias and breadth of explorative gameplay, but the correlation was weak and not statistically significant. However, after controlling for extraversion, openness to experience, video game experience, and attitudes of horizontal/vertical individualism and collectivism, attentional breadth explained 10-20% unique variability in participants' global and local gameplay behaviours. These results suggest that naturally-occurring attentional breadth can predict behaviour in an open-world video game, independent of certain personality traits and social attitudes. .

Keywords: **attentional breadth, global/local bias, extraversion, openness to experience, individualism and collectivism, video game behaviour.**

Introduction

Human individuality is humorously conveyed by the old saying, "You are absolutely unique. Just like everyone else."[1] In the field of psychology, this uniqueness is explored by studying individual differences. Individual differences are empirical representations of the ways by which psychological traits vary from person to person (see more in Stangor, 2012). Personality traits are commonly studied as individual differences variables (e.g., Ashton & Lee, 2001, 2007). Nonetheless, a highly broad range of traits aside from personality can be measured in individual differences studies. For example, cognitive variables such as attention and working memory have been used as individual differences measures in research studies (e.g., Nunez et al., 2015; Moosbugger et al., 2006), especially in relation to educational studies and health sciences (e.g., Kyndt et al., 2012; NICHD Early Child Care Research Network, 2005).

Global/Local Cognitive Processing

Attentional breadth is a cognitive trait that represents a person's tendency to view "the forest or the trees". People perceive visual stimuli on a "global" level (the forest) or on a "local" level (the trees). Specifically, global bias refers to a holistic perceptual style such that one allocates their attention more broadly to the item or scene as a whole. On the other hand, local bias refers to a perceptual style that focuses on the elements that comprise an item or scene by allocating attention more narrowly. This trait naturally differs between individuals and is measured using computerized tasks.

Attentional breadth was first studied in 1977 by Navon, who

[1] Although widely quoted, there is no author to whom this quotation can be originally attributed. See more at: https://quoteinvestigator.com/2014/11/10/you-unique/

constructed the Navon Letters Task (NLT), one of the most recognized measures of global/local bias (see Figure 1a for an example of a congruent and an incongruent Navon letter). Navon's research demonstrated a global precedence effect where individuals typically prioritize the global level over the local level. Individuals show faster reaction times when identifying letters that are congruent (i.e., the same letter at the global and the local levels) versus incongruent (i.e., different letters at the global and local levels), and this congruency effect increases when they are asked to report the local level than when they are asked to report the global level. The greater interference by the global level suggested that global processing received greater attentional priority.

Kimchi and Palmer (1982) constructed another measure of attentional breadth called the Hierarchical Shapes Task (HST). On each trial of the HST, participants are shown stimuli consisting of a standard hierarchical shape item above two comparison hierarchical shape items from which participants are asked to select the one they think best matches the standard (see Figure 1b). Each image was composed of smaller squares or triangles forming a larger square or triangle. One comparison item matches the standard at a local level whereas the other matches the standard at a global level. The researchers calculated global bias by taking the total number of selections that matched at the global level. Thus, a higher number of global selections indicates a higher degree of global bias. Attentional breadth as measured by the NLT and HST remains relatively stable and constant over time within an individual (Dale & Arnell, 2013). This consistency is such that some people have a consistent bias to allocate attention to the global level or the local level, while others have no bias, and this may vary with the nature of the stimuli (Poirel et al., 2008).

a) b)

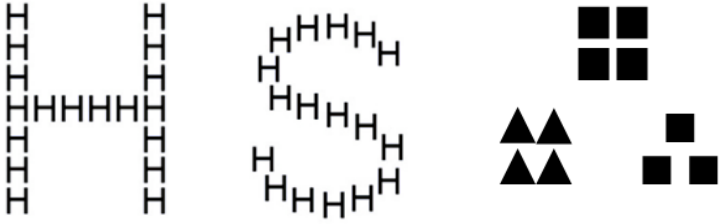

Figure 1. *a) An example from the Navon Letters Task of a congruent item on the left and an incongruent item on the right; b) An example from the Hierarchical Shapes Task of a target item (top), a global selection (left), and a local selection (right).*

Previous literature has established how attentional breadth has been associated with more than just the visual system. Rather, researchers have discovered evidence on how it relates to cognitive control and social behaviour. Taking a clinical approach, researchers have found that local bias tends to be prevalent among individuals affected by certain mental illnesses such as schizophrenia (Bellgrove et al., 2003), obsessive-compulsive disorder (Yovel et al., 2005), and autism spectrum disorder (Scherf et al., 2008). However, local bias is associated with positive attributes as well. Past experimental research has shown that experiencing a pleasant stimulus can increase local bias by narrowing attentional breadth (Gable & Harmon-Jones, 2008).

Regarding brain activity, several researchers have detected associations between cortical activity measurements and global/local processing. For example, Fink and colleagues (1996) investigated the neural underpinnings of global/local processing and found that local processing was emphasized in the left hemisphere, whereas global processing was emphasized in the right hemisphere. Extending these findings, Gable and Harmon-Jones (2008) observed that the combi-

nation of positive affect and high approach motivation was associated with not only narrow attentional breadth, but also higher left hemisphere activity in the frontal lobe. Expanding on this research, Pitchford and Arnell (2018) revealed that activation of cognitive control mechanisms during an effortful control task narrows attentional breadth in those with high approach-motivation. Specifically, when individuals express high motivational approach tendencies, they reduce their attentional breadth if exerting high self-control, and this relationship was found to be distinct from the link between left frontal lobe activity and local processing. Relating to the local bias associated with schizophrenia mentioned earlier, Choi and colleagues (2014) found that certain event-related potentials (ERPs) during local processing differ in those with schizotypal traits compared to a control group, suggesting that psychopathology influences attentional breadth as a result of differences in brain activity.

Global/Local Bias and Real-World Behaviour

Moving beyond behaviours observed in lab settings, global/local processing has also been shown to predict real-world social behaviours, such as public health behaviours. Specifically, a recent individual differences study on attentional breadth found that greater global bias can predict greater compliance with COVID-19 public health guidelines (Mendonca, 2021). This study found a positive correlation between the HST global bias score and one's compliance with public health guidelines after controlling for political affiliation and other factors. Similarly, other studies have found that asking participants to attend to the global level of hierarchical stimuli led to them making more monetary donations to charity than when participants were asked to attend to the local level of these same stimuli (Mukherjee et al., 2018). Another study showed how global bias relates to holding prosocial attitudes (Colzato et al., 2010). This

study showed that greater global processing on the NLT was associated with greater compassion and prosociality self-reported through a social value orientation task. This evidence suggests that perceiving something globally may relate to acting globally. Nonetheless, the literature has not yet studied attentional breadth in relation to virtual behaviours, such as video game behaviour.

Video Game Behaviour

Video games have taken the interest of countless researchers, often to examine cognition and behaviour. One reason is because video games evolved from being purely a source of entertainment to being useful in many real-world applications. For example, specialized video games are being more frequently applied in educational settings (Hutchison, 2007), where these games can engage students and sometimes improve learning. Similarly, video games are being applied in healthcare settings (Halldorsson et al., 2021), where they are used in special therapy programs. There are a number of reasons why video game technology can provide these benefits. First, video game experiences can help promote skills such as hand-eye coordination, working memory, and other cognitive skills (Benoit et al., 2020). Second, games can provide rich learning experiences due to their interactive features and high interest among youth (Granic et al., 2014).

Video game behaviours often reflect who we are. This notion is confirmed by research on video games that shows how in-game behaviour often reflects the personality and preferences of the player (Teng et al., 2012). Zeigler-Hill and Monica (2015) studied avid video game players and correlated their HEXACO personality scores in relation to video game behaviour. Participants self-reported their attitudes, behaviours, and feelings involved with the video games they play on a regular basis. Their findings suggest that video

game behaviours not only align with personality traits, but they are also consistent and predictable.

Scholars are increasingly investigating the reciprocal nature of cognition and behaviour in relation to video game experiences. Numerous studies have covered the role of players' attention in video game performance. Bavelier and Green (2003) studied how video game experience can boost cognitive traits such as selective attention. First, they noted that video game players exhibited greater accuracy compared to controls on tasks such as the attentional blink, suggesting they had more efficient attentional deployment over time. Gamers also outperformed controls on the "useful field of view task", suggesting they had more efficient attentional deployment over space. Next, they exposed non-gamers to video game training with action video games, which markedly improved their selective attention on these tasks compared to a control group who trained on the special puzzle video game, Tetris. In terms of disordered cognition, a study by Segev and colleagues (2017) examined participants' video game behaviour in relation to the presence of cognitive symptoms, finding that such symptoms correlated with externalizing behaviours in a video game. These studies demonstrate how cognitive traits can predict video game behaviour.

Doodle Champion Island Games

The video game selected for this study was "Doodle Champion Island Games" (hereafter "Champion Island"), a Google Doodle video game published on July 24th, 2021, to coincide with the Tokyo 2020 Summer Olympics.[2] In Champion Island, players explore a world filled with seven sport mini-games, hundreds of citizens, and dozens of side-quests. The sport mini games are based on sports featured in

[2] The updated August 24th version was used for the present study: https://www.google.com/doodles/doodle-champion-island-games-august-24

the Tokyo Summer 2020 Olympics: rock climbing, artistic swimming, archery, marathon, rugby, table tennis, and skateboarding. Champion Island's character and world design are based on concepts from Japanese culture, folklore, and mythology. Participants are free to choose where to travel, what sports to play, and other choices. The reason for selecting Champion Island was because my research seeks to involve unconventional, non-commercial video games in order for cognitive science to foster knowledge on how the relevance and cultural role of video games can be broadened beyond traditional, commercial contexts.

The Present Study

As noted above, individual differences in global/local bias, as measured with the HST, have been shown to predict compliance with real world public health behaviours such as social distancing and mask wearing during the COVID-19 pandemic (Mendonca, 2021). Also, as noted above, video gameplay reflects characteristics of the player (Zeigler-Hill & Monica, 2015). The Champion Island open-world video game is by far the most complex interactive Google Doodle created to date (Walsh, 2021), and one where participants can create their own experience through choosing which aspects of the game they complete. Therefore, the question addressed in this work was whether individual differences in global/local bias, measured by the HST, could predict Champion Island gameplay behaviours given that gameplay may relate to whether players perceive opportunities and objectives in the game primarily from a global level or from a local level. I hypothesized that attentional breadth would predict breadth of gameplay behaviour such that higher global bias on the HST would positively correlate with more globally-focused gameplay as define by a greater number of areas explored, interaction with a greater number of characters, more games played, more quests un-

dertaken and completed. Moreover, I hypothesized that global bias on the HST would negatively correlate with locally-focused gameplay, as calculated by the participants' maximum and average number of attempts per sport. Finally, I predicted that extraversion and openness to experience would positively correlate with NPC Interactions and Total Areas Visited, respectively.

Methods

Participants

Twenty-six university students were recruited through the SONA psychology research platform using a convenience sampling approach. Six participants were removed due to various exclusion criteria (see Results), leaving seven male participants and 13 female participants (M_{age} = 21.3 years; SD = 2.72) for analysis. English proficiency was a requirement for participation, and was verified by the researcher. Participants were compensated with SONA research participation credit. Because this was a correlational study, all participants performed the same tasks under the same conditions. Notably, participants completed all tasks via remote virtual participation using their own devices. The study was approved by the institution's Research Ethics Board. In accordance with ethical standards, all participants provided informed consent prior to participating. Coders signed a confidentiality agreement, participated in training, and used a manual to complete their coding duties.[3]

Materials

Video Game: Champion Island

Using their own computer, all participants played the Champion Island video game individually for 75 minutes while their screen was

[3] This study was pre-registered, including methods and hypotheses, which can be viewed at the following link: https://aspredicted.org/blind.php?x=XG6_MPV

recorded. Coders later transcribed the recording by watching the entire gameplay recording while filling out a checklist and tally chart to track relevant behaviours (see Appendix A for checklist used by coders). The tasks were selected based on in-game progress as well as actions that relate to the psychological constructs of interest (e.g., global/local bias and individualism-collectivism). For consideration of data inclusion/exclusion, notes were taken if any interruptions occurred (e.g., internet disconnection).

Sports Participation. Seven different sports can be attempted in the game. The number of sports attempted was scored out of 7 ("Sports Attempted"). The number of times each sport was attempted was tallied and averaged across the sports that were attempted at least once such that higher numbers reflected greater attempts/sport played (AvgSportAttempts). The total number of sport attempts was also calculated (TotalSportAttempts) as was the highest number of times any single sport was played (MaxSportAttempts). A scroll was obtained for each sport after successfully winning the event the first time, and the number of scrolls earned was also recorded (ScrollsEarned). We also recorded the average number of attempts required to earn a scroll (PreScrollAttempts), and the average number of times a sport was played subsequent to earning the scroll, for example to earn a higher score (PostScrollAttempts).

Trophy/Quest Participation. The game featured numerous side-quests to complete and NPC characters with which to interact. The number of interactions with an NPC was totalled (TalkNPC). Quests could be completed for their own sake, or to earn trophies. Quests were initiated when the player engages with an NPC, but not all engagements with an NPC resulted in a quest opportunity, and not all quests were undertaken, therefore the total number of quests accepted was counted as a separate variable

(TrophiesAttempted). Completing a quest automatically resulted in earning a trophy. Therefore, the number of trophies earned (TrophiesEarned) also measured the number of completed quests.

Quests involved several steps and participants may have only completed a portion of the steps without completing the quest. The criteria for each step were defined objectively so that they were coded the exact same way for each participant. A step was defined by a single, explicit action that was taken in the game to affect progress in the quests. Accepting the quest was considered 'Step 0' because it activated the rest of the steps, but it was not considered making the same degree of progress as the other steps. The checklist for quests consisted of a positive integer that listed the number of steps completed on a specific quest by the end of the gameplay duration (TrophySteps) which was recorded for exploratory analyses. If a quest had not been accepted, then that item of the checklist was left blank. Finally, when an NPC had to be convinced of something through specific dialogue choices, then talking to them and convincing them were considered separate steps because the actions and consequences were independent.

Exploration. The coding checklist included whether each of the seven main areas were visited as well as seven side areas and six unlockable areas. How many of the 14 readily accessible areas had been visited was recorded as "TotalAreas". Coders also tallied the number of times a participant visited their Team Base if they chose a team.

Composite Global and Local Gameplay Measures. For the operational definition of global gameplay, participants' overall score of in-game global bias was estimated with a composite global measure calculated as the average of the standardized measures (z-

scores) of number of different sports attempted (Sports Attempted), number of quests accepted (Trophies Attempted), number of areas visited (Total Areas), and number of NPC interactions (NPC Interactions) in that for each of these scores higher scores are thought to indicate more global bias. The main connection to the global bias processing style is that participants perceive opportunities and objectives in the game holistically. This means that they have a broad outlook on their possibilities in terms of sports and quests – examining the bigger picture – rather than fixating on specific opportunities, which resembles the local bias processing style. A composite local gameplay measure was also calculated from the average of the z-scores for max and average number of times each sport was played.

Background Questionnaire

Participants typically vary in age, gender, and task-related experiences (e.g., video games and competitive sports). Thus, a background survey was developed to collect these data points (see Appendix B) immediately prior to participants completing the attentional breadth task and the attitude and personality questionnaires.

Attentional Breadth Cognitive Task

The Hierarchical Shapes Task (HST; Kimchi & Palmer, 1982) was used to measure local global bias. In the task, participants viewed an example trial, then completed 24 experimental trials (see Figure 1b). For each trial, participants were shown three stimuli consisting of a target stimulus centred above two adjacent stimulus options. Each stimulus was composed of 3 or 4 small circles, squares, triangles, or crosses (local level) forming the shape of a larger square or triangle (global level). Participants were asked to select, based on their initial instinct, which of the two options best matched the target shape. Of

the 24 trials, 12 were filler trials intermixed with 12 test trials. Filler trials had an objectively correct answer: the correct option matched the target shape at either the global or local level, and the incorrect option did not match the target at either level. The test trials included two subjectively correct options, where one option matched the target at the local level (e.g., both were made of small squares as in the right option in Figure 1b), and the other choice matched the target at the global level (e.g., both formed a larger square as in the left option in Figure 1b). For both filler and test trials, the order of options (whether global/local or the correct/incorrect appear on the right or left) changed throughout the task to minimize confounds. Selecting the option that matched the target at a local level indicates that the participant had a bias for narrow attentional processing on that trial. Conversely, selecting the global level option indicates a bias for broad attentional processing. Participants' overall HST score for global bias was calculated by adding the number of global selections on the test trials (from 0 to 12) such that a higher HST score signifies greater global bias.

HEXACO Personality Domains Questionnaire

Scores on "extraversion" and "openness to experience" from the HEXACO personality inventory (Lee & Ashton, 2007) were collected using the 10 questions from each domain (Lee & Ashton, 2009). Extraversion measures one's tendency to enjoy social interaction and hold generally positive self-esteem. Openness to experience measures an individual's fondness of unconventional ideas and novel experiences. All items were answered on a 5-point scale, ranging from strongly disagree (1) to strongly agree (5). After reverse-scoring negatively-keyed items, an average score for each of the two domains was calculated.

Horizontal-Vertical Individualism and Collectivism Questionnaire

The Horizontal-Vertical Individualism and Collectivism (HVIC; Triandis & Gelfand 1998) questionnaire measures collectivism and individualism in two forms: horizontal and vertical. The questionnaire included 4 statements for each of these categories where participants indicated the extent to which each statement accurately captured their attitude, feelings and behaviours on a 9-point scale ranging from never (1) to always (9). Scores were averaged within each subscale: horizontal individualism (HI), vertical individualism (VI), horizontal collectivism (HC), and vertical collectivism (VC).

Procedure

Data Collection

Through a Microsoft Teams meeting, the experimenter first provided a brief game tutorial for Champion Island that clarified that participants could play however they prefer. The experimenter provided the participant with the online questionnaire link along with their participant number. Prior to the experimenter leaving the video call, participants were asked to share their screen (via screen-sharing function of Teams) and turn off their audio/video during gameplay. Participants were asked to play the game for 75 minutes, then close the Teams meeting and open the link to complete the remainder of the study unrecorded using the Testable online experiment platform. The questionnaire consisted of background questions (see Appendix B), 24 trials of the HST, questions on the two HEXACO domains, followed by the HVIC questions.

Participants' data was excluded from the sample if certain disruptive events took place during the Champion Island gameplay: (a) their internet connection or computer was troubled for more than 15

minutes (non-consecutive); (b) they were inactive for more than 15 minutes (non consecutive); or, (c) they were not engaging properly, such as doing something else on their computer other than the video game. Additionally, participants' data was removed from the sample if they did not score at least 9 out of 12 on the HST filler trials where there are objectively correct answers and pass at least two out of the three attention checks embedded in the questionnaires.

Data Analysis

After data exclusions, coders carefully reviewed each gameplay recording in order to code all the variables involved in the analysis. As mentioned previously, coding the operationalized variables consisted of filling in the checklist and tracking sheet. This was a structured observational approach because the variables are predefined. Recording was done mechanically by computer software, but the coding was performed by humans. Thirty-five percent of the data files were coded by two coders so that reliability estimates could be calculated. Additionally, the correlations amongst the key global and local gameplay variables were examined to verify their suitability for inclusion in the composite measures.

To test the hypotheses, Pearson's r correlations were examined between HST global scores and HVIC scores, HEXACO scores, the composite global gameplay measure, and the composite local gameplay measure. Correlations between global and local gameplay measures and the personality measures were also examined. In addition to correlation analyses, two multiple regression analyses were conducted to examine whether attentional breadth scores on the HST could predict global and local gameplay composite measures over and above the HVIC scores, personality measures from HEXACO, and prior video game experience.

Results

Overall, six participants were removed from the dataset. Three participants failed the questionnaire attention checks, which suggested their questionnaire data were not reliable. One participant failed to obtain the minimum of 9 out of 12 correct responses on the filler trials of the HST, which suggested improper completion of the HST. One participant had previous progress on the game and their data were deemed to be compromised. The sixth removal was due to a recording glitch that lost over 15 minutes of footage.

Descriptive Statistics for Scale Measures

Descriptive statistics for the key measures of interest are listed in Table 1. The sample had considerable variability in the HST scores and extraversion, openness to experience, and HVIC questionnaire scores. All of these means fall in the mid-range of the scales, and the standard deviations and minimum and maximum values indicate considerable spread with no ceiling or floor effects. With regard to coded gameplay behaviours, all twenty participants attempted each of the seven sports, which means that all participants also visited each of the seven main areas on the game map. Hence, the two gameplay variables of Sports Attempted and Main Areas suffered from ceiling effects. On the other hand, participants showed a large range of scores for the rest of the gameplay measures, including the components of the global gameplay and local gameplay composite variables. Despite the Main Areas variable suffering from ceiling effects, Total Areas remained suitable for analysis as a component of the global gameplay composite variable because it consisted of the sum of Main Areas and Side Areas, the latter of which had sizeable variance within the sample.

Inter-rater Reliability for Coded Gameplay Variables

Gameplay data for seven participants (35%) were coded independently by two separate coders who produced two sets of scores that were examined to create a final version of scores. The intraclass correlations (ICC) were used to calculate inter-rater reliability. ICC is used as a valid measure of inter-rater reliability in research designs wherein only a subset of participants will be coded by multiple raters (Hallgren, 2012), and wherein pairs of raters change for each subject. ICC values ranged from .864 to .978 Average Sport Attempts had an

Table 1: *Descriptive Statistics for Variables of Interest*

	N	Mean	SD
HST	20	6.60	
Extraversion	20	3.05	
Openness	20	3.62	
Sports Attempted	20	7.00	
Trophies Attempted	20	10.95	
NPC Interactions	20	47.70	
Total Areas Visited	20	10.85	
Average Sport Attempts	20	4.78	
Max Sport Attempts	20	8.60	

Note. *Openness = Openness to Experience. Possible scores for each variable are the following: HST = 0 to 12; Extraversion and Openness to Experience = 1 to 5; HVIC dimensions (HI, HC, VI, VC) = 1 to 9; Sports Attempted = 0 to 7; Trophies Attempted = 0 to 24; Areas Explored = 0 to 14; NPC Interactions and Average/ Max Sport Attempts = any positive integer. Global Gameplay and Local Gameplay were calculated as the average z-score from a set of gameplay variables. As standardized variables, the mean is 0 and the standard deviation is 1. Therefore, they are not reported in this table.*

ICC of .978 ($p < .001$). Trophy Attempts had an ICC of .948 ($p < .001$). NPC Interactions had an ICC of .864 ($p = .003$). Side Area Visits had an ICC of .898 ($p = .001$). The greatest discrepancy between coders was on the number of NPC interactions, which was not surprising due to the fact that this variable had a wide range of scores (12 – 90 interactions based on the final version of scores). The most probable cause of the discrepancy can be accounted for by the coder not following the exact criteria for what constituted an interaction (see Methods). Because the two sets were not identical on all scores, the discrepancies needed to be addressed. For the number of NPC interactions, the average score from both sets was taken for the final version. For all other gameplay variables, discrepancies were resolved by the researcher re-evaluating the game recording and deciding on the score for the final version. After being resolved by the researcher, the reconciled values were used for the analyses.

Relationships Amongst Gameplay Measures

Sports Attempted and Main Areas Visited were not included in the global gameplay composite variable due to ceiling effects. As seen in Table 2, all remaining components from the global gameplay composite variable (Trophies Attempted, NPC Interaction, and Total Areas) had strong positive inter-correlations ($r > .8$) that were statistically significant ($p < .001$). Additionally, they all had moderate to strong negative correlations with the two components of the local gameplay composite variable (Average Sport Attempts and Max Sports Attempts). From these strong and significant positive correlations between the global gameplay composite variables, global gameplay measures demonstrated strong convergent and divergent construct validity and were deemed suitable for use in the global gameplay composite variable. Given that they were highly positively correlated with each other, and highly negatively correlated with com-

ponents of the global gameplay variable, Max Sport Attempts and Average Sport Attempts were deemed suitable as the components of the local gameplay composite variable.

Relationships Between Gameplay Composites and Other Measures

Pearson's r for the global gameplay composite and HST scores

Table 2: *Correlation Matrix for Standardized Gameplay Variables*

	NPC Interactions	*Total Areas*	*Average Sport Attempts*	*Max Sport Attempts*
Trophies Attempted	.874**	.816**	-.696**	-.670**
NPC Interactions		.801**	-.590**	-.559*
Total Areas			-.432	-.507*
Average Sport				.895**

** p<.01, *p < .05

showed a weak positive correlation (see Table 3) that was not statistically significant. The correlation between the local gameplay composite and HST scores was medium-strength and negative, but non-significant (p = .112). Global gameplay had a significant strong and negative correlation with local gameplay. HST score was highly negatively correlated with present video game experience, but this fell short of statistical significance. Additionally, past and present video game experience were non significant predictors of greater global gameplay and less local gameplay.

Regression Analysis

Video game experience and personality measures were somewhat

related to global and local gameplay measures and HST scores. Therefore, controlling for this variability would allow examination of the relationship between global and local gameplay and HST over and above these measures. A simultaneous regression was conducted predicting global gameplay using the predictors of HST scores, extraversion, openness to experience, HVIC measures, past and the researcher re-evaluating the game recording and deciding on the score for the final version. After being resolved by the researcher, the reconciled values were used for the analyses.

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Relationships Between Gameplay Composites and Other Measures

Pearson's r for the global gameplay composite and HST scores showed a weak positive correlation (see Table 3) that was not statistically significant. The correlation between the local gameplay composite and HST scores was medium-strength and negative, but non-significant (p = .112). Global gameplay had a significant strong and negative correlation with local gameplay.

HST score was highly negatively correlated with present video game experience, but this fell short of statistical significance. Additionally, past and present video game experience were non significant predictors of greater global gameplay and less local gameplay.

Regression Analysis

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A second simultaneous regression was conducted predicting local gameplay using the same predictors of HST, personality and video game experiences. As shown in Table 5, together the predictors explained 54.4% of the variability in local gameplay, R = .737, F(9,10) = 1.087, p = .333. HST Global bias predicted 22.37% of unique varia-

Table 3: *Correlation Matrix for Key Variables*

	HST	Global Play	Local Play	Extra	Openness	HI	HC	VI	VC	Past VG
HST	1									
Global Gameplay	.145	1								
Local Gameplay	−.272	−.628**	1							
Extra	.178	−.067	.294	1						
Openness	0.057	.039	.146	.318	1					
HI	−.009	−.160	.192	−.366	−.016	1				
HC	.262	.028	.231	.673**	.401	−.244	1			
VI	−.152	−.2.80	.164	−.364	−.294	.426	−.354	1		
VC	.067	−.181	−.051	.210	−.117	−.349	.401	−.053	1	
Past VG	−.091	.513*	−.435	−.040	.099	−.249	.053	−.026	0.52	1
Present VG	−.420	.327	−.192	−.293	.240	0.37	.015	−.041	.124	.507*

= Key Correlations

= Other Correlations of Interest

Note. *Extra = Extraversion; Openness = Openness to Experience; Past VG = Past Video Game Experience; Present VG = Present Video Game Experience. ** p < .01, * p < .05*

bility in local gameplay over and above the factors of personality and video game experience (see Figure 4), but this was not significant, nor were any other predictors.

Discussion

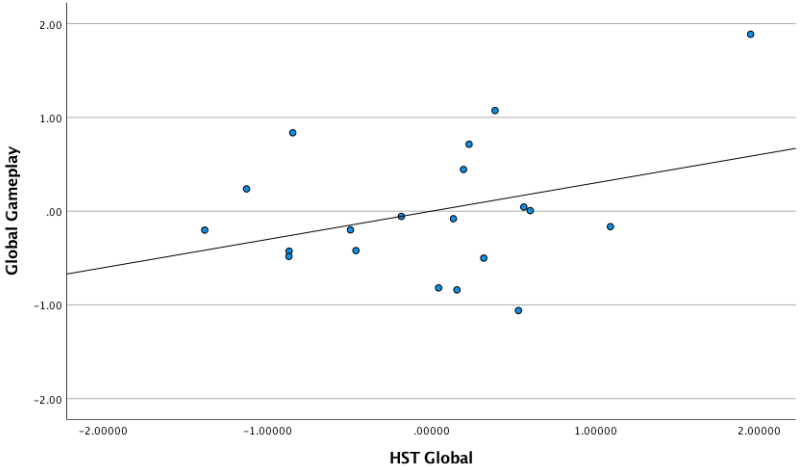
Hypothesis Testing

Attentional Breadth and Global/Local Gameplay

It was predicted that there would be a positive correlation between HST global scores and the global gameplay composite variable. The correlation was weak (r = .145) and not statistically significant, but was in the correct direction. Similarly, it was predicted that HST global scores could explain unique variability in global gameplay over and above extraversion, openness to experience, individualism-collectivism, and video game history. As predicted, HST had a fairly strong partial correlation with global gameplay once these measures were controlled for, but this was not statistically significant. The partial correlation of .340 was more noteworthy than the zero-order correlation of .145 because there was a high amount of variability in global gameplay explained by the other predictors (e.g., video game experience), which is excluded from the partial correlation calculation. My predictions were based on obtaining a larger sample size (approximately N = 60) with greater statistical power than the actual result. As this statistical power was not obtained, the p-values are less useful in validating the effects between the key variables of interest (e.g., HST scores and global/local gameplay behaviour measures).

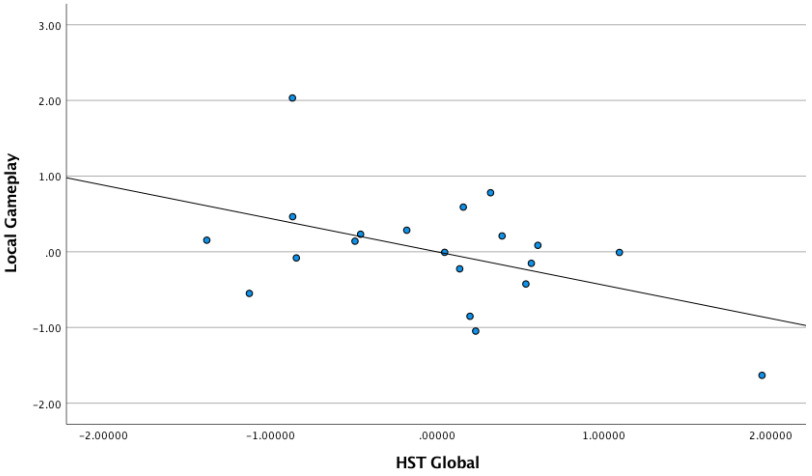
I predicted that there would be a negative correlation between HST global scores and the local gameplay composite variable. The correlation was relatively modest (r = −.272) and not statistically significant, but was in the right direction. Similarly, I predicted that

Figure 3: *Partial Scatterplot for HST and Global Gameplay with Line of Best Fit*



Note. *Both variables are shown as z-scores.*

Figure 4: *Partial Scatterplot for HST and Local Gameplay with Line of Best Fit*



Note. *Both variables are shown as z-scores.*

Table 4: *Regression Analysis Predicting Global Gameplay*

Predictor	Partial *r*	SE	*t*-value	*p*-value
HST	.340	.264	1.142	.280
Extraversion	–.011	.496	–.035	.973
Openness to Experience	–.254	.396	–.829	.427
Child VG	.364	.351	1.238	.244
Present VG	.297	.428	.982	.349

Note. *For all variables, N = 20. SE = standard error. * p<.05. ** p<.01. *** p<.001.*

Table 5: *Regression Analysis Predicting Local Gameplay*

Predictor	Partial *r*	SE	*t*-value	*p*-value
HST	–.473	.259	–1.699	.120
Extraversion	.181	.487	.581	.574
Openness to Experience	.116	.389	.369	.720
Child VG	–.403	.344	–1.392	.194
Present VG	–.119	.420	–.380	.712

Note. *For all variables, N = 20. SE = standard error. * p<.05. ** p<.01. *** p<.001.*

HST global scores could explain unique variability in local gameplay after accounting for the same personality measures and video game experience. As predicted, HST had a fairly strong negative partial correlation with local gameplay, but this was not statistically significant. Once again, the partial correlation of –.473 was more noteworthy than the zero-order correlation of –.272 because there was a high amount of variability in local gameplay explained by the other predictors such as past video game experience.

The mild relationship between HST global bias in predicting global gameplay does not directly support any existing findings. Even so, this relationship shows how acting "globally" (e.g., having positive, prosocial interactions with NPCs) may be related to the HST (over and above other predictors), which resembles existing research by Mendonca (2021) as well as Colzato and colleagues (2010) who show the link between attentional breadth and prosociality.

Personality and Gameplay

Contrary to expectations, there was no significant relationship between Extraversion and NPC interactions, ($r = -.051$, $p > .05$). One reason why these two variables are not correlated could be because voluntary interactions may reflect some participants pursuing a trophy rather than reflecting intrinsic inclination toward social interaction. For example, although the Trophy House provides hints to where trophy quests may be initiated, players might have talked to several NPCs before coming across the individual they are in search of for the quest.

Contrary to expectations, openness to experience did not positively correlate with areas visited ($r = -.033$, $p > .05$). The absence of a correlation could be because the effect of openness to experience was weaker than that of past video game experience, which caused participants to struggle more on the sports attempts, resulting in less time for exploring areas. Video game experience, past and present, were found to be related to gameplay measures. This relationship is sensible because video game experience allows one to be more successful at the sports, which decreases the need to repeat attempts in a manner that exhibits local gameplay. Simultaneously, this in-game success also provides more opportunity to make progress in quests and side areas in a manner that exhibits global gameplay. However, although a player may have the ability (i.e., due to video game experi-

ence) to make greater progress in the game, they may intrinsically enjoy playing a specific game which draws them to repeat sports even after the scroll is earned. Therefore, deeper analyses could be conducted using the gameplay measures of post-game sport attempts as well as bonus version sports attempts.

There were also some suggestive correlations between video game experience and personality measures. For example, extraversion and openness to experience were found to have weak-to-medium correlations with present video game experience (see Table 3). However, the present study did not produce any key results directly connecting personality to gameplay in Champion Island, contrary to past findings showing that personality could predict the nature of in-game play (e.g., Zeigler-Hill & Monica, 2015). While results suggest that participants' gaming background and the level of difficulty of Champion Island may play a role in whether or not a player behaves based on their gaming abilities or based on their personality and naturally occurring attentional breadth.

Limitations and Strengths

One strength of this study is how the remote participation aspect of the design is likely to have more ecological validity than if participants were to have completed all tasks and the gameplay within the lab. This is because the external validity would be higher when applying in natural settings given that people would typically be playing Champion Island in their own homes on their own computers, rather than in a lab. Another strength is that participants' gameplay behaviours were video-recorded and coded, which generally has greater accuracy than a self-report measure, such as if participants indicated what aspects of Champion Island they completed by filling in a questionnaire.

The present study contained numerous limitations on the precision

of measurement techniques, threats to internal validity. To start, the past and present video game experience questionnaire was short and limited, yet this seemed to be a relevant factor that could be explored at a deeper level. For example, the number of hours per week and the number of years could have been collected to more deeply measure video game experience. This may be especially important given the perceptual effects of habitual video game engagement (e.g., Chopin et al., 2019). Another area with questionable measurement was the coded number of NPC interactions. This behaviour was difficult to quantify in all situations because the purpose was to measure intentional interactions, but this was not easily distinguished between moments when the player may have accidentally clicked a button that prompted the NPC dialogue.

One potential confound in the gameplay setup was that those with less video game experience may have struggled with the controls in a manner that impeded their expression of global/local gameplay. Similarly, a potential environmental bias influencing gameplay was that the game emphasized on the sports, and participants may have simply felt compelled to complete the sports prior to the side quests (e.g., the game description says, "earn all 7 scrolls to restore balance to the island," indicating that scrolls rather than trophies are the superior goal). Moreover, the 75 minute gameplay duration may have been too short for those who struggled with the controls. Accordingly, future research could consider providing a different amount of time, providing more support for game controls, or both. Alternatively, 75 minutes may be too long because there were ceiling effects for the Main Areas and Sports Attempted gameplay variables. An effective way to account for gameplay duration and video game experience would be to use a homogeneous set of participants with respect to video game experience (past or present).

For example, future studies can use a bunch of experienced gamers. and give them less time, or use a bunch of novice gamers and give them more time.

Another limitation was that participants played the game prior to completing the HST, so instead of measuring participants' naturally-occurring global bias, the HST may have measured participant's global bias in response to the video game challenges, which may have required exerting a lot of self-control, especially for participants less familiar video games, in turn manipulating attentional breadth (Pitchford & Arnell, 2018). The present study had several limitations on the generalizability of results. First and foremost, the sample size (N = 20) was inadequate in terms of statistical power and external validity of sample, due to the fact that it was insufficient in representing a normal distribution. The skew of the data prevents the error variance from cancelling each other out, resulting in less measurement accuracy and reliability. Additionally, some of the quests were not attempted by any participant, so not all aspects of this game were captured. Another limitation of this study are that only university students were looked at in this sample. Therefore, the results do not tell us how this gameplay relates to psychological traits of children and youth, an important demographic in video game research.

Implications and Future Directions

This study did not examine participants' behaviour during the sports mini-games. Future research could consider this behaviour, such as the use of strategies (e.g., power-ups in the rugby mini-game). Similarly, only one game was used for this study, and future research could examine video games from different genres. The present study employed a nonexperimental, single-group research design. In the future, an experimental research design with multiple conditions could be used. For instance, researchers can manipulate participants'

global/local bias by priming them for global bias prior to them playing the game. This sort of experiment would test causal relationships between global attentional bias and in-game variables. Thus, a similar research question about this relationship could be answered by providing the very first experimental test on the gameplay behaviours in this specific game. Given the use of electroencephalography (EEG) on research in attentional breadth (e.g., Pitchford & Arnell, 2018), future research on video games and global/local bias could measure brain activity through EEG or similar methods. Similarly, local and global processing resemble "analytic" and "holistic" thinking respectively (Nisbitt et al., 2001). There may be games by which these patterns of thinking can be better examined.

On a broader level, other areas of cognitive research could be integrated with attentional breadth, attitudes, and personality in future video game research. Visual cognition is a related cognitive field with existing video game research involving eye-tracking (e.g., Chen & Tsai, 2015) and visual information processing (e.g., McColeman et al. 2020). Future research could investigate how these variables relate to each other as well as video game behaviour to better understand the cognitive mechanisms that relate to our virtual behaviour.

Through its artistic and technical richness, Champion Island shows how non-commercial video games can be used to celebrate culture and the global community (Walker, 2021). Games and gamification are becoming more effective engagement mechanisms beyond the typical "gamer" (e.g., Hassan, 2017). Thus, the research on this game can be continued to develop more results relevant to the real world, such as the potential of Champion Island to promote prosociality and global-minded thinking. For example, a future area of inquiry could be the extent to which this game can successfully promote prosocial attitudes and behaviours, such as cultural

tolerance through appreciation of Japanese culture and folklore.

Conclusion

In summary, the present study aimed to examine whether attentional breadth can predict virtual behaviours over and above other psychological factors. This research question stemmed from existing research indicating how attentional breadth can predict real-world public health behaviours (Mendonca, 2021). Although many results were not statistically significant, the overall methodology provided interesting results and implications on how attentional breadth may be related to video game behaviours and experience. Finally, this study sets the stage for more cognitive research on open-access video games such as Champion Island.

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