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Sense of Purpose and Sustaining Attention

Jiayi Yu

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Jiayi Yu

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Jiayi Yu

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Committee Members

Dr. Kenneth Logan PsyD, Chair

Dr. Bill Buhrow Jr. PsyD, Member

Dr. Kathleen Gathercoal PhD, Member

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Abstract

The dissertation investigated the interplay between an elevated sense of purpose moderated by heightened altruistic motivation and sustained attention in a college undergraduate population. Drawing on existing literature highlighting the positive effects of purpose on well-being and cognitive abilities, the study introduced an experimental design to explore the causal relationship between purpose and attention. Participants were recruited from the undergraduate population of a Christian liberal arts university in the Pacific Northwest. A continuous performance test (CPT) —the AX-CPT paradigm—was utilized to assess sustained attention. The experimental group was prompted with the opportunity to earn a monetary donation for a humanitarian organization based on their task performance, while the control group received no such prompt. The study examined the influence of motivation on attentional capacity. Results indicated no significant difference in attentional performance between the experimental and control groups, though a statistically detectable difference was observed in reaction time between working and non-working students. Further analysis explored trends in reaction time, accuracy, and motivation ratings, revealing complex relationships that challenge preconceived notions. The findings contribute to understanding attention, motivation, and purpose, emphasizing the need for nuanced measures and suggesting avenues for future research.

Keywords: altruism, purpose, attention, motivation, reaction time

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Sense of Purpose and Sustaining Attention

Chapter 1

A sense of purpose has long been of interest to people. This concept seems to be ever present and undeniably impacts the human spirit. Numerous studies have attested to the positive benefits of a sense of purpose on people across the lifespan. For those who suffered childhood emotional abuse and neglect, having a sense of purpose ameliorated the subsequent symptoms of depression across multiple measures (Hartanto et al., 2020). Emerging adults who feel a greater sense of purpose share a closer relationship with their parents and also have a smoother differentiation process, which contributes to more self-mastery (Hill et al, 2016). With regards to work, both hedonic measures—experiences of pleasure, and eudaimonia measures—experiences of purpose, meaning, and growth, predicted extra role behavior and workers' attitude towards their jobs (Turban & Yan, 2016). In older adults, researchers established the association between a sense of purpose and a reduced rate of cognitive impairment (Bell et al, 2022).

Attention has become the new value currency in a world that increasingly relies on data and information. Our relationships, education, occupation, spirituality, entertainment, and numerous other domains compete for our attention, causing it to be increasingly difficult for us to sustain a concerted effort. More complaints of inattention now exist among other growing mental health concerns. While inability to sustain attention is positively associated with childhood adversity (Vogel et al., 2020), a sense of purpose ameliorates the effects of childhood adversity (Hartanto et al., 2020). In addition, Hartanto's team also cited literature that explained a sense of purpose's role on effective self-regulation by encouraging focal shifts from ruminating on past negative events that are unchangeable to purposeful future plans and goals. The shift of

the focal attention, may be a key mechanism in how sense of purpose promotes better mental health outcomes for those who suffered childhood emotional abuse and neglect.

Siegel (2012) emphasizes the significance of dedicated focus time for our well-being. According to Siegel, sustained attention on a task involving energy and interest triggers the release of acetylcholine, promoting structural changes in the brain through neuroplasticity. Focused attention also has been shown to activate brain derived neurotrophic factors. Siegel argues that the capacity and habit of paying focused attention beyond our seasons in school can help prevent dementia. Moreover, focused attention opens the door to meditative practices that help alter epigenetics and regulate gene expression. In addition, focused attention is necessary for wellness and balance of our mental, physical, and relational states which then allows for an enduring state of equanimity (Siegel, 2012). Psychologist Mihaly Csikszentmihalyi, in his book *Flow: The Psychology of Optimal Experience* (2009), concluded that being able to control our attention is one of the most effective tools available to improve the quality of our experience as our attention shapes our memories, thoughts, and feelings. Furthermore, the ability to focus is core to work productivity. Different types of attention (focal and non-focal attention) are related to memory consolidation, and the types of problems they help solve have been explored (Siegel, 2012; Newport, 2016). With regards to children struggling with attention deficit and hyperactivity disorder (ADHD), meditation and mindfulness training have proved to enhance mother-child relationships (Singh et al., 2010). Though diagnoses of ADHD have increased in the past few decades, no evidence suggests more children meet diagnosis criteria when standard procedure is carried out (Polanczyk, 2014). Neuromarker research on whole-brain functional connectivity suggests it may be more accurate to see ADHD on a spectrum of neural and behavioral dysfunction rather than a zero-sum, all-or-nothing disorder (Rosenburg et al., 2016).

As such, a better understanding of ways to sustain attention may offer helpful interventions to those who struggle with inattention at diagnosable and subclinical levels.

As outlined above, both a sense of purpose and the ability to sustain attention contribute to our well-being. Existing research shows a relationship between having a sense of purpose and some cognitive abilities. A 2021 prospective meta-analysis of cross-sectional associations, based on 140,000 participant data, examined the association between a sense of purpose in life and higher verbal fluency and better episodic memory. Data from 32 countries, across demographic, socioeconomic, and cultural stratifications showed a strong association between a sense of purpose and higher verbal fluency and episodic memory (Sutin et al., 2021). They explained that those who have a stronger sense of purpose tend to engage in behaviors that contribute to better cognitive health such as less tobacco use, more physical activities, more social interactions, and exhibited personality traits such as extraversion, emotional stability, and conscientiousness; these factors all correlate with positive cognitive functioning.

For older adults, a sense of purpose has positive benefits on cognitive decline and the effects of dementia. A 2020 cross-lag path model study using the second and third wave of the Midlife in the United States study showed that adults who have substantial decreases in a sense of purpose also have on average, a more substantial decrease in memory performance, albeit the correlation was small (Dewitte et al., 2020). In this model, higher sense of purpose predicted higher subjective belief of memory, and while subject belief of performance does not represent objective memory performance, these two measures positively predict each other over time. Older adults who have a higher sense of purpose experienced less baseline decline in memory. A longitudinal study involving a 12-year follow-up of 4,599 older American adults (Lewis & Hill, 2021) found those with a higher sense of purpose predicted greater word recall memory at

baseline. On occasions where participants reported a higher sense of purpose than usual, they were likely to perform better on word recall in the memory task at that occasion. Sense of purpose also predicted baseline mental status; participants were likely to show concurrent increases in both sense of purpose and mental status. Within-person effects of sense of purpose was modified by age, with older adults showing a larger effect. Lewis and Hill discussed how feeling purposeful helps those facing challenges to overcome them more quickly and reduces reactivity to stressful experiences. A sense of purpose also contributes to cognitive reserve which is made up of complex cognitive processes such as self-reflection, envisioning the future, self-representation, and allocation of resources in the midst of competing goals. This combined with accumulation of lifestyle characteristics protect individuals from phenotypic manifestation of neurological insults. Postmortem analysis suggested a third of adults who showed minimal cognitive impairments prior to death have similar levels of amyloid and neocortical neurofibrillary tangles to those with Alzheimer's disease. Lewis and Hill explained cognitive reserve as the protective barrier to help preserve cognitive functioning despite accruing neural markers for Alzheimer's disease. This is the same for those who struggle with major depressive disorder, as enhanced sense of purpose also helped to mitigate the negative effects of the depressive symptomatology related neurostructural abnormalities and dysregulation that affects memory (Lewis & Hill, 2021).

Within a sense of purpose and its benefits, prosocial behavior such as volunteering, has been shown to have significant positive effects on health, contributing to improved physical, mental well-being, and reducing mortality rates. Additionally, research indicated that volunteering can delay the onset of Alzheimer's disease and related dementias (Han et al., 2020). A 2020 multilevel model study (Han et al., 2020)—using nine waves of the U.S. Health and

Retirement Study, cognitive test batteries, and the polygenic risk approach via genome-wide association studies—demonstrated robust within-person associations between volunteering and higher levels of cognitive functioning, as well slower cognitive decline. The within-person analyses employed in this study were particularly noteworthy as it protected against research selection bias as those who volunteer may have other traits that promote cognitive health when compared to their non-volunteering counterparts. Furthermore, to isolate prosocial behavior and its direct positive effects on health and gene regulation, Han and team, through predictive modeling, found those who are at greater genetic risk for Alzheimer's disease would experience more protection against cognitive decline if they were to volunteer 100–200 hours per year, or about 2 to 4 hours per week (Han et al., 2020). Regarding the recipient of altruistic or prosocial benefits, research has identified altruism, especially altruistic behaviors directed towards a global community instead of limited towards local recipients offered the strongest sense of well-being (Xi et al, 2016).

Motivation and its effect on attention must be accounted for as it often mediates or moderates enhanced cognitive performance. There is an established relationship between motivation and attention, including increased preparatory cue-related activity during attentional tasks (Corbetta & Shulman, 2002; Kastner & Ungerleider, 2000) and increased responses in fronto-parietal attentional regions (Engelmann et al., 2009) under reward and incentive conditions. A 2011 study, examining 54 participants' brain structural images, captured frontal-parietal regions' responses for attention and preparatory related activity under reward conditions (Padmala & Passoa). Subcortical sites also exhibited reward related signals including the nucleus accumbens, caudate, putamen and the midbrain area involving the ventral tegmental area and some areas of the substantial Niagara. Compared to no-reward conditions, reward conditions

reduced conflict responses in the medial parietal cortex and increased top-down control in the filtering out of task-irrelevant information (Padmala & Passoa, 2011).

When comparing age group differences, a 2023 study looking at event related potential patterns found effects of different cue types on preparatory processes in both younger and older adults (Sullivan et al., 2023). In younger adults, various incentive cues elicited the effects that researchers described akin to impulsive and habit forming, promoting faster but less accurate responding. Older adults exhibited more pronounced transient effects at frontocentral sites, possibly indicating a greater reliance on frontal attentional resources. The results suggested incentive cues initiate heightened preparatory attention in younger adults, interfering with reactive control processing at the time of the target. In contrast, older adults were less susceptible to the negative effect that incentive has on reactive control and engage in strategies that prioritize overall task performance. Despite age differences, the event related potential patterns indicated that early, automatic attentional processes associated with incentive cues are preserved with age.

Knowing more about how motivation interferes with performance in the clinical population can inform strategies to enhance cognitive abilities in individuals grappling with cognitive deficits. A 2015 study established a direct correlation between motivation and cognitive performance, mediated by effort, in patients diagnosed with schizophrenia (Foussias et al., 2015). Foussias and team found significant associations between motivation and global cognitive performance, particularly in verbal fluency, verbal memory, working memory, attention/processing speed, reasoning, and problem-solving. Effort exerted during cognitive testing was related to both motivation and cognitive performance, predicting cognitive performance and partially mediating the relationship between motivation and cognitive performance. Reduced effort during testing, observed in approximately 12% of the sample, was

associated with more severe global cognitive impairments, driven by worse performance in reasoning and problem-solving and attention/processing speed (Foussias et al., 2015).

The exploration of a sense of purpose and motivation's intricate interplay with cognitive processes, as evidenced by various studies spanning different contexts and age groups, underscores its pivotal role in shaping attentional mechanisms and cognitive outcomes. Efforts to comprehend how altruism and a sense of purpose operate within the cognitive framework can offer valuable insights not only for theoretical advancement but also for informing interventions aimed at harnessing the positive impact of altruism on cognitive well-being, especially on attention.

Purpose of the Study

The direct impact that a sense of purpose has on one's ability to sustain attention warrants further investigation. This study utilized an experimental design to seek a causal relationship between an increased sense of purpose and sustaining attention. Experimental group participants were given an opportunity to earn a monetary donation to an international humanitarian organization by giving an optimal performance on a task that required them to sustain attention. Here, motivation serves as a moderating variable, facilitated by the incentive of benefitting communities in need. This experiment aimed to tap into the experimental group participant's sense of altruism to increase their sense of purpose and motivation. The potential insights from this research may offer strategies for better sustaining attention, fostering personal well-being, and contributing positively to the world.

Research Question

This study examined whether an elevated sense of purpose, moderated by heightened altruistic motivation, contributes to improved attentional sustainability. Specifically, the study explored the potential impact of altruistic motivation on attentional capacity, focusing on the college undergraduate population. The research incorporated subjective ratings at the end to understand the individuals' perceived experiences. This experimental procedure posited that the purpose incentivized group, by being informed about communities in need and directly contributing to these communities through their performance, would experience an enhanced sense of purpose and exhibit superior performance on the continuous performance test.

Chapter 2

Method

Participants

Participants were recruited from a Christian liberal arts university located in the Pacific Northwest in exchange for research credit for undergraduate psychology classes. All participants were given informed consent to educate them about the study's overview and to ensure confidentiality. A priori analysis conducted through Gpower estimated a sample size of 54 participants to uncover a large effect size, $\alpha = .05$; power (1-b) = .82; ES (*f*) = .40 (Faul et al., 2007). This sample and effect size were selected due to the number of anticipated college undergraduates. Participants were systematically assigned to incentivized and control groups on an alternating pattern to ensure similar sample size between the two groups.

Materials

Demographic Questionnaire

A demographic questionnaire was sent out to participants, gathering pertinent demographic information including age, gender, religious background, and employment information. These were seen as potential factors that affect participants' attention performance. Please refer to Appendix A for the questionnaire.

Continuous Performance Tests

The continuous performance tests (CPT; Egeland & Kovalik-Gran, 2008) are acknowledged for their effectiveness in evaluating sustained attention. The AX-CPT paradigm, selected for its capacity to assess sustained and selective attention, explores two distinct neural mechanisms: proactive control, involving the sustained maintenance of contextual information,

and reactive control, more closely associated with transient activation (Gonthier et al., 2016). This approach introduces a layer of complexity that mirrors the nature of tasks encountered in real-life scenarios, necessitating the engagement of diverse attentional mechanisms. As such, the AX-CPT test was chosen for the study to ensure that its findings are pertinent to understanding how a sense of purpose influences individuals' behavior in real-life pursuits. To facilitate the testing process, the study used Millisecond's web-based software (Inquisit, 2023) for its user-friendly interface and accessibility. Three measures of performance were used and their definitions are listed below:

Percentage Correct. This metric represents the accuracy of the participant's responses during the AX-CPT. It is calculated as the percentage of correct responses out of the total number of trials. A higher percentage correct indicates better accuracy in executing the task.

Reaction Time. Reaction time measures the elapsed time between the presentation of a stimulus (e.g., a cue or target) and the participant's response. In the context of the AX-CPT, reaction time provides insights into the speed of information processing and decision-making. Shorter reaction times typically indicate faster and more efficient cognitive processing.

Probability of Hit (ProbHit). ProbHit is a statistical measure that assesses the likelihood of correctly identifying a specific target or stimulus in the task. It is calculated as the proportion of trials where the participant correctly responds to the target, given that the target was presented. ProbHit is a useful metric in evaluating the participant's ability to accurately identify and respond to relevant stimuli in the AX-CPT (OpenAI, 2024). For further clarification, probability of hit is a measure capturing correct responses out of correct targets given, whereas percentage correct is the overall correct responses out of all cues given.

Procedure

Participants were greeted in the lobby of the psychology department building by the researcher and walked to the designated room reserved for testing. The researcher confirmed their participant IDs, consent, and demographic questions. The purpose-incentivized group received a prompt informing them that optimal performance on the test will result in a $10 donation to MAP International, an organization dedicated to providing medicine and health supplies to over 2 billion people lacking access to medicine (Appendix B). Additionally, the purpose-incentivized participants viewed MAP International's video to gain insights into MAP's mission, the communities they assist, and the impact they create (Map International - Medicine for All People, 2023) . Following this, the incentivized participants underwent the AX-CPT test. The non-incentivized control group did not receive any messages and immediately underwent the AX-CPT test. Within the instructions provided at the beginning of the test, participants were instructed to press the "E" key when the target stimuli (A and X as the first and fourth letters) appeared and the "I" key when the non-target stimuli (any other letter/order) appeared on the screen. Following the study, all participants answered two questions aimed at evaluating if their exposure to information about MAP's operations and the presented donation resulted in a heightened sense of purpose and motivation. Participants were asked to rate on a scale of 1–10, how much learning about MAP and the suggested donation increased their motivation to do well on the test. Participants were also asked, "Where is the donation going?" to determine the accuracy of participants' recollection of the test prompt details. Finally, all participants were informed of the design of the study at the end of the experiment and were asked to keep the information confidential from classmates from the same classes as they may have signed up for

the study. Control group participants were assured that they were not informed of any donation to clear up any confusion. The experiments ran for 25–30 min.

Analysis Methods

Participant performance data was analyzed using JASP (JASP Team, 2024, Commit: ea61bc8). Group mean differences between treatment and control groups were analyzed using independent samples *t*-tests. Additional group means analyses compared working and non-working participant performance, mental health symptoms and non-mental health symptoms participant performance, self-reported highly motivated and lowly motivated participant performance, and ages 18–19 years old and > 19 years old participant performance. All statistical tests were two-tailed, with the alpha level set at 0.05. Pearson's correlation analyses determined how self-rated motivation scores and age impacted percentage correct, reaction time, and probability hit.

Chapter 3

Results

Demographics

The final sample consisted of 52 persons: 27 donation incentivized participants in the experimental group (52%) and 25 non-donation-incentivized participants (48%). Participants consisted of 32 females (62%) and 20 males (38%); 25 engaged in part-time work (48%) and 27 not working (52%); 18 experienced mental health symptom(s) that affected their ability to pay attention (35%) and 34 with no mental health symptoms (65%). Given the university is a Christian university, the majority of the participants—40 (76.9%)—identified as Christian; six participants identified as Catholic (11.5%), five participants identified as not having a religion currently or reported being Agnostic (9.6%), and one participant reported being Sikh (1.9%). Lastly, participant ages ranged from 18–31 years with the average age being 19.2 years and the median age 19 years.

After the tests, all participants were asked to rate from 1–10, how much the suggested donation increased their motivation to do well on the test; all incentivized students responded with a number. When asked if they remembered where the donation was going, 26 out of 27 (96%) incentivized participants answered correctly by either responding with “MAP” or general descriptions of MAP International’s mission.

The overall attrition rate, from the 3–month period when the experiment was run, was 27%. There were 71 students signed up for the study, 55 students (77%) showed up and participated in the study. Three students’ (4%) online results were excluded because the original experiment design contained a secondary aim to validate the efficacy of the remote web-based CPT test; this required a larger sample size that was unobtainable at this time.

Purpose-Incentivized Participant Performance Compared with Non-Incentivized Participants

Participants who were told that their performance would generate a $10 donation to MAP International did not show significantly better attention, as measured by the percentage of correct responses, reaction time, or probability of hit, compared to participants who did not receive the donation prompt (see Tables 1 & 2).

Table 1

Independent Samples T-*test: Purpose-incentivized Group and Non-incentivized Groups*

Results	*t*	*df*	*p*
Percentage correct	0.931	50	0.356
Reaction time	0.441	50	0.661
ProbHit	0.889	50	0.378

Note. ProbHit = probability of hit.

Table 2

Group Descriptive of Incentivized Group (1) and Non-Incentivized Group (2)

Results	Group	*N*	*M*	*SD*	*SE*	Coefficient of variation
Percentage correct	1	27	90.148	8.725	1.679	0.097
	2	25	87.716	10.104	2.021	0.115
Reaction time	1	27	443.539	78.579	15.123	0.177
	2	25	434.471	68.936	13.787	0.159
ProbHit	1	27	0.947	0.052	0.010	0.055
	2	25	0.933	0.063	0.013	0.068

Note. ProbHit = probability of hit.

Working and Non-Working Group Comparison

Looking at students who reported working part-time jobs and non-working students' performance, the independent samples *t*-test did not indicate a significant difference. In terms of raw group means, students who worked part-time jobs had a higher group average in terms of percentage correct (see Tables 3 & 4).

Group means comparisons indicated a significant difference in reaction time, t (50) = 2.07, p = .04, where students who held part-time jobs (M = 460.43, SD = 83.73) exhibited slower reaction times compared to the non-working group (M = 419.5, SD = 57.41).

Table 3

Independent Samples T-*test: Working vs. Non-Working Students*

Results	*t*	*df*	*p*
Percentage correct	1.141	50	0.259
Reaction time	2.069	50	0.044
ProbHit	0.353	50	0.725

Note. ProbHit = probability of hit.

Table 4

Group Descriptive of Part-Time Working Group (1) and Non-Working Group (2)

Results	Group;	*N*	*M*	*SD*	*SE*	Coefficient of variation
Percentage correct	1	25	90.520	8.906	1.781	0.098
	2	27	87.552	9.782	1.883	0.112
Reaction time	1	25	460.429	83.725	16.745	0.182
	2	27	419.504	57.406	11.048	0.137
ProbHit	1	25	0.943	0.063	0.013	0.067
	2	27	0.937	0.053	0.010	0.057

Note. ProbHit = probability of hit.

Mental Health and Non-Mental Health Group Comparison

Looking at students who reported mental health symptoms that affected attention and those who did not report symptoms, there were no significant difference in terms of percentage correct, reaction time, and probability hit (see Tables 5 & 6).

Table 5

Independent Samples T*-test: Mental Health Symptoms and No Mental Health Symptoms*

Results	*t*	*df*	*p*
Percentage correct	-0.659	50	0.513
Reaction time	-1.586	50	0.119
ProbHit	-1.266	50	0.211

Note. ProbHit = probability of hit.

Table 6

Group Descriptive of Mental Health Symptom Participants and Non-Mental Health Symptoms Participants

Results	Group	*N*	*M*	*SD*	*SE*	Coefficient of variation
Percentage correct	N	34	88.350	9.113	1.563	0.103
	Y	18	90.167	10.079	2.376	0.112
Reaction time	N	34	427.588	66.069	11.331	0.155
	Y	18	461.075	83.461	19.672	0.181
ProbHit	N	34	0.933	0.061	0.010	0.066
	Y	18	0.954	0.049	0.012	0.051

Note. ProbHit = probability of hit.

Effects of self-perceived motivation on Performance

The correlation analysis below examines the relationship between students' self-reported motivation rating and performance measures. These motivation self-report scores were correlated with percentage correct, reaction time, and ProbHit. The results suggest the subjective reported level of motivation had a moderate negative correlation with reaction time ($r = 0.317$, $p = 0.108$) and a weak negative correlation with percentage correct ($r = 0.226$, $p = .258$). As expected, ProbHit, the percentage of correct responses out of correct targets, demonstrated a significant positive correlation with percentage correct ($r = 0.878$, $p < .001$; see Table 7).

Table 7

Pearson's Correlations for Motivational Scale, Percentage Correct, Reaction Time, and ProbHit

Results 1	Results 2	Pearson's *r*	*p*
Motivational scale self-report	Percentage correct	-0.226	0.258
Motivational scale self-report	Reaction time	-0.317	0.108
Motivational scale self-report	ProbHit	-0.172	0.390
Percentage correct	Reaction time	0.305	0.122
Percentage correct	ProbHit	0.878	< .001
Reaction time	ProbHit	0.198	0.323

Note. ProbHit = probability of hit.

The motivational scale mean was determined (M = 6.22), and the score of 6 was used as the cut-off where 0–6 were coded as lower motivated and 7–10 were coded as higher motivated (see Table 8). Students who reported lower levels of motivation (this was a smaller sample size than those who reported higher subjective motivation) yielded higher performance measures when looking at raw group average (see Table 9), though the differences were not statistically significant (see Table 10).

Table 8

Descriptive Statistics for Self-Report Motivation Score 0–10

Measures	Motivational scale self-report
Valid	27
Median	7.000
M	6.222
SD	2.966
Minimum	0.000
Maximum	10.000

Table 9

*Group Descriptive of Highly Motivated (1) and Lowly Motivated (*2)

Results	Group	*N*	*M*	*SD*	*SE*	Coefficient of variation
Percentage correct	1	15	88.500	10.356	2.674	0.117
	2	12	92.208	5.926	1.711	0.064
ProbHit	1	15	0.935	0.064	0.016	0.068
	2	12	0.962	0.029	0.008	0.031
Reaction time	1	15	433.717	75.465	19.485	0.174
	2	12	455.817	83.968	24.239	0.184

Note. ProbHit = probability of hit.

Table 10

Independent Samples T*-test of Highly Motivated and Lowly Motivated Performance*

Results	*t*	*df*	*p*
Percentage correct	-1.102	25	0.281
ProbHit	-1.370	25	0.183[a]
Reaction time	-0.719	25	0.479

[a]Brown-Forsythe test is significant ($p < .05$), suggesting a violation of the equal variance assumption.

Participants Age and Attention Performance

A correlation between participant age, percentage correct, reaction time, and probability of hit was performed. One response from a 31-year-old participant who was multiple standard deviations outside of the normal age distribution was removed from the correlation (1.9%). Correlation results suggested age had a weak negative correlation with percentage correct (r = -0.206, p = .146), a weak negative correlation with ProbHit (r = -0.271, p = 0.055), and a weak correlation with reaction time (r = 0.123, p = 390). Again, ProbHit, the percentage of correct responses out of correct targets, demonstrated a significant positive correlation with percentage correct (r = 0.719, p < .001; see Table 11).

Table 11

Pearson's Correlations of Age, Percentage Correct, Reaction Time, and Probability Hit

Age and Results	Relationship	Age	Percentage correct	Reaction time	ProbHit
1. Age	Pearson's *r*	—			
	p -value	—			
2. Percentage correct	Pearson's *r*	-0.206	—		
	p -value	0.146	—		
3. Reaction time	Pearson's *r*	0.123	0.093	—	
	p -value	0.390	0.514	—	
4. ProbHit	Pearson's *r*	-0.271	0.719	0.088	—
	p -value	0.055	< .001	0.541	—

Note. ProbHit = probability of hit.

Chapter 4

Discussion

Results from the study indicated that motivated altruism, prompted by a potential donation to a medically needy community, did not increase participant performance on a continuous performance task involving reaction time or response accuracy. This finding challenges the assumption that students prompted with altruistic purpose would outperform their counterparts on the CPT test. Of these analyses, the reaction time difference between working and non-working students was the only measure of significance with working students exhibiting slower reaction times. Implications of the findings are as follows:

Types of Incentives, Extrinsic and Intrinsic Motivation

This current study can be argued to have involved both extrinsic motivation and intrinsic motivation. A $10 external reward could have been considered external motivation, aligning with conventional views on monetary incentives. Simultaneously, redirecting the funds to a community in need introduced an element of intrinsic motivation, tapping into the participants' sense of altruism. Existing research suggests that increasing external motivation diminishes intrinsic motivation (Ngaosuvan & Mantyla, 2005). The experimental conditions involving both types of motivation possibly offset each other.

Concerning incentives, both the type and amount matter. A 2021 study examining incentives to promote recycling behavior revealed that financial incentives were less effective at prompting recycle behavior involving emotionally involved products and less effective with individuals with higher environmental knowledge (Li et al., 2021). In a 2000 research article titled "Pay Enough or Don't Pay at All," researchers found that for more significant incentive

amounts, performance correlated with the size of monetary incentives, while smaller incentives yielded lower performance than no incentives at all (Gneezy & Rustichini). The present study included similar elements to the aforementioned research. Assisting a community in need is an emotionally charged task and participants may exhibit varying levels of knowledge regarding humanitarian efforts. According to the incentive mechanisms described in the recycle study, financial incentives may yield similarly mixed effects on participants with in-depth knowledge about humanitarian efforts and on the nature of the task. Lastly, the monetary amount offered might not have been sufficient to elicit higher effort from the experimental group. These findings underscore the complexity of incentive systems, emphasizing the need for more detailed knowledge of participants emotional involvement, knowledge levels, and the adequacy of the incentive amount.

Employment and Reaction Time

A statistically detectable significance finding was discovered in the slightly slower reaction time observed in students who worked part-time. To ascertain the validity of this observation, a more extensive sample size or enhanced controls, such as additional paired characteristics or standardized working conditions, may be warranted. For instance, 16 out of the 25 students who worked part-time predominantly worked 16.75 per week, while the remaining nine students worked an average of 5.6 hours per week. Addressing these variations in hours worked could potentially influence the underlying hypothesis regarding the causation of delayed or slower reaction time.

An intriguing aspect emerges when considering that working students tend to exhibit a higher percentage of correct responses. Literature on work behavior show that employees exhibit self-control of their own thoughts, feelings, and behaviors in order to adhere to coworker

expectations, company culture, performance expectations, and professional reviews, and to favorably influence the compensation (Johnson et al., 2018). In addition, regular practice of self-control can gradually improve one's capacity for self control and build more resilience to self-control depletion (Johnson et al., 2018). Therefore, this result might suggest that working students tend towards healthy inhibitory behavior, potentially indicative of a professional mindset prioritizing self-control over impulsivity.

Subjective Reporting of Motivation Does Not Equate to Higher Performance

Researchers Ngaosuvan and Mantyla (2005), adding to past motivation research, confirmed the variance between subjective ratings of motivation and actual performance. In their study looking at motivation and performance, participants who reported higher extrinsic motivation did not improve in actual memory performance (Ngaosuvan & Mantyla, 2005). Similarly, students in the current study who rated themselves as highly motivated did not exhibit a higher percentage of correct scores, reconfirming the disconnection of subjective motivation ratings from actual cognitive performance. Particularly interesting was when comparing raw group means, though not statistically significant, participants who rated themselves as more motivated had lower raw group average for percentage correct and probability hit when compared less motivated students. This contributed in the pattern where higher motivation scores correlated with lower reaction time and percentage correct. It is possible that students who excel despite reporting lower motivation are inherently intrinsically motivated, potentially obviating the need for additional motivational stimuli, or it may be they possess a higher baseline of attentional abilities. Faster reaction times combined with lower percentage correct suggest impulsivity which potentially dovetails with those who finds themselves more affected by emotional stimuli. While students who reported higher subjective motivation felt a stronger sense

of motivation or purpose to excel, this subjective sense did not translate into improved performance.

Mental Health Symptoms Does Not Decrease Performance

Interestingly, students who stated they experienced mental health symptoms that affected attention did not perform worse than students with no mental health symptoms. This trend poses an interesting question regarding the effect of subjective mental health symptoms as relates to actual performance. This phenomenon has been observed before in a 1997 study, where no relationship was found between subjective cognitive complaints and cognitive functioning in symptomatic HIV-1 seropositive patients, though a significant correlation was found between subjective complaints and mood (Moore et al., 1997). Conversely, a 2006 study involving individuals' activities of daily living, overestimated their functioning when assessed using objective ratings (Shulman et al.). Consequently, it can be inferred that subjective ratings of perceived symptoms do not accurately predict observed performance.

While having a mental health diagnosis, or at least a narrative detailing symptom affecting performance, could potentially compromise one's confidence to negatively affect performance, such labels may serve as limiting factors, especially among young adults who are starting to approach the complexities of mental health diagnoses where understanding may be framed within a binary perspective facilitated by the disease model. This simplistic understanding may overlook the existing spectrum of mental health conditions, which may present differently within various contexts.

An alternative perspective could be that students aware of their limitations may exert additional effort during testing to overcome perceived shortcomings, resulting in better performance. This presents a possible avenue for further investigation, exploring the implications

of a cohort reporting mental health symptoms but performing equally or even better than their healthy counterparts. Such findings could contribute to destigmatizing mental health issues, challenging self-limiting beliefs associated with diagnoses, and countering the misappropriation of mental health narratives for personal gain.

Limitations and Future Research

Future studies could incorporate measures that assess motivation levels both before and after the motivational prompt to obtain participants' baseline motivation and how it evolves in response to incentives. By including pre-prompt motivation measures, researchers could precisely gauge each participant's initial motivational state, thereby isolating the specific impact of the motivation condition on attentional control. This approach might help shed light on transient shifts in motivation influenced cognitive performance and within-person effects.

Given that a substantial number of participants performed adeptly on the test, achieving a mean score of 88.98% accuracy, and a majority recorded scores of 90% or higher, an extended examination, such as a prolonged test much longer than 20 min or task encompassing real-life challenges or diverse outcomes, could unveil the impact of altruistic motivation on individuals' long-term behavior. By extending the duration and complexity of assessments, future research endeavors might unveil the sustained impact of altruistic motivation on individuals' cognitive functioning and behavior, thereby enriching our understanding of the lasting and repeated effects of purpose-driven motivations.

Finally, expanding the participant pool to include more varied backgrounds could provide a more intricate exploration of a sense of purpose and attention. If students who worked part-time showed a difference in reaction time, what might more varied life experiences unveil? To ascertain the relationship between employment, inhibition, and impulsivity, a more extensive

sample size and enhanced controls, such as additional paired characteristics or standardized working conditions may be warranted. Expanding the study to encompass a more heterogeneous group may provide insights into how life experiences shape cognitive performance and whether certain demographic factors influence attentional control differently. This approach would contribute to a more comprehensive understanding of the broader population, enriching the study's applicability and the generalizability of its findings.

Chapter 5

Conclusion

In conclusion, this study explored the relationship between an increased sense of purpose by heightened altruistic motivation and sustaining attention in a college undergraduate population. The findings did not support the initial hypothesis that individuals prompted by altruism would outperform their counterparts on the CPT.

The study encountered several observations and trends, including the slower reaction time in students who reported part-time employment. Moreover, the study revealed subjective ratings of motivation had no impact on actual performance. Participants who subjectively reported higher motivation did not perform better on the attentional task. This reconfirms previously found disconnects between subjective motivation and cognitive performance. Lastly, students reporting mental health symptoms did not do worse than those without mental health symptoms. This challenges preconceptions about the impact of mental health symptoms on cognitive performance and calls for a deeper exploration of the relationship between subjective reports of symptoms and objective performance.

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Appendix A

Research Study Participant Demographic Questions

* Required

Name*

Your answer

Do you currently experience any mental health problems that affects your ability to pay attention? If yes, please briefly explain. *

Your answer

Age*

Your answer

Do you have a job? If so, brief explain what it is and hours worked per week.*

Your answer

Gender*

Your answer

Faith background*

Your answer

Appendix B

Donation Prompt Script

Prompt to the Incentivized group

"Try your best on this test. A high score will generate a $10 contribution to MAP international, an organization who provides medicine and health supplies to those in need. You are encouraged to visit MAP International's website to read about individuals and communities they are helping. Please watch the video below.

https://www.map.org/#our-mission

While $10 USD does not sound like a large amount, every dollar contributed helps MAP International provide more than $118 million in donated medicine due to the organization's low expenses and generous amount of medicine and health supplies it receives. MAP International has a 100/100 on Charity Navigator's Accountability and Transparency score which measures a charitable organization's financial efficiency, sustainability, and trustworthiness.

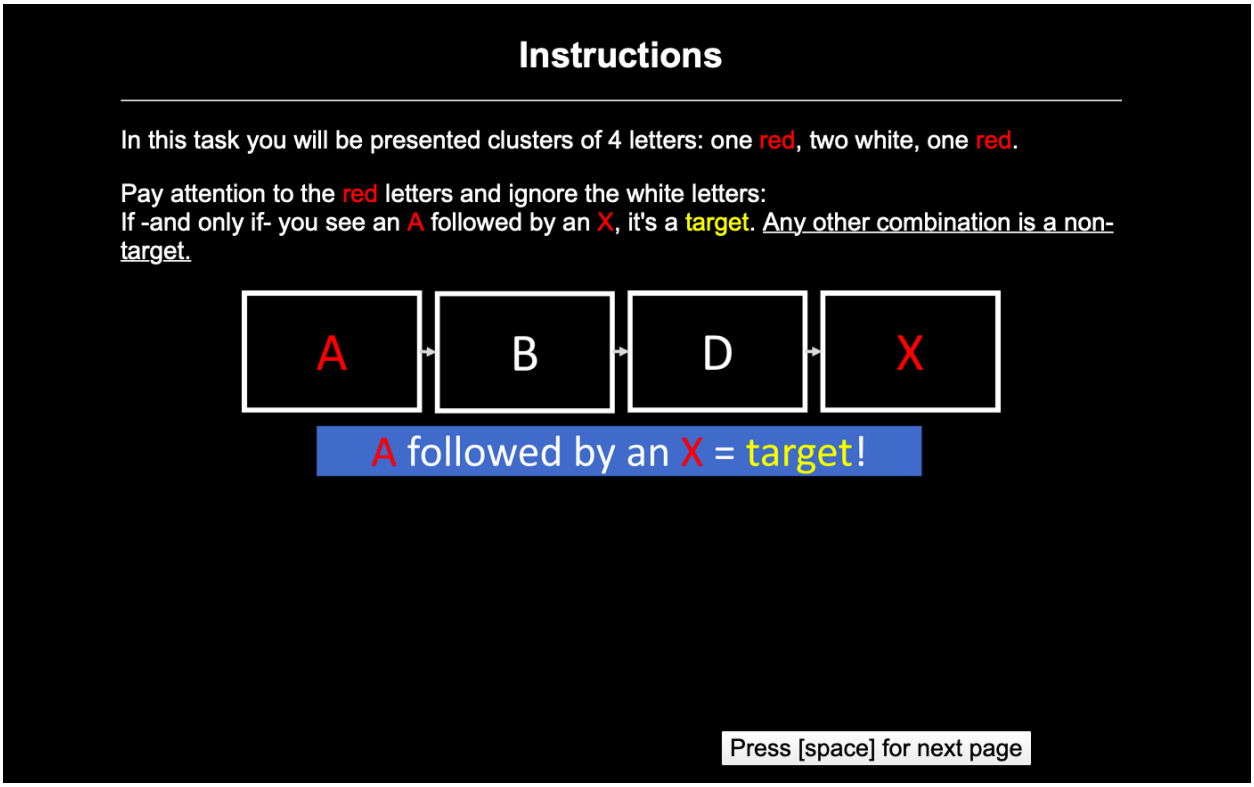
Please follow the prompts and do the best you can. Test is finished when "Thank you for your participation message appears." You can then exit the test by pressing the spacebar. Thank you."

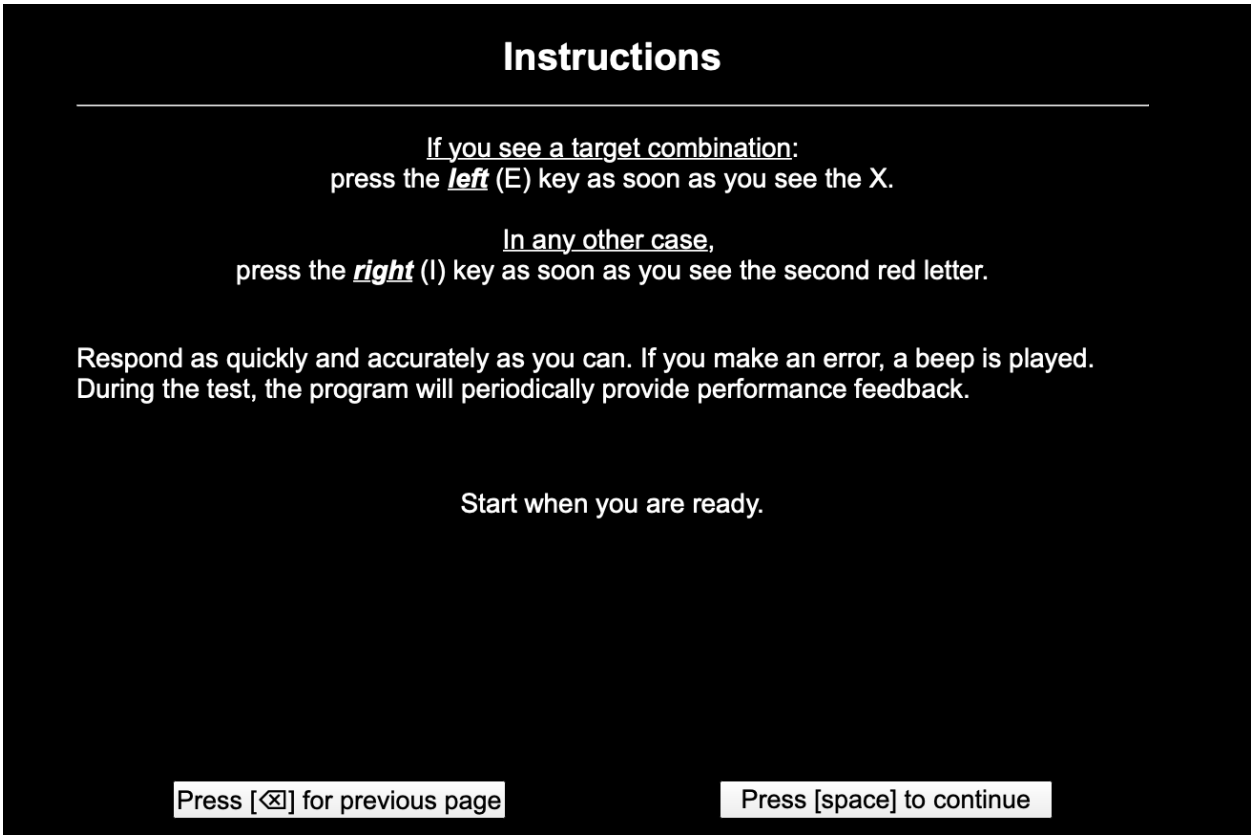
Test Script to Control group:

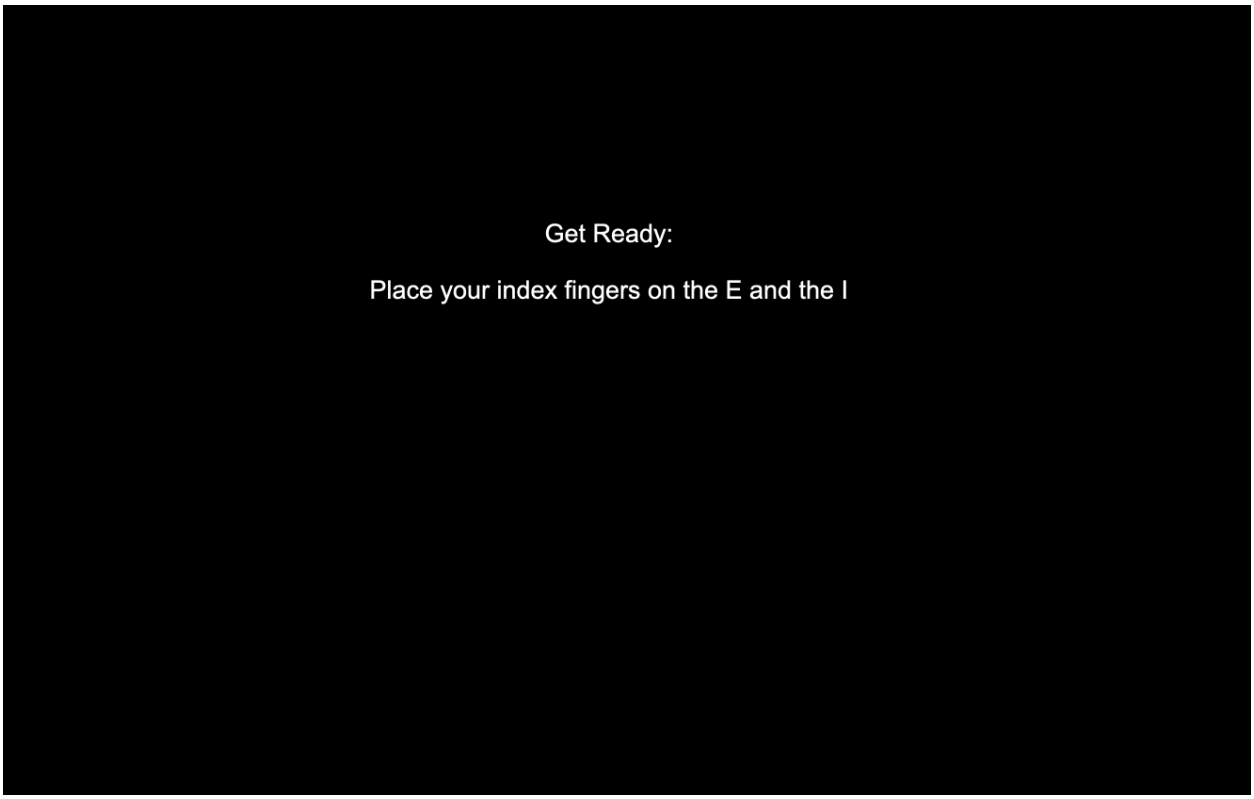
"*Please follow the testing prompts and do the best you can. Test is finished when the "Thank you for your participation" message appears. You can then exit the test by pressing the spacebar. Thank you.*"

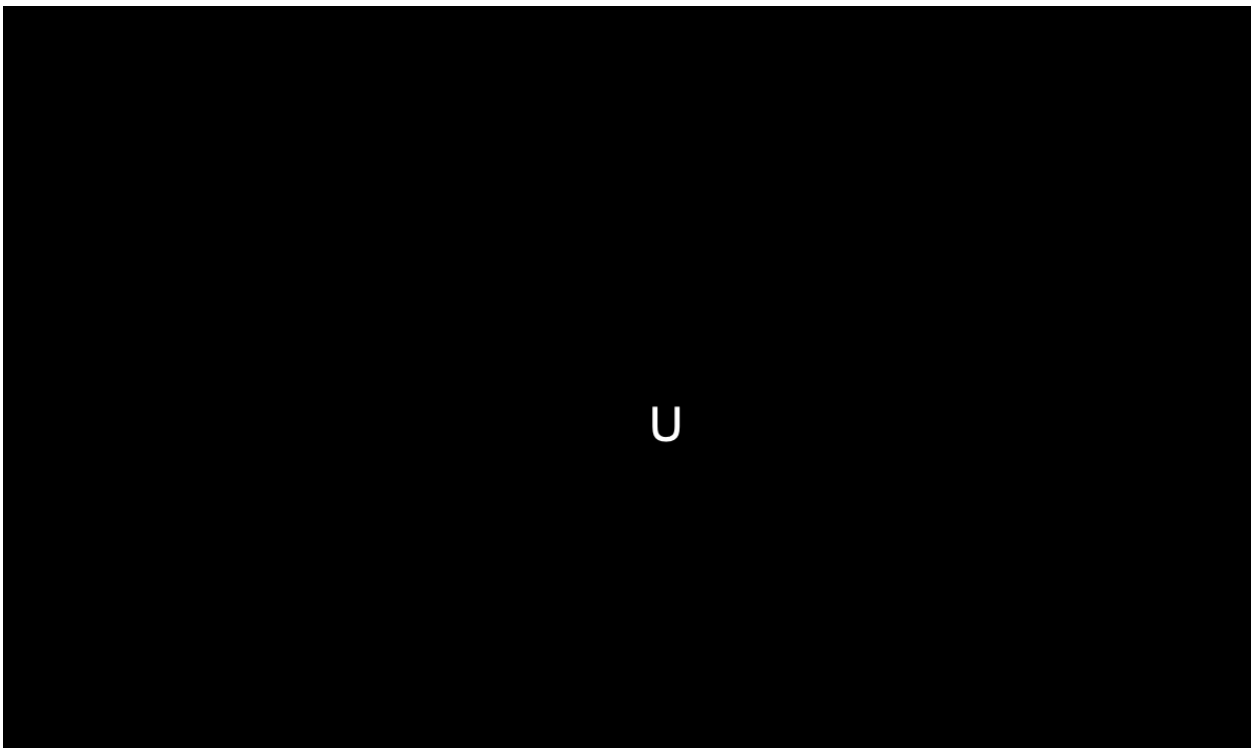
Appendix C

AX-CPT Test Screenshots




Instructions
If you see a target combination:
press the left (E) key as soon as you see the X.
In any other case,
press the right (I) key as soon as you see the second red letter.
Respond as quickly and accurately as you can. If you make an error, a beep is played.
During the test, the program will periodically provide performance feedback.
Start when you are ready.
Press [⌫] for previous page
Press [space] to continue


Get Ready:
Place your index fingers on the E and the I


U