IE 323 -Evaluating the Ergonomic Design of the PlayStation 5 DualSense Controller

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1. Introduction

The PlayStation 5 DualSense controller, developed by Sony Interactive Entertainment, is one of the most widely used gaming controllers in the world. Having over 80 million units made available and sold to the public. The standard input for the PlayStation 5 (PS5) is relatively significant in the gaming community as it has some of the most interesting technology though the haptic feedback and adaptive triggers. These inputs help the users have much more immersion and comfort while playing the games. Though these inputs are very immersive they do come with their own drawback of usability amongst all users. Along with this there is an extremely glaring drawback to this controller, that being its only one size and shape, once again making it not suitable to a diverse range of users be it due to the adaptive triggers causing too much resistance or the shape and size of the controller not being the most optimal for a users hand dimensions.

Though there are these two major drawbacks to the PS5 controller there have been advancements made to allow for a more diverse group of users in one aspect of the controller, that being the adaptive triggers. The main problem with the adaptive triggers was that the resistance that the triggers added could cause discomfort or in some cases unusability of the device. Advancements by the company that produces these consoles and controllers, Sony, have helped limit this issue as they have added a feature where the adaptive trigger feature may be turned off in the settings. As one of the major issues with this device have already been solved, this report will evaluate the shape and size of a controller mainly.

Looking at gaming as a whole, it is growing exponentially across all ages, genders, and groups of users with differing levels of ability. Due to this the ergonomic comfort and usability become of the utmost importance. A controller that does not fit properly in the user's hand can lead to discomfort, fatigue, and possibly even strain injuries over time. Furthermore, the accessibility boundaries for individuals with limited motor control or underlying disabilities persist, which creates a challenge for inclusive design of these controllers. These limitations highlight the need for human factors to easily evaluate the controllers design to support all users with physical cognitive interaction with the system.

The specific problem this study will address is the ergonomic mismatch between the PS5 controller and the wide hand ranges and lack of capability with the controller. This problem is pertinent because discomfort and strain can diminish performance and lead to a bad user experience especially during prolonged gaming sessions. By utilizing Human Facotrs and Ergonomics principles, this report will help with the understanding of how controller design features such as grip shape, trigger resistance, weight, and button placement affect the usability and comfort across a diverse group of users.

The objectives of this project are as follows:

1. Show the DualSense controller's ability to accommodate a variety of hand sizes and user profiles.
2. Identify features in design that may cause fatigue, discomfort, or prolonged strain during gameplay.
3. Provide evidence-based recommendations for improving comfort and accessibility in future controller designs.

This study aims not only to benefit Sony's future product design but also to add to the broader understanding of human-technology integration in gaming or entertainment systems as a whole.

2. Methodology

2.1 Participants and Hand Size Classification

A total of 10 participants completed the study. The ages of the participants ranged from 18-25 and included a mixed-gender distribution representative of the active gaming population. No participants reported prior injuries or any conditions that could bias their results. The participants were first classified into three experience categories based on self reported hours of gaming per week, specifically focusing on the time spent playing first-person-shooter (FPS) style games. The classification of this is as follows:

Experience Level	Gameplay Hours	Description	Count
Novice	< 3 hours/week	Rare or infrequent gaming, minimal FPS exposure	3
Intermediate	3-10 hours/week	Moderate gaming frequency, occasional FPS usage	4
Experienced	> 10 hours/week	Frequent and consistent gaming, regular FPS exposure	3

Hand length was measured using digital calipers, from the crease of the wrist to the tip of the middle finger. Based on anthropometric reference ranges widely used in ergonomic design (NCSU Ergonomics Center, 2020), participants were divided into one of three differing hand size groups as follows:

Group	**Hand Size (cm)**	**Count**
Small	< 17 cm	3
Medium	17-19 cm	5
Large	> 19 cm	2

This approach follows the standard anthropometric classification logic used in ergonomic equipment design, hand-tool studies, and control interface research. By categorizing the members of the study into these three groups it allowed the analysis to focus on relative ergonomic fit rather than individual variability alone. This is done as the study is not focused on making a controller that fits everyone perfectly as each controller would have to be different, the study focuses on expanding the usability of the controller to allow for more accessibility to a larger group of people.

The prevalence of medium-sized hands in the participant group alights well with what is seen in anthropometric population distributions in young adults. This distribution also ensured that observations were reflective of meaningful variability between small and large handed individuals. While the larger handed group had fewer participants (n = 2), their responses still illustrated clear ergonomic challenges and provided meaningful data trends consisten with expectation based on the percentile-based anthropometry.

The reasoning behind the chosen particimpant group composition was not just due to the availability of volunteers, it comes down to the group being well-suited to assessing controller ergonomics. Firstly, as the age range of 18-25 mirror that of the higher-use demographic, most console gamers fall within this age bracket, which makes the results more generalizable. Secondly, the mixture of experience levels (novice, intermediate, and experienced) avoids skill bias. This categorization ensured that observed performance differences were not solely caused by user proficiency, this strengthens the ergonomic conclusions of the research.

2.2 Tools and Equipment

The experiments required precise and repeatable tools to measure both ergonomic performance and subjective user perception outcomes. The following equipment and instruments were used during the study. Firsty, A Playstation 5 Console and a Playstation 5 DualSense controller are necessary for the study. The DualSense controller was the central system being evaluated, the features of the controller such as the adaptive triggers and haptic feedback, provided a realistic gaming experience consistent with everyday usage. Secondly, *Call of Duty Black Ops 7*, was used as a standardized test environment. This was necessary to evaluate the shooting performance consistently. The firing range in *Call of Duty* was chosen as it allowed participants to complete identical tasks, such as the one we used of eliminating 15 moving targets, this ensures uniformity across all trials. Thirdly, a Digital Caliper was used to measure hand length and grip span to the nearest millimeter. These measurements enabled accurate anthropometric classification into small, medium, and large hand-size groups. Forth, a stopwatch application on a mobile phone was used to record the time required to eliminate the 15 moving targets. Time was recorded to the nearest second for performance comparison across the differing hand sizes. The fifth item was was an observer checklist, which was a checklist that us as the researchers were able to use to document, hand repositioning, grip changes, finger stretching, shaking or rubbing of hands, and Mispresses. This ensured that the behavioral observations were standardized and recorded in real time as the test was completed. The sixth piece of equipment was a post-task usability survey, which was created in google forms. The participants completed a post-experement survey which measured: comfort, fatigue, ease of control, and overall satisfaction. These response were collected using a 1-10 likert scale, which is a rating system that asks participants to score their experience using a numerical range. The 1-10 scale was as follows, where a 1 represented a poor experience and a 10 represented a highly positive experience. This allowed subjective comfort and fatigue levels to be expressed in measurable terms that could be compared between the participants. Finally, the last piece of equipment used was anthropometric reference charts.

Population hand measurements were used to validate the hand-size classification ranges. Additionally, they were used to compare participant measurements against the industrial ergonomic norms. These tools as a whole enabled the combination of objective measurements, behavioral observations, and subjective feedback, resulting in comprehensive ergonomic evaluation.

2.3 Procedure

The procedure of this experiment was created in a way to ensure consistency, repeatability, and accurate measurement of ergonomic performance across all of the participants. Each participant completed the experiment in the same steps as below:

Step 1- Participant Briefing and Pre-Experiement Surver

Each of the participants firstly completed a gaming-experience questionnaire which also included them stating their age and gender. The gaming-experience questionare consisted of average weekly gameplay hours which was later used to classify each of the participants into the previously mentioned novice, intermediate, or experienced groupings. All of the participants were then told that the entire task would only take 15 minutes and we answered any questions they had before completing the study.

Step 2 - Anthropometric Measurement

Using digital calipers, each participant's hand length and grip span were measured to the nearest millimeter. We took each persons hand measurements twice and averaged the two measurements to insure their accuracy. Based on these hand lengths, the participants were categorized into small, medium, or large hand-size groups through the ranges that were mentioned before.

Step 3 - Standardized Gameplay experiment (Five trials were completed per Participant)

Each of the 10 participants completed a standardized FPS task using the *Call of Duty* (COD) firing range. The experiment required each participant to eliminate 15 moving targets as quickly as they can while trying to be as accurate as they can be. The reasoning behind this is that it give us a quantitative data to go off of and see how performance is affected by controller-hand correlation along with having the person being a realistic situation which would need quick movements and usability of most buttons and triggers. To increase the reliability of the data collected, each of the participants were instructed to complete the test five separate times. For each of the five trials for each participant the time to eliminate 15 targets was recorded in seconds. By recording five trials of each participant it allowed for us to reduce the influence of outliers and capture a more stable individual performance. We were able to assess whether any fatigue accumulated across repeated attempts of relatively the same movements. Overall, by completing multiple trials it was able to produce a reliable mean performance value for each of the participants. After the five trials were completed, the average time across all trials was calculated and used as the participant's performance score.

Step 4 - Observations of behaviors during gameplay

During the five trials, we the researchers, completed a structutred checklist to document ergonomic strain indicators which were: hand repositioning, finger stretching, grip switching, and signs of any muscle fatigue, though one of the most important documented things that required one of our full attentions was documenting the incorrect button presses. Recording these behaviors repeated across the five trials provided a more accurate representation of how ergonomic mismatch affected gameplay.

Step 5- Post-Experiment Usability Survey

Immediately after each of the 15-minute studies, each participant was informed to complete a usability survey which measured their perceived comfort, perceived fatigue, Ease of use of the DualSense controller, and overall satisfaction. These were collected using the previously mention 1-10 Likert scale. Additionally, any comments were reported in an open ended question and collected to see the most commonly reported comments.

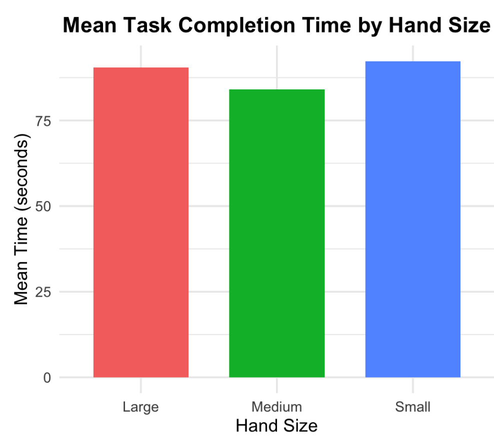
3. Results

The following results will show the measured performance, discomfort indicators, and subjective user ratings from each of the 10 participants. All of the quantitative values represent the average of the aforementioned five repeated trials per participant. THe results are presented in both a table and a graph to help better visualize the data.

3.1 Task completion time

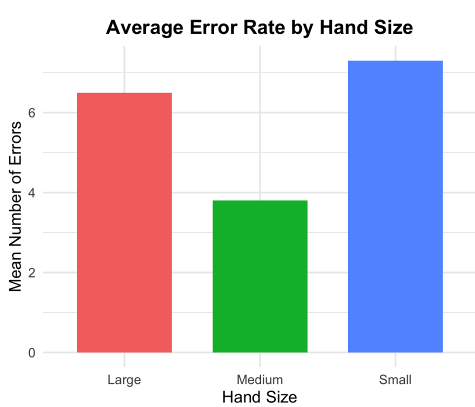
The main performance metric was the amount of time, recorded in seconds, required to eliminate 15 movig targets in the firing range. The mean completion times categorized by each of the hand-size groups are shown below along with the graph which visually highlights the difference in performance between each of the three different hand-size categories:

Hand Size	Mean Time (Seconds)
Small	92.3
Medium	84.1
Large	90.5



3.2 Error Rate (Incorrect button presses)

The table and graph below represents the number of unintended button presses or activation eros during the gameplay, the data represents the mean values across all five trials and 10 participants.

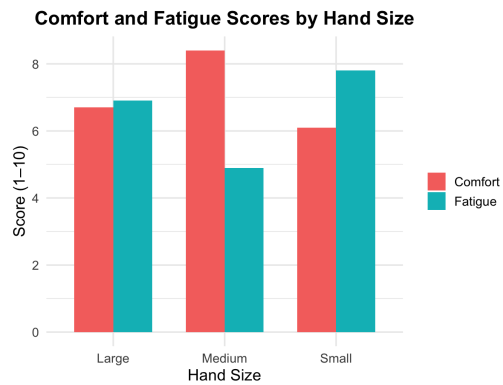


Hand Size	Mean Errors
Small	7.3
Medium	3.8
Large	6.5

3.3 Comfort and Fatigue Ratings (on a Likert Scale)

Participants completed a survey in which they rated comfort and fatigues using a likert scale from 1-10. The higher comfort values represent a better experienc, while the higher fatigue values represent more of a discomfort while using the Dualsense controller. The following table and graphs show this data, with the graph showing the relative difference in the experience across each of the groups and how much they enjoyed using the controller.

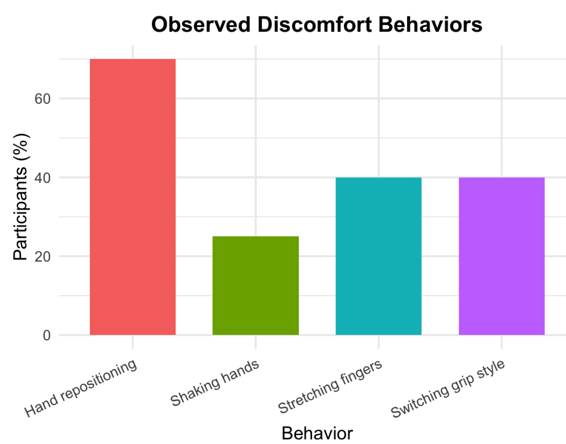
Hand Size	Comfort	Fatigue
Small	6.1	7.8
Medium	8.4	4.9
Large	6.7	6.9



3.4 Observed Discomfort Behaviors

During all of the trials, observable behaviors were recorded as indicators of discomfort or poor ergonomic fit. These observations included hand repositioning, finger stretching, grip switching, and hand shaking.The frequency of each behavior is summarized below, there is a 25% of participants with shown to have shaking hands, during one of the participants trials they had shaking hands but reported to have their hands shake normally during everyday usage so they were counted as half a participant to keep the data more accurate. Below are the table and chart showing this data:

Behavior	% of Participants
Hand repositioning	70%
Stretching fingers	40%
Shaking hands	25%
Switching grip style	40%



3.5 Raw Trial Data

The raw data used to produce the mean values in Sections 3.1-3.4 is included in the following table. Each participant completed their five trials and their averaged values were calculated from the repeated performances which was later averaged between the handsizes for the tables and graphs above.

Participant	HandSize	Time_T1	Time_T2	Time_T3	Time_T4	Time_T5	MeanTime	Errors_T1	Errors_T2	Errors_T3	Errors_T4	Errors_T5	MeanErrors	Comfort	Fatigue
P1	Small	95	92	90	94	93	92.8	8	7	8	6	7	7.2	6	7.8
P2	Small	88	91	96	93	92	92	6	7	7	8	8	7.2	6	7.7
P3	Small	94	90	92	91	93	92	7	8	7	7	8	7.4	6.3	7.9
P4	Medium	83	85	82	84	85	83.8	3	4	3	4	4	3.6	8.5	4.8
P5	Medium	87	84	83	85	85	84.8	4	4	3	4	4	3.8	8.3	4.9
P6	Medium	80	83	84	86	82	83	3	3	4	4	4	3.6	8.4	5
P7	Medium	82	84	83	85	84	83.6	4	3	3	4	3	3.4	8.6	4.7
P8	Medium	86	84	81	82	85	83.6	4	4	4	3	4	3.8	8.2	5.1
P9	Large	89	92	91	88	90	90	6	7	6	7	6	6.4	6.6	6.9
P10	Large	92	90	91	91	90	90.8	7	6	6	6	7	6.4	6.8	6.8

3.6 Qualitative Participant Feedback

Participants also provided written feedback describing personal experiences with the DualSense controller. The most commonly reported qualitative statements were the following:

- "The triggers feel stiff after a while" (This was usually reported around the 4th or 5th trial)
- "My thumbs feel too far from the sticks" (appeared to be reported by solely the small-hand group)
- "Controller feels cramped" (appeared to be reported mainly the large-hand group with one medium-handed participant also reporting this)
- "After a couple trials my thumbs started hurting from holding the sticks down"

4. Discussion

The results of this study show clear performance differences between the hand-size groups while interacting with the PS5 DualSense controller. While all of the participants were able to complete the same gameplay tasks, the efficiency, accuracy, comfort, and the observed strain variaried amongst the three different hand-size groups.

Participants in the medium hand-size group achieved the fastest task completion times and lowest error rates. They also reported the highest comfort ratings and lowest fatigue levels. This data suggests that the DualSense controller's physical dimensions best match the anthropometric range that was represented by this medium hand-sized group. The distance between the thumbsticks and buttons, the trigger activation force, and the grip shape likely contributed to the consistent and efficient control input for that of the medium-handed participants.

On the other hand, the small hand-sized group demonstrated slower task times and a higher error rate, along with elevated fatigue levels. Observable discomfort behaviors, such as frequent hand repositioning and finger stretching, show the idea that small-handed participants experienced a difficulty reaching the thumbsticks and maintaining a stable finger position on the triggers. These factors likely increased the muscular effort, reduced the efficiency of their gameplay, and led to higher fatigue.

Similar to the smaller-handed participants, the larger-handed participants showed slower performance and moderate fatigue, though it was not as severe as the small group. It is important to note that as the large-hand group only had two participants the data is not a consistent as that of the other groups, in the future it would be benificial to even out the number of larger-handed members of the study. The most notable issue for this group was the limited spacial accommodation within the controller. The larger handed participants frequently switched grip styles or repositioned the controller in their hands, this indicates that the cramped controller space forced unnatural wrist and thumb positions.

These results align with core human factors principles and human-centered design recommendations (ISO 9241-210, 2019). Devices should fit most of its users (5th-95th percentile), as described in ergonomic design guidelines (Dreyfuss, 2025; NCSU Ergonomics Center, 2020). When they do not, the users compensate physically. This compensation increases the users muscle strain, reduces their precision, and causes a raise in cognitive workload. In this completed experiment and study, small and large-handed participants showed more grip adjustments and fatigue, while the medium-handed individuals maintained a more stable posture and higher control accuracy.

4.1 Practical Design Implications

The results of this study lead to multiple possible design improvements that could increase the ergonomic compatibility, specifically:

1. Multiple controller sizes (Small/Medium/Large)
2. Adjustable or modular grip geometry
3. Reduced thumb travel distance
4. Adjustable trigger resistance in the hardware of the device not just the software
5. Alternative grip contours on the device for the larger handed users

These five improvements could reduce fatigue and the variance in performance amongst the different hand sizes. This ultimately would lead to the controller being more inclusive of different hand sizes.

4.2 Study Limitations

While the trends of the data were clear, there are several limitations on how the data was collected that must be acknowledged:

1. There was a small number of participants (n = 10)
2. Only one gamplay environment was tested
3. The duration of the experiment was limited and data could change with longer play sessions
4. The subjective ratings could have personal bias amongst them

Despite the four limitations mentioned above, the consistency across performance, observed behaviors, and user feedback supports our findings to be reliable.

4.3 Future Work

Future evaluations could be completed to extend this study by adding or improving the following:

1. Increasing the participant sample size
2. Testing across multiple game genres
3. Comparing performance across different controllers (Xbox, Scuf, etc.)
4. Studying the extended gaming sessions ergonomic effect
5. Possibly using EMG sensors to measure muscle activation

5. Conclusion

This study evaluated the ergonomic performance of the PlayStation 5 DualSense controller across individuals with different hand sizes. The results showed very clear trends: The participants with medium-sized hands completed the gameplay tasks faster, made fewer errors, and reported higher comfort when gaming. On top of this the medium hand-sized individuals also showed fewer observable signs of strain. On the other hand the individuals with small or large hands required more grip adjustments and reported feeling higher levels of fatigue, this indicates that there was an ergonomic mismatch between the controllers design and the hand dimensions that were outside that medium or average range.

These findings demonstrate that while the DualSense Controller provides an effective performance for users that fit withing the medium hand-size or mid-range anthropometric profile, it does not universally accommodate the entire broad population. In the cases where the fit was poor, the users compensated physically, which reduced their precision and increased both muscular and even cognitive workload.

Overall, the study highlights the importance of ergonomic inclusivity in controller design. By offering multiple size options, adjustable grip geometry, or customizable trigger settings on the hardware could improve the usability for a much wider range of users. Future work should involve a larger participant sample along with the use of multiple games that differ from the FPS category and possibly looking at alternative controllers to further evaluate the ergonomic performance and comfort. The results of this experiment and study provide a insight into how controller design impacts user experience and can recommend future improvements in gaming controllers.

6. References

The Measure of Man and Woman. (2025). Google Books. https://books.google.com/books/about/The_Measure_of_Man_and_Woman.html?id=5qzHQgAACAAJ

for, O. (2019). *ISO 9241-210:2019*. ISO. https://www.iso.org/standard/77520.html

North Carolina State University Ergonomics Center (2020). *Anthropometric Data for U.S. Adults — Summary Table.* *https://ergocenter.ncsu.edu/wp-content/uploads/sites/18/2020/07/Anthropometry-Summary-Table-2020.pdf*