Cognitive correlates of First-Person Shooter gaming: A cross-sectional study of Counter Strike players

**Slide 1** – Cognitive correlates of First-Person Shooter gaming: A cross-sectional study of  
Counter-Strike players, Eleanor Hyde.

**Slide 2** – Cognition: mental processes, Cognitive Correlates & Cognitive Plasticity

* **Cognition**: refers to mental processes such as thinking and memory
* **Cognitive Correlates**: factors which are associated with or related to cognitive skills
* In the context of video games, if people who play FPS games score higher on cognitive tasks which measure attention, then attention would be considered a cognitive correlate of FPS gameplay.
* **Cognitive plasticity:** is the brain’s version of being flexible or adaptable. It’s the ability to grow and change as we engage in different activities, just like muscles that get stronger when we exercise them.
* The theory behind studying FPS games is that perhaps these games provide a kind of "mental workout" by challenging the player.
* The question we are exploring is whether regular gameplay could actually enhance certain cognitive skills over time.

**Slide 3** – Challenging leisure activities & cognitive plasticity (von Bastian, Hyde & Jiang, 2023)

* Why do we think playing video games could enhance cognition? Aren’t they a waste of time, like our parents always told us?
* Recent research suggests that doing certain activities can be good for our cognition, similar to how physical exercise is good for your body, engaging in mentally challenging activities can be good for your brain.
* However, some activities have more potential to stimulate the brain than others.
* Regular engagement in other physical, cognitive, and social activities can have a positive impact on cognitive skills, with more challenging activities showing greater benefits.
* Research shows that playing board games, playing music or doing tai chi can boost our cognitive skills – but the more demanding the activity the greater the potential benefits for cognition.
* FPS games are a highly popular and challenging leisure activity which involves a range of cognitive skills to play, such as fast reaction times, decision-making, multitasking, which are associated with greater cognitive performance.
* By studying people who play these games and their cognitive abilities, we can learn more about whether these kinds of gaming experiences actually contribute to mental skills in a meaningful way.

**Slide 4** – Previous Methodological Limitations

* Previous research shows mixed findings regarding the cognitive correlates of FPS gameplay, potentially due to some methodological weaknesses.
* **Broad definitions of video games**
* Past studies often looked at video gaming without distinguishing between different game genres or specific games. However, the skills required for Call of Duty may differ greatly from those needed for Mario Kart.
* By focusing solely on Counter-Strike, we can be more precise in identifying any cognitive skills that may be associated specifically with this type of FPS gameplay.
* **Small samples of novice players**
* Often small samples are used which consist of people who play video games occasionally. This limits our ability to detect any meaningful patterns or associations.
* In our study, we focused on a large group of Counter-Strike players, including both less experienced and highly skilled Professional players, to better understand how varying levels of expertise may relate to cognitive skills.
* **Limited assessment of video game skill**
* When looking at video game skills, studies have relied on simple self-reports about how many hours people play or how good they think they are at the game. This doesn’t always give an accurate picture of actual gaming ability or cognitive skills.
* We wanted a more detailed assessment of gaming skill levels, which was informed by casual professional players, such as members of Endpoint’s Pro Counter-Strike team who helped us develop materials for this study.

**Slide 5 & 6** – Cognitive Task

* We used a task that is super typical for cognitive research, where participants were shown an object, and were asked to report the colour or shape of the object.
* Lets try, I’ll show a shape on the left and I’d like you to shout out if it’s Blue or Green, Ready? I’ll give you one more louder this time, and I’ll show it on the right, blue or green?
* Thanks so much! We also had another rule that was presented to participants which I won’t test you on this time, but again they’d be shown a shape but this time asked if it was curvy, or spiky.

**Slide 7** – Reaction Times (RTs)

* From this task our main measure is RTs which can inform us about our participant’s cognitive performance in terms of:
* Processing Speed: general ability to process information quickly and efficiently (RTs)
* Task Mixing: the ability to conduct two or more tasks in close succession (Mixing Costs)
* Task Switching: the ability to switch from one task to another (Switching Costs)

**Slide 8** – Counter-Strike Skill

* Along with the cognitive task, participants filled out a questionnaire that asked about their Counter-Strike gaming skills. We looked at four key pieces of information from these questionnaires, such as how many hours they play per week and their self-rated skill level.
* To make sense of all this data, we used a machine learning method called k-means cluster analysis. Method of grouping participants based on their Counter-Strike skills. The algorithm finds patterns in the data and groups people who have similar responses together.
* In our case, it suggested that the data was best represented by four distinct groups, which we named according to their characteristics, which we named…
* This cluster scatter plot shows how the groups differed in Counter-Strike expertise. On the horizontal (x) axis, we have *weekly hours played*, and on the vertical (y) axis, we have *total hours played* over time. There's also a third factor, *self-rated skill and current ranking*, which is represented on the third dimension (z-axis)

**Slide 9** – Processing Speed

* So how did our participants and the different cluster groups do on our cognitive tasks? First we’ll look at processing speed.
* Decisive evidence in favour of a main effect of expertise group on single and switching RTs, but no differences in mixing RTs.
* Suggesting our more expert players had faster processing speed in the easier speed and more challenging switching trials, but not in the mixing trials.

**Slide 10** – The drift-diffusion model

* To dig deeper into our data, we used something called a *Drift-Diffusion Model* (DDM). This is a way of understanding decision-making by breaking down the time it takes for people to respond in a cognitive task into different components.
* Imagine you’re looking at a shape and trying to decide if it’s blue or green. At first, your brain takes in the information, and then there’s a "thinking" phase where you gather more and more evidence about the color. This process continues until you’re sure enough to make a choice.
* **Drift Rate (v):** This is like the "speed" of your decision-making. It shows how quickly you’re gathering the information needed to make the choice. If you can tell whether the shape is blue or green quickly, your drift rate is high.
* **Boundary Separation (a):** This reflects how cautious you are. It’s like setting a threshold for how much evidence you need before making a decision. If you’re aiming for speed, your threshold is lower, meaning you decide quickly. If you’re focused on accuracy, your threshold is higher, meaning you take more time to be sure.
* **Non-Decision Time (t0):** This represents the time spent on everything other than the actual decision-making, like initially seeing the shape or pressing the button after making the choice.
* By using DDM, we can understand not just how fast participants respond, but how they make decisions—whether they prioritise speed, accuracy, or have a balanced approach.

**Slide 11** – Drift-diffusion model

* So how did our cluster groups do in terms of the modelling variables
* For drift rates, we found that our more expert players had higher drift rates equating to faster information processing on switching trials
* For boundary separations, we found that our more expert players had wider boundary separations meaning that they were more cautious in their decision making
* For non-decision times, our more expert players had faster non-decision times meaning they were faster in their encoding and motor response

**Slide 12** – Summary

* Semi/Professional… indicating faster information processing in stable tasks.
* Experienced… suggesting better adaptation to changing task demands.
* Semi/Professional… reflecting faster cognitive processing, more efficient decision-making in dynamic tasks and a preference for accuracy in stable tasks.

**Slide 13** – Take home message

* More skilled *Counter-Strike* players exhibit *enhanced decision-making abilities* across both stable and dynamic cognitive tasks.
* These findings suggest a link between gaming expertise and *greater cognitive efficiency* (von Bastian et al., 2022).
* While correlational, performance advantages observed go *beyond simple reaction time*, reflecting more sophisticated processing strategies.