Fun isn't easy: Children optimize for difficulty when "playing for fun" vs. "playing to win"

Mariel Goddu, Joshua Rule, Elizabeth Bonawitz, Alison Gopnik, & Tomer Ullman

The "explore-exploit" dilemma trades off behavior with two distinct objective functions. Children who *explore* (e.g., try a new flavor of popsicle) optimize for *information gain*. Children who *exploit* (e.g., choose a familiar flavor) optimize for a *known reward*. But what of the child who waves their popsicle like a sword, or makes a drip design on the kitchen floor?

Here, we take a step toward *finding the reward function of play* by contrasting children's choices in a game when they are playing versus when they are exploiting. In Exp. 1 (ongoing), we introduce n = 44 participants aged 5–10 years (M = 7.6, SD = 1.5) to a game in which players toss beanbags and batons to knock down blocks on a court. We ask children 8 forced-choice questions about how to structure the game when *playing for fun* ("to have as much fun as you can") vs. *playing to meet a win-criterion* ("to knock down all the blocks to win stickers"). Questions concerned either "goal-relevant" factors that affect the likelihood of knocking down blocks, or "goal-irrelevant" ones (see Fig. 1).

If play is similar to exploration, it may pattern as random behavior, with responses roughly uniform across the options for each factor, or it may pattern as an 'injection' of noise on top of existing exploitation policies. In contrast, some accounts propose that play may be linked to problem-solving (Chu & Schulz, 2020), or behavioral flexibility (Fagen, 1982). Following these latter accounts, our predictions were:

1) For goal-relevant factors, children will select more difficult specifications in "fun-mode" than in "win-mode";

2a) For goal-irrelevant factors, there will be no difference between conditions; and

2b) For goal-irrelevant factors, children will opt for specifications that demand flexible behavior (e.g., high novelty and randomness; see Fig. 1).

Overall choices in fun-mode follow a coherent pattern, and contrast with choices in win-mode. For each participant, we calculate a weighted average for both Fun and Win responses for each factor, and a difference score between these averages (Fun-Win). Difference scores for goal-relevant factors (M = 0.34, SD = 0.60) differ significantly from goal-irrelevant (M = 0.16, SD = 0.37); $t(42) = 1.71$, $p = 0.04$; see Fig. 1 (right). For goal-relevant factors, difference scores are significantly positive, indicating a preference for difficulty in Fun, $t(43) = 3.80$, $p < 0.001$. For goal-irrelevant factors, we find a smaller difference between Fun and Win, $t(42) = 2.91$, $p = 0.002$, and a preference for options that fall between "medium" and "high" (weighted average M = 2.05, SD = 0.21). Difference scores are not correlated with age for goal-relevant factors ($r = 0.21$, $p = 0.20$) or goal-irrelevant, ($r = -0.02$, $p = 0.91$).

In Exp. 2, we replicate these results using a between-subjects design. First, children (n = 15; M = 7.1 years, SD = 2.3) play the game with all factors set to "medium." Then, they are randomly assigned to Fun or Win (i.e., are told the goal of the game) and, as in Exp. 1, are asked to make a choice for each factor. So far, weighted averages differ between Fun vs. Win for goal-relevant factors, $t(13) = 4.39$, $p < 0.001$, but not for goal-irrelevant, $t(13) = -0.72$, $p = 0.47$.

These results suggest that school-aged children challenge themselves more when playing than when they are optimizing for a specific goal. Our findings support a competence-based curiosity account of play, where playing optimizes for information gain about one's action capacities.

References

Chu, J., & Schulz, L. E. (2020). Play, curiosity, and cognition. *Annual Review of Developmental Psychology*, *2*, 317–343.

Fagen, R. (1982). Skill and flexibility in animal play behavior. *Behavioral and Brain Sciences*, *5*(1), 162–162.

Figure 1. Schematic of “beach bowling.” For each of the eight variables, participants (children aged 5-10) are provided with three forced-choice responses and prompted to choose their first and second choices. Two photos of the real-life setup are included in the lower right-hand corner.