2019 Klaus J. Jacobs Research Prize
“Leveraging video games to promote brain plasticity and learning”

Daphne Bavelier studies how the brain adapts to changes in experience, either by nature or by training. She has made striking discoveries suggesting that playing fast-paced, action-packed entertainment video games enhances several aspects of cognition.

In 1999 Daphne Bavelier’s lab found that playing action video games causes enhancements in attention. Why is this notable and how can this research inform education and policy?
Bavelier found that playing action video games enhances certain cognitive functions, including better attention, reaction times and switching from one task to another. Action video games require players to move rapidly, keep track of many items at once, hold a good deal of information in their mind at once, and make split-second decisions. Bavelier demonstrated that action video game play causes enhancements in voluntary attention, making it – along with physical activity and meditation – one of the rare behavioral interventions to improve performance on tasks beyond the intervention itself. In other words, playing action video games not only results in greater video game play expertise, but it also results in better performance on other tasks used to assess cognition. As Bavelier could show, this training transfer effect from one task to another is mediated by greater attentional control. Bavelier proposes that this fundamental change in attentional abilities facilitates enhanced learning capacity, termed “learning to learn”, and hence the learning of future tasks.

What are the limitations of leveraging video games to promote learning?
There are many unknowns in this young emerging field. First, the exact attentional mechanisms that foster learning are just being discovered. We do not know yet whether the same attentional mechanisms are fostering different forms of learning, or whether separate attentional mechanisms are at play. Second, Bavelier’s work has focused so far mainly on cognition, but understanding how to best induce changes in other domains, such as emotion or social behavior, is equally important. And third, most of the research so far has focused on adults, but brain plasticity is even more important in childhood. There is tremendous potential in exploiting action video games, and new technologies in general, to assist and enrich child development.

What are the risks associated with these new technologies?
Video games, and more generally new technologies, are invading all aspects of children’s life, and it is clear, that these technologies are here to stay. Understanding the effects of video game play is essential, given that large numbers of young people regularly spend many hours gaming, and given that many video games now on the market claim to change behavior or enhance cognition. Bavelier’s work, with its focus on brain plasticity, has concentrated primarily on possible positive impacts of so called action video game play, mainly first- or third-person shooter or war games

Yet, this should not be taken to imply that there are no negative impacts or that there is no

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abusive use. Indeed, there are at least two critical lessons to be taken from Bavelier’s work: First, the impact of video game play on human behavior is multidimensional. Playing action video games can positively impact some domains of human behavior (for example perception and spatial cognition), but not others (for example processing facial emotions). Second, not all video games have the same impact. While action video games enhance certain domains of cognition, social simulation video games do not. Hence, it is important to parse out these differential impacts of video games and their underlying neural mechanisms in detail. Such an evidence-based approach is central to understanding how to maximize any possible positive outcomes, while minimizing or eliminating any negative outcomes. As any socially disruptive innovation, video games can be put to virtuous uses or hurtful ones and Bavelier sees it as her responsibility to both highlight the positive use of video game play for child development as well as to denounce its negative impact.

À propos negative impact: Many action video games are violent. Does the type of video game matter for the learning benefit?
The type of game certainly matters. With Social simulation games for example, Bavelier did not find the same enhancement in attentional skills as with action video games. There are a number of game components that are specific to shooter games that seem to be key in improving perception and attention. Whether violence is a key ingredient though, remains unknown. Bavelier notes that action games do not have to be violent by definition. If one looks at the mechanics, one can see that most action games emphasize decisions under time pressure, the need for divided attention all the while requiring constant shift in focused attention to properly aim. It is perfectly doable to achieve these goals in nonviolent games. Here is a possible scenario: you are on another planet with the mission of rescuing all sick animals. Touching them will decrease your health hence you have been tasked by the medical team to laserbeam medicine at them in order to save them. Different diseases require different medicine, so this emphasizes problem solving and control. You can recreate the same action game dynamics in a non-violent context.

For what will the Research Prize money be used?
With the prize money Bavelier will leverage her research on action video games and brain plasticity to help consolidate a still fragmented field around the science of play. Play has been recognized as a critical behavior of central importance for child development. Yet, an evidence-based, integrated and quantitative understanding of play behavior still eludes us. Bavelier aims to characterize the brain states associated with play behavior, akin to what has been done for sleep. She conceives of play not just as an emotional brain state, as has been previously proposed, but as a unique exploratory motor mode associated with positive mood and high reward. The challenge is to integrate perspectives from neuroscience, education, ethology, and digital technologies to further characterize play behavior and its impact on child development.

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The prize will allow Bavelier to strengthen what is now largely a neuroscientific endeavor by bringing in experts with a clinical and educational background to help shape an integrated science of play.