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Guest Editorial

Electronic media and human development: The legacy of Rodney R. Cocking

For both of us, Rod Cocking was one of our closest colleagues and a very dear friend. He also linked us together in the study of electronic media, the topic of this memorial issue. Rod saw that electronic media were a huge—and understudied—component of children's lives. Perhaps most important, he saw the connection between understanding children's real lives and the creation of a developmental science that is broad enough and deep enough to specify the complex interrelations between developing children and their social, cultural, and cognitive contexts. One logical outcome was to connect electronic media with developmental processes.

Because of his driving interest in children's lives, Rod was early to understand the value of studying the computer genre that children spent most of their time with - electronic entertainment games, rather than what most researchers were focusing on—the use of computers in formal education. As one of the founding editors of *Journal of Applied Developmental Psychology*, Rod therefore offered to put our research on this topic into a special issue of the *Journal* on electronic games, and Irving Sigel, the other founding editor, enthusiastically agreed; but Rod did more than simply review a set of papers from both of our laboratories; he was an active midwife of the special issue (Greenfield & Cocking, 1994). Ultimately, we expanded that issue into a book, entitled *Interacting with Video*, which Irving Sigel published as part of his Advances in Applied Developmental Psychology series (Greenfield & Cocking, 1996).

The first part of both the special issue and book focused on experimental studies of the impact of entertainment video games in developing representational competence, a topic of particular interest to both Rod and Irving Sigel (Cocking & Renninger, 1993). Indeed, without Rod no one would even have realized that the cognitive effects of video games constituted examples of representational competence (Greenfield, 1993). In the context of video games, representational competence includes visual skills such as iconic representation, mental rotation, and spatial visualization. Let us, as an example, focus on iconic representation.

In one experiment, carried out in Rome and Los Angeles, we found that iconic (as opposed to verbal) representation increased after playing a computer game, with its virtual icons, but not after playing the same game played in a mechanical medium (Greenfield et al., 1994/1996). These were the two treatment conditions. We also administered a pre- and post-test in which we asked participants to view a computer simulation of the logic of electronic circuitry and to indicate their understanding in a written test. The instructions included nothing about mode of representation. Although correct answers could be constructed equally in either mode (iconic or verbal or through a

combination of iconic plus verbal modes), iconic representation was the mode of representation significantly associated with solving the comprehension test. That is, the more iconic your representation, the more likely you were to figure out the logic of the computer circuitry that had been presented in our screen display.

The implication is that skill with and use of iconic representation facilitates scientific-technical learning, a topic of great interest to Rod. In terms of children and their naturally occurring environments, the implication is that entertaining electronic games constitute an informal learning environment that prepares children's representational skills for the worlds of science and technology, including computer technology.

Rod had a vision beyond understanding the cognitive development of children in their natural environments. This expanded vision was to integrate the biological, emotional, social, and cognitive facets of children into a unified developmental science. Correspondingly, the special issue of *JADP* on interactive entertainment technologies went beyond cognitive effects to include a study of physiological and emotional effects of an electronic game. As active midwife of the special issue, Rod suggested that we include a paper concerned with the effects of an interactive virtual reality game on physiological arousal and aggressive thoughts (Calvert & Tan, 1994/1996).

Calvert and Tan were interested in the effects of a violent virtual reality game, called *Dactyl Nightmare*, in which players can experience a simulated three-dimensional environment. A key component of that study was to compare the effects of *playing* an interactive virtual reality game with the effects of simply *watching* the game. Older adolescents were compared after they interacted with this virtual reality game, after they observed others who interacted with this game, or after they simulated game movements except for the violent ones. We found that adolescents who interacted with the game were more aroused and had more aggressive thoughts than those who observed others play the game or who simulated the game movements (Calvert & Tan, 1994/1996). In other words, interaction influences behavior more than observation does. We continue to be interested in how those aggressive events were represented. In particular, pulling the trigger in the virtual reality game may be encoded in an enactive way in the body, i.e., I know how it feels to pull that trigger, not just how to watch someone do it, which I then must translate into my own actions. Put another way, interactive media can decrease the distance between the representational act and the actual behavior (Cocking & Renninger, 1993). The implication is that doing an activity can be more powerful than viewing it because it may be more easily translated into one's own behavioral repertoire.

Only a few years after the special issue of *JADP* and the subsequent book it produced had appeared, Rod realized that the media had become dramatically different. His example was the *Encyclopedia Brittanica,* which had gone from print-only to Internet-only access in the space of about 5 years. He wanted to make sure that developmentalists became aware of this altered electronic environment and that they studied its developmental implications. Rod therefore encouraged one of us (SLC) to develop another special issue of *Journal of Applied Developmental Psychology*: "Children in the Digital Age" (Calvert & Jordan, 2001). As he had done before, Rod brought to our attention a recent paper from Patricia Greenfield and her colleagues that provided an excellent overview of the emerging field of interactive media. He later became one of the co-editors of the subsequent book, *Children in the Digital Age: Influences of Electronic Media on Development*. (Calvert, Jordan, & Cocking, 2002). The book was in press at the time Rod disappeared in February 2002. It was to be his last. Months later, his body was found; in a senseless tragedy, he had been brutally murdered.

Before his disappearance, Rod set the stage for one last special issue on children and media: a monograph on *The Impact of the U.S. Children's Television Act on Children's Learning*, by Calvert and Kotler (2003). He left us in very good hands with Ann McGillicuddy-De Lisi who worked tirelessly to help make this monograph a fitting legacy to Rod.

The monograph focuses on the Children's Television Act, designed to provide "educational" and "informational" (E/I) television programs for children. In this law, Congress defined both prosocial and academic programs as educational. We tracked 2nd–6th grade children from 13 locations across the United States for an academic school year, having them come online to our website as Georgetown Hoya TV Reporters. Children initially clicked on the programs they viewed, and they then wrote a report about their favorite program which we analyzed. Most programs created by broadcasters to fulfill their E/I obligations were prosocial rather than academic in nature, and therefore, not surprisingly, children mainly learned social and emotional lessons. Girls and younger children benefited the most from these programs, in terms of the number of programs viewed; girls also learned more lessons. We also found that educational television programs lost older children's, especially boys', interest over time, a finding that we validated with Nielsen data. Next we conducted an experimental study of responses to the most viewed and least viewed academic and prosocial programs. Older children understood the programs best, but younger children and girls liked them the most, which dovetails nicely with our naturalistic findings. Prosocial programs were better liked and better understood than academic programs. In comparison with favorite programs that were strictly entertainment-driven, children reported more lessons from their favorite educational programs. The implication from these findings is that public policies such as the Children's Television Act, designed to improve the well-being of children, can be successful.

One of the most lasting legacies of Rod was his work at the National Science Foundation where he established and served as program officer for Developmental and Learning Sciences. During his tenure at NSF, Rod established the first three centers of a total of five that were part of the Children's Research Initiative (CRI), an initiative designed to move the field of Developmental Science forward. He encouraged us to apply for a center award, but was careful to maintain an arm's length from the review process because of his close professional and personal ties to both of us.

The Children's Digital Media Center (CDMC), with collaborators Sandra Calvert at Georgetown University, Patricia Greenfield at UCLA, Barbara O'Keefe at Northwestern University, Ellen Wartella at the University of California Riverside, and Elizabeth Vandewater at the University of Texas at Austin, became one of those first NSF Centers. The initial fruits of our Center were published last year in this journal (Calvert, Mahler, Zehnder, Jenkins, & Lee, 2003; Greenfield & Subramanyam, 2003). This year we have enough findings to fill an entire issue; our topics include sexual and racial discourse in online chat rooms and bulletin boards, online social peer interactions, the discourse styles made possible by video games, identification with heroes portrayed in DVDs, the role of educational television in early reading skills, and policy pieces focusing on the Internet, particularly in the pornography area. Another special issue will appear late this year in the *American Behavioral Scientist*, edited by Ellen Wartella, Elizabeth Vandewater, and Victoria Rideout, and will include some of our research that examines the role of media in early development. We know Rod would have been eagerly waiting for these findings, ever ready to assist our field in any way that he could.

Rod's legacy in the children and media area was rich, deep, and lasting. He was actively involved in how children symbolically represent media and a firm believer that media research

should inform issues. He nurtured media research and media researchers, and brought media research by ourselves and others to the attention of developmental colleagues through the *Journal of Applied Developmental Psychology*. He co-edited books on children and electronic media with both of us. His most lasting contribution in the area of children and media, we believe, was to sow the seeds for the Children's Digital Media Center at the National Science Foundation. We hope that the ongoing development of the Children's Digital Media Center and the knowledge it is starting to bring to our field will be our most lasting tribute to the scientific legacy of Rodney R. Cocking. We wish he was here to help us bring this dream to fruition, and we dedicate this issue to his memory.

Acknowledgements

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