Cool Papa Bell

When vision is interrupted, how does iconic memory guide motor tasks?

Cool Papa Bell was a star baseball player in the U.S. Negro Leagues for more than 20 years during the early 20th century. He was a superb outfielder and batter and was elected to the Hall of Fame in 1974. What Cool Papa Bell was probably remembered most for, however, was his speed on the base paths. Legend has it that he once scored from first base on a bunted ball and that he could circle the bases faster than any player of his time, black or white. In fact, fellow Hall of Fame member Josh Gibson once said, “Cool Papa Bell was so fast he could get out of bed, turn out the lights across the room and be back in bed under the covers before the lights went out.” Although it sounds ridiculous, Gibson may have been right!

It goes without saying that vision is a critical component of most activities of daily living, such as walking along a path, guiding a mouse-controlled cursor to an icon on your computer desktop, or even just pouring a glass of milk. All of these examples require precise aiming—from placing a footstep on the path, acquiring the target with a cursor, or guiding the flow of liquid into a container. Quite simply, actions that require vision for successful completion are doomed to fail if you can’t see what you’re doing.

But, in the absence of vision, how soon would a visually guided task be doomed to fail? Research suggests that we do not need to continuously watch something to use the visual information accurately. Rather, we possess a very accurate, albeit short-lived, sensory memory that fills in the details when we glance away or when something blocks our line of sight. This sensory memory system appears to be distinct from the memory that we use, say, to look up and retain a phone number while dialing it, or the memory that we use to retrieve the name and image of our first-grade teacher. The visual sensory memory is an iconic representation of an object or the environment in general. Research suggests that our iconic memory can be used as a faithful substitute for a short period of time when vision is obstructed or averted.

Together with his students and colleagues, researcher Digby Elliott studied the processing of visual information in many experimental situations. In some studies, he gathered people in a large gymnasium and asked them to walk to targets located on the floor a short distance away. In other experiments, he asked them to throw objects at these targets. Before beginning an activity, the participants were told to close their eyes so that the target was no longer directly visible. What he found was that people were surprisingly accurate at

From T.D. Lee, 2011, *Motor control in everyday actions* (Champaign, IL: Human Kinetics).

these tasks in the absence of vision. In fact, there was often no decrement in performance at all when the activity was completed within two seconds of removing vision! Apparently, the visual memory of the target was a sufficient and reliable substitute for direct visual information and could faithfully guide the action.

But, some speculated, perhaps the participants in Elliott's research performed so well without vision simply because the targets were stationary. How would they perform if the task involved a moving object, such as catching a ball? Would they need a continuous supply of visual information to be successful? Once again, Elliott provided a provocative answer to the question. In a further series of experiments, Elliott and his colleagues asked participants to wear special goggles while catching tennis balls projected from a ball machine about 10 yards (9 m) away. These goggles could be programmed to alternate between being clear (providing a full view of the ball) and being clouded (letting in light but eliminating any information about the flight of the ball). Remarkably, Elliott found that catching performance remained excellent when snapshots of vision as short as 20 milliseconds were alternated with periods of no vision as long as 80 milliseconds. Moreover, success was not improved by increasing the length of the visual snapshot. Instead, performance degraded quickly when the periods without vision were increased to 100 milliseconds and longer.

Digby Elliott's research reveals quite nicely that we have a dependable visual representation of our static immediate surroundings that allows us to move about and interact without accidents for relatively long periods of time. Moreover, we do not need continuous vision of our dynamic environment either: updated information that is provided with a frequency as low as 10 times per second (Hz) will still permit us to perform actions safely and efficiently.

Could Cool Papa Bell actually get into bed before the lights went out, as Josh Gibson reported? Well, it all depends on what you consider as the lights going out. For Bell, the vision of his bedroom layout and where he had to go to get back into bed without tripping could have been faithfully represented for plenty of time to allow him to get back safely under the covers. And don't forget, he was very fast.

Self-Directed Learning Activities

1. Define *iconic memory* in your own words.
2. How could iconic memory fit in the closed-loop flowchart model for a curling draw described in the previous story?
3. What role do you think iconic memory serves when we blink?
4. Reenact one of Elliott's walking or throwing eyes-closed experiments. Do your findings replicate his results?

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Notes

- The National Baseball Hall of Fame site includes more information on Cool Papa Bell, along with a link to the speech he gave upon induction into the Hall of Fame:

  http://baseballhall.org/hof/bell-cool-papa

- The Wikipedia article on Cool Papa Bell includes several more stories about his legendary speed:

  http://en.wikipedia.org/wiki/cool_papa_bell

- Artificial light, computer monitors, and televisions are just some of the devices that use intermittent periods of light and dark. We perceive these intermittencies as flicker when the cycles occur at less than a critical fusion point, which depends on a large number of environmental and other factors, but which is generally less than 50 Hz.

Suggested Readings

Elliott, D. (1990). Intermittent visual pickup and goal directed movement: A review. *Human Movement Science, 9,* 531-548.

Elliott, D., & Khan, M.A. (2010). *Vision and goal-directed movement: Neurobehavioral perspectives.* Champaign, IL: Human Kinetics.

Elliott, D., Zuberec, S., & Milgrim, P. (1994). The effects of periodic visual occlusion on ball catching. *Journal of Motor Behavior, 26,* 113-122.

Schmidt, R.A., & Lee, T.D. (2011). Sensory contributions to motor control. In *Motor control and learning: A behavioral emphasis* (5th ed). (pp. 135-176). Champaign, IL: Human Kinetics.