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# My Uncle Used to Watch Television

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In writing the latest installment of Lifelong Interactions, I knew I wanted to consider how we as human beings have come full circle from being very physical, to living an abstract life, and eventually to having a need for physicality in our golden years. It just so happened that the day before my deadline for this article, I had an interesting discussion with a colleague and close friend, Chris Krause. During the three years since I started my research on tangible interaction devices, Chris has always kept me on my toes, questioning the value that tangible user interfaces can add to the office environment. Our conversation was enlightening.

Many anthropologists regard the Cradle of Humankind, a region of the heart of South Africa, as the site of man's origins. It was during Chris's visit to this place that he realized as humans we have gradually moved from having a direct relation with the events we are responsible for, to being increasingly further removed from the consequences of our actions. After my discussion with Chris about the lifestyle of early man, I began to explore the ramifications of modern man's technology-driven detachment from direct, tactile experiences.

It's interesting to contrast current methods of subsistence with those used by early man. The hungry caveman would notice his grumbling stomach and go hunt for a meal, or dig for edible roots. Modern man gets his food indirectly.

Consider how you get food on your table. As an employee, you spend time in a workplace, possibly an office. At this office you most likely have a computer and earn some reward tokens by typing away at the keyboard. At the end of the month you are rewarded through another indirect mechanism that we call banking. Your employer sends a message to your bank stating the amount of credits to be added to your account. No physical objects are transferred. You then exchange these virtual objects for real objects at a supermarket, objects that have been prepared and packaged by a person totally unrelated to you. And so the supply chain is constituted: total strangers exchanging virtual objects for real-world objects.

My 85-year-old uncle, Charles Keegan, used to enjoy his home entertainment system, including a television set. Unfortunately, his eyes have now succumbed to macular degeneration, an age-related illness characterized by a detached retina leading to complete blindness. He has been classified as legally blind. Using the multitude of remote-control devices is becoming an acute problem for my uncle. He has many devices to keep track of, each with small buttons closely spaced, pre-programmed with multiple functions.

In general the majority of modern electronic consumer devices are packed with features with multiple functions assigned to the same control buttons on the physical interface. Manufacturers justify this overloading with the product's lower retail price.

Now envisage a remote-control system that relies on the touch and shapes of three-dimensional objects. The majority of blind people retain a sense of touch; the majority of all people has some sense of touch and have become accustomed to the feel of familiar objects.

Human aging results in unexpected changes in our bodies. My uncle never envisaged going blind. He kept physically fit and active, running his own business independently up to the age of 81, until the debilitating illness affected him. No longer an able-bodied person who can lead an independent life, he now relies on a third party for assistance.
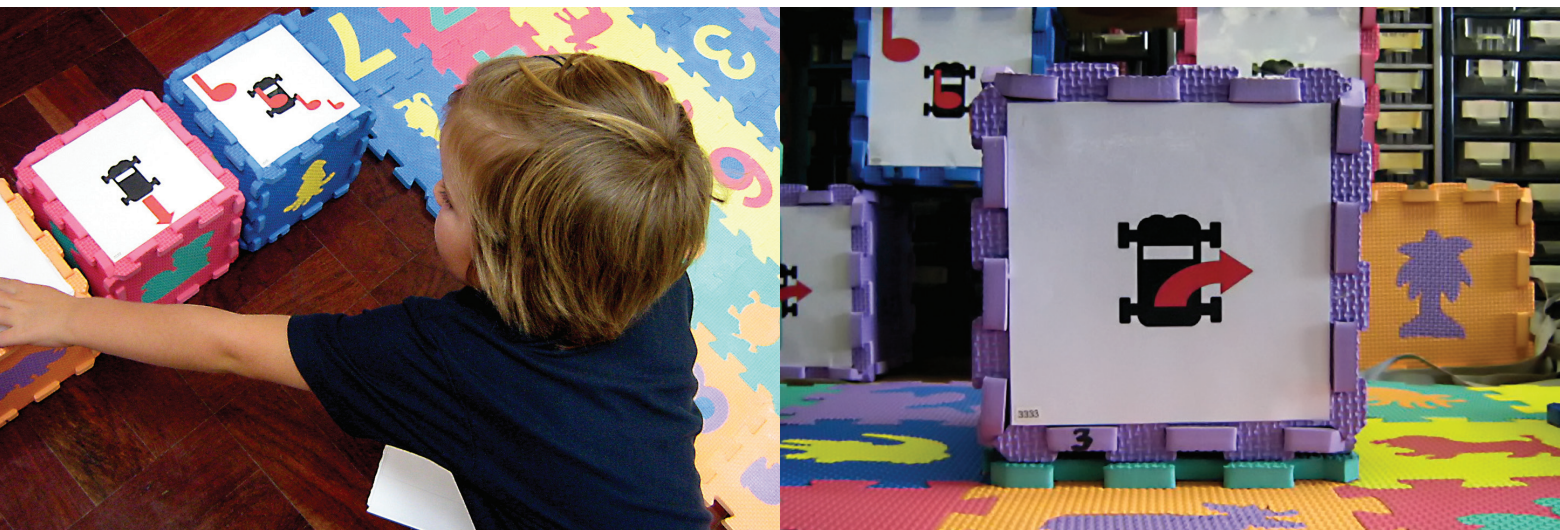
How can technology possibly address diminished vision at an age when it's too late to learn Braille? The answer might very well be found in the way our caveman ancestors interacted with their environment. They used their sense of touch and their actions were concrete, providing a direct link between cause and effect. Direct interaction has the advantage over other means of interaction in

that varying levels of abstraction are transparent to the user and do not interfere with the understanding of the interface.

As an example of abstraction introduced in the electronic age, consider how station selection on the radio was done five decades ago, and how we do it today. In the 1960s the radio had a tuning knob and dial for selecting the receiving station. As the knob was turned, a line would move across a graduated background, providing the user with a direct correlation between the rotation of the knob and the movement of the line. The background indicated the

appropriate for those who have lost their sight or have difficulty with fine motor control. For these people, manipulating large three-dimensional objects gives potential relief from the minuscule buttons of a television remote controller's two-dimensional interface.

My own interest in TUIs encompasses the development of physical systems that support the creation of simple programs by novices using physical objects. The ultimate aim is to provide a programming environment that can be operated by computer illiterates to construct very simple programs for

[1] Norman, D. "Natural User Interfaces Are Not Natural." *interactions* 17, 3 (2010): 6-10.

[2] Ullmer, B and Ishii, H. "Emerging Frameworks for Tangible User Interfaces." *IBM Systems Journal* 39, 3-4 (2000): 915-931

location to which the line should be moved in order to tune to a radio station. Current radio designs present the user with a range of buttons, which can be depressed. Searching for a radio station is accomplished by depressing a specified button and listening to the audio while a circuit changes frequency. The user has little control over the rate at which the frequency changes, at least not the fine control afforded by the tuning dial. This additional abstractness has been added to numerous consumer items, supposedly in an attempt to add more functionality into an ever-decreasing volume.

A number of researchers are investigating the removal of abstraction layers by inventing new direct-manipulation mechanisms, often building on prior knowledge [1]. One group of researchers is grounding work in Tangible User Interfaces (TUIs) [2]. It is my opinion that TUIs are particularly

execution on a computing device such as a desktop computer, a custom-made low-cost computer, or a computing device embedded in the world of the novice programmer. I'm motivated by the innate ability of humans to manipulate real-world objects using their hands. This is accomplished with greater ease than the manipulation of virtual objects using artificially created instruments such as the computer keyboard.

What I find of particular interest is the search for a method to introduce computer-programming principles to children living in rural communities in developing regions. I anticipate a solution requiring the integration of high-tech research with a low-tech implementation. Our laboratories at the CSIR Meraka Institute have pursued this concept for some time, initially using custom-designed and -assembled electronic circuitry to receive instruc-

tions, interpret them, and produce a result by effecting changes in the real world.

I hypothesize that through the provision of concrete inputs and concrete outputs, the abstractness of programming is reduced, and demonstrating to the novice that setting up a sequence of instructions for delayed execution is possible. If this concept is grasped by the novice programmer, then the first steps to becoming a seasoned programmer have been taken.

Our initial design consisted of transparent cubes, approximately 400mm square. Embedded inside the

such as discarded CDs and lengths of abandoned electrical wiring.

I ponder whether modern man is abstracting life too much. I recall having read that one of the effects modern technology has on humans is that of isolation [3]. I, too, have succumbed to technology, sending email messages to students who are in a lab just down the hall from me.

Will humankind be able to recover from a disastrous event if all our current electronic technology has been destroyed and we have to revert to manual processes and actually speak

[3] Bell, G., Blythe, M. and Sengers, P. "Making by Making Strange: Defamiliarization and the design of domestic technologies." *ACM Transactions on Computer-Human Interaction* 12, 2 (2005):149–173.
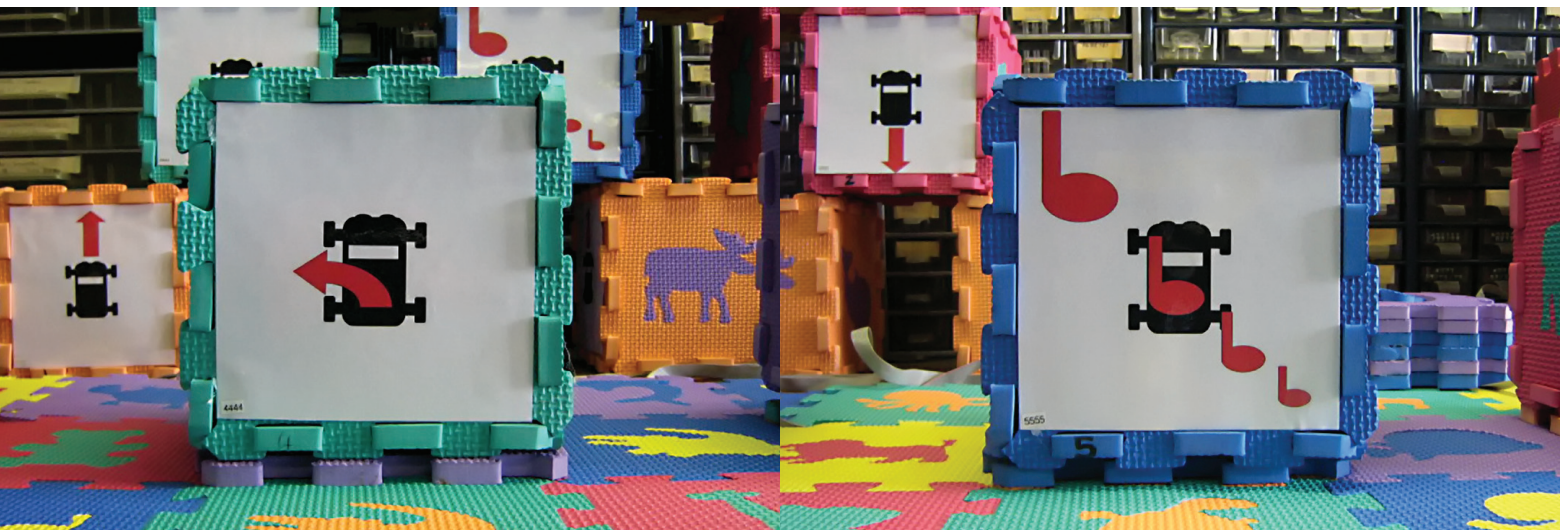


surfaces were low-cost magnets, sold in the retail sector as part of home-intruder detection systems. So-called "reed" sensors accompany the magnets, consisting of two ferro-magnetic "fingers" that make contact in the presence of a strong magnetic field. In our design the sensors were embedded in a separate sensing surface. By varying the combinations of the magnets, the sensing surface detects which cubes have been placed at predetermined positions. Attached is a low-cost computing device that receives the combinations, interprets them, and sends commands to a toy robot.

Since our initial design, we have progressed through a number of iterations. The second design incorporated colorful foam blocks, and in the third design we investigated the use of natural materials, shaping soft rock using hand tools. The fourth design investigated the use of recycled materials

to other people face-to-face? And what about my uncle? Our culture's dependence on technology has arguably complicated his experience of blindness—can we turn that around and use all that we've learned to make technology more accessible to those with a disability? On second thought, where is that power switch…

**ABOUT THE AUTHOR** Andrew Cyrus Smith is a senior researcher at the CSIR Meraka Institute, a unit of the Council for Scientific and Industrial Research (CSIR), South Africa. He is currently researching the use of handcrafted artifacts as alternatives to the computer keyboard and mouse. Potential beneficiaries of his research are the computer illiterate in developing regions.