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Poremba, Cindy

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Beyond Boy's Toys: Women, Play and MindStorms™ Robotics

Cindy Poremba
Computing Arts and Design Sciences
Simon Fraser University
Surrey, BC
poremba@sfu.ca

Abstract

The LEGO® MindStorms™ Robotics Invention System is increasingly used by adults for both serious prototyping and creative play. What is particularly interesting about the MindStorms™ system is that it offers women the opportunity to participate in an embodied computing environment that supports women-friendly programming concepts such as Constructionism and bricolage. So where are the female hobbyists and artists? This paper argues for the development of a feminine/feminist MindStorms™ robotics practice that subverts the male agency of the product and creates a dialogue surrounding women and robotic play. Using a toy for expression and discourse is a political act: a reclaiming of play time and space for women, and an affirmation of a programming style that rejects dualisms and situates women in the programming experience. This paper will argue the mechanics and cultural space surrounding the MindStorms™ system make it a particularly interesting subject for theorizing and encouraging discourse surrounding women's relationships to robotics and play. It also presents several ongoing projects by the author that explore the idea of subverting the cultural space surrounding MindStorms™ robotics.

1 Introduction to MindStorms™ Robotics

The LEGO® MindStorms™ Robotics Invention System (RIS) was released in 1998. At its core is the RCX, or Programmable Brick, which can be programmed to run independently of a computer workstation, and to which can be added various sensors and motors. The MindStorms™ system stems from research done by MIT's Epistemology and Learning Group. Although MIT's research showed no gender bias for children playing with the system, LEGO® markets the product towards a so-called consumer "sweet spot" of 10-14 year old boys. This decision is evident in both the physical design of the product (choice of brick colours) and sample applications (robots, cars). Sales of the MindStorms™ RIS increased by an unanticipated 300% when the toy caught the interest of the adult,

predominantly male, "hacker" community [2]. Recently, MindStorms™ appears to be making a breakthrough with some academic and artist groups— a workshop put on at transmediale.01¹ demonstrate the use of the system for DIY expressive play, and the *Jungle Cube* installation (by the LEGO Lab at the University of Aarhus) explores the use of the robots for artistic expression [4].

1.1 Embodied Programming and Artistic Practice

The history of the system presents a gendering of Mindstorms that is both designed and culturally constructed. However, MindStorms™ is conceptually based on the learning theory *Constructionism*², developed by Seymour Papert, which asserts knowledge is best learned through the building and discussion of artifacts [10]. Feminist epistemology recognizes procedural and constructionist knowledge as supporting what has been termed "women's ways of knowing" [19]. Further, the construction of knowledge in Constructionism is remarkably similar to knowledge gained through artistic practice—in fact, Papert formed the first principles of Constructionism while viewing a sculpting class [10]. Constructionism, like art, progresses loosely from research and idea formation, to instantiation, and finally to discussion of the artifact. Idit Harel's three X's of Constructionism: eXploring (learning how to discover for oneself), eXpressing (learning how to use a vast palette of tools to become designers, builders and architects of your own ideas), eXchanging (sharing of ideas with others) demonstrate these commonalities with artistic process [9]. Here art can be portrayed as an instantiation of an idea that then allows for critical discourse surrounding the artistic or expressive work. In this sense, the goals of

¹ <http://www.transmediale.de/01/en/workshop.htm>

² Constructionism (the *n* word, not the *v* word) differs from Constructivism in its emphasis on the creation of artifacts.

Constructionism and the phenomenon of creative expression share common ties.

Perhaps stemming from this Constructionist influence, playing with the MindStorms™ robotics is very much a process of *bricolage*: both in the sense of programming the robotics and physically building LEGO® structures [18]. Bricolage was first coined by social anthropologist Claude Levi-Strauss to describe a process by which one solves a problem by using and manipulating the materials at hand. The bricolage process encourages an acceptance of a profound human connection with our tools, which may be why it has been implicated in a female-preferred, and highly capable, “soft” style of computer programming [16]. In addition, the ready reconfiguring of physical and digital components presents a challenge to mind-body dualisms and to nature-culture binarisms [11]. Bricolage-style programming is often favored by the very “hackers” that are drawn to MindStorms™ play, and, in practice, is as respected and relevant as formal programming [5]. A bricolage approach to robotics may also circumvent cultural inhibitors to women's play, by providing an environment conducive to sporadic interruption³ and the opportunity to interact socially in the discussion of robotic artifacts.

Despite its relationship to female-oriented design and programming practice, MindStorms™ emerges as a gendered system through both the rhetoric of the product design and the cultural niche created by home robotics hobbyists pulled from computer hacking and electronics. The robotics kit adopts many of the hard edged, straight beams of earlier Technics™ kits (and its spiritual predecessor, the Erector set): rounded corners and organically influence designs are relegated to specialty components. The grey and yellow tones that dominate the set reflect the real-world construction and engineering projects to which a young male audience can aspire—the composition of the basic kit speaks to preferred use simply through the number of rubber wheels and tank treads provided. When the system moves into the adult hobbyist sphere and more sophisticated projects are sought, technical challenges centre around extensions to the tankbots and crane-arms suggested by the originating system and its documentation. While a few designers have extended the system beyond this model (Mario Ferrari⁴, for example, has build both domestic tools and robotic games), the vast majority of online projects and MindStorms-based robotic competitions involve the products of a distinctly male culture.

³ An inhibitor discussed in Green, 2001 [7]

⁴ <http://www.marioferrari.org/>

2 Reclamation and Resistance

The gendering of a particular type of technology is, of course, a socially constructed phenomenon that is by no means incontrovertible. Cited examples of the regendering/reclamation of what had been established as “male” technology include everyday items such as the telephone [12] and the microwave [5]. Reclaiming gendered space in the digital world supports a strategy of working on the problem of female technological alienation from both the inside out, and the outside in:

*“This is for us the main challenge of cyber-feminism: how you incorporate a feminist language into technology, how you incorporate the body into technology, how you incorporate feminist ideology into technology and how you subvert technology for your own means and purposes. That is our prime project.”*⁵ [13]

The MindStorms™ system provides an opportunity for a cultural challenge to what is rapidly becoming yet another masculine gendered technological space. Here we invoke the spirit of *hackivism*, broadly defined to include any appropriation of technology as critical discourse (hacking defined by Jenny Marketou as *any imaginative and unorthodox use of any artifact*) :

*“‘Hacking’ means reconstructing a tool to understand its workings and to reconstruct it in a personal, creative way. How can art subvert and reappropriate given esthetics and technologies and what does this mean in culture in general. I can make reference to the history of art when Duchamp took a wheel and put in the gallery space or snatched Mona Lisa. He snatched a product and reconstructed a new system of meaning and representation.”*⁶ [16]

Some of the more interesting examples of technological resistance and reclamation include the *Child as Audience* and *Home Surgery* projects. *Child as Audience*, a joint project of hactivist.org and the Critical Art Ensemble, provided instructions on how to hack/pervert the Nintendo Gameboy™ console: designing games that, among other things, used the Gameboy™ physical interface to teach children about masturbation. The ideology behind the project was to reclaim an extremely closed system (the Gameboy™), and resist the comodification of children and children’s experience [8]. Another prominent example is the Barbie Liberation Organization’s (funded by rtMark) release of instructions on how to exchange the voice boxes in talking toy versions of GI Joe and Barbie figures. This protest drew attention to the sexist nature of the electronic

⁵ Julieanne Pierce, as quoted.

⁶ Jenny Marketou, in interview.

messages⁷ through the manipulation of the technology itself [1]. Game modding and patching is another noted avenue of resistance. Anne-Marie Schleiner suggests game hacking offers a possible strategic means for feminists to participate in the formation of new gender configurations: game patches offer an unexpected perversion of the accepted semiotics of game worlds and game play [15].

Jenny Marketou defines two types of hackers: The first is the *celebrity hacker*, motivated by control and mastery. The second, however, is the *cultural hacker*, who uses computer hacking methods as an open source medium and strategy to reconstruct new systems and creative environments [15]. Hacking as an art suggests contributing to the formation of new configurations of characters, space, time and play. Altering the cultural space behind the robotic system does not dictate physical hacking of the system—the beauty of the technology is that it’s a tool for experimentation and play, and the opportunities for all manner of expression exist in its components. However, that’s not to say feminine robotics expression does not run contrary to what can be seen as a preferred use of the system. Instead of physical modification of MindStorms™, what we need is a modification of the gendered cultural space surrounding the system, manifest in a feminine practice. In this way MindStorms™ can be used a tool to inspire more diverse models of “play as discourse” in electronic culture.

3 Home Robotics and “the Feminine”

From this conceptual standpoint, I set out to explore the possibilities of “cultural hacking” the MindStorms™ robotic system. In doing so, I appropriated a Constructionist-style methodology⁸ to support artistic rather than educational goals. On the whole, the following projects attempted to demonstrate a “play practice” as a means of expression and cultural resistance.

One of the goals in creating this work was to open up discussion of the cultural role of play in women’s culture, particularly in relation to digital technologies. As a researcher, I am struck by how often women are dismissive of the perceived “unproductive” leisure of digital games, toys, or even the computer itself. A common explanation is that women are still responsible for the bulk of domestic work, and do not have as much, or more sporadic, leisure time. Yet another defense is that women are still fighting long won battles in proving their responsibility and maturity against claims of frivolity and general mindlessness⁹. The concern is that, through this action,

⁷ Post surgery, the new Joe chirps “Want to go shopping?”, while a liberated Barbie notes “Dead men tell no lies.”

⁸ Appropriation is a cornerstone of the bricolage process...

⁹ From Mark Bernstein: “The quiet irony here is that, if you go back to the drawing rooms of Wilde or Shaw or Galsworthy and ask, “Why are

women are shutting themselves off from channels of personal growth and expression. Women need play—the act itself speaks of new ways of thinking, new challenges overcome, and new perspectives on everyday life. Further, if societal issues prevent women from the opportunities implicit in creative digital play, those issues need to be confronted and brought to the foreground in digital discourse.

Another issue in a discussion of a feminine aesthetic for robotics work is determining what exactly it means for robotics to be *feminine*. In the following experiments I tried to keep with the playful nature of LEGO® as a toy, but explore unconventional uses that had a distinctly feminine bent or provoked feminist commentary. I tried to shy away from the creation of domestic projects that were not tied to commentary, or explicitly sexual projects (such as obvious projects using the vibrating motion of the engines), in the hopes of extending the creative scope of MindStorms™ projects, and feminine aesthetics in general. Experiments in MindStorms™ reclamation play began with an installation project based on the kitschy photographic work of commercial photographer Anne Geddes. All projects use version 2.0 of the RIS: the Pneumatic Wearables project additionally uses mechanical parts from the LEGO® Ultimate Builder’s Set™, while the Geddes-influenced installation uses the Vision Command™ expansion.

3.1 Geddes Installation

The Geddes Installation was an experiment in using a children’s toy to explore the relationship between a popular feminine romantic view of the infant in relation to the artificial and masculine aesthetic of the robot. The installation is visually inspired by a recent series of photographs in which babies are photographed in a transparent, organic environment that evokes a cocoon or womb.



Figure 1: Geddes-inspired installation

The project consisted of a cocoon-like nylon structure hanging at waist level. Inside sits an autonomous reactive

women oppressed”?, the New Woman will answer that women are trained to play games and amuse themselves, while men are sent to school and thence to work” [3].

robot built in a curved shape to mimic a biological pliability (in contrast to the rigidity of the plastic LEGO® components). From the robot comes a soft, rhythmic beeping, designed to evoke both a heartbeat (biological), and a heart monitor (technological).

The robot senses an interactor's approach through a vision recognition system reconfigured as a smart sensor (in this scenario, detecting motion). At this point, the beeping grows faster. The robot appears to grow agitated, and makes a variable grasping motion towards the interactor, pressing into the cocoon. The constrained action coupled with the flexibility of the environment combine to create a more organic motion than is seen in the robot alone.

Overall, the visual design of the project was effective, and quite close to how I had envisioned the installation. This was particularly important as it was important to make the visual connection with Geddes' photographed babies. The nylon environment, though delicate to work with, reinforced the union between a technology (in this case the chemical technology of nylon) and women's everyday experience (the nylon stocking being, for the most part, a uniquely female wardrobe item.) The relative fragility of the robot structure also provided a nice parallel to the infant model.



Figure 2: Emphasizing robot-fetus connection

Visitors' interaction with the robot mainly consisted of waving motions, which seemed to keep their relationship on the level of sensor/interactor, rather than viewing the piece holistically. During the installation, we changed the behavior of the camera sensor to identify (through colour) the cap on a red marker; inadvertently created a more anthropomorphic relationship with the robot. Visitors held the marker up to calm the agitated robot in a manner reminiscent of calming an infant.

Reaction to the installation was positive, but overall tended to centre on technical implementation¹⁰ over conceptual issues. People tended to find both the installation and discussion of the project mildly unnerving. Some of the feedback I received was that the robot infant was "creepy," which was an interesting comment given the theme and

¹⁰ People seem naturally curious about the use of MindStorms™ in an installation and its technical capabilities.

design of the project. Overall, I think the project does demonstrate the possibility of conveying a feminist-themed project within the context and capabilities of the MindStorms™ system.

3.2 LEGO® Pneumatic Wearable Performance

An upcoming project involves the use of MindStorms™ components in a wearable performance that uses biofeedback through homemade sensors and pneumatic components. The wearable consists of several biometric sensors (specifically a Galvanic Skin Response and Temperature sensors) to measure emotional response in the female performer. Upon detecting emotional agitation, a signal would be sent to the pneumatic pump system which would inflate the performer's chest: creating an (ironic) "instant confidence boost".

The Pneumatic Wearable Performance project presents a number of challenges in implementing an affective wearable robotic system. The implementation involves the creation of two biometric "homebrew" sensors, as well as custom inflatable "padding." The delicate structures formed by LEGO® blocks create an engineering challenge, although from a performance standpoint will likely dictate a careful, light movement that evokes a forced and exaggerated feminized gait. However, the biggest challenge is in creating enough consistent inflation to create a noticeable difference in the appearance of the performer. As in the previous project, the design methodology for this work is a Constructionist-based play practice, that will centre on experimenting with a variety of designs and implementations.

This performance subverts intended use of the robotics system on a number of fronts: the toy becomes mildly sexualized, but is still used in a playful manner. The pneumatic components reflect a colloquial, feminine turn on the word "pneumatic" that differs from existing MindStorms™ projects using pneumatics in an industrial sense. In addition, the combination of wearable toy and performer creates a manner of toy-based cyborg, arguably owned in part by the LEGO® corporation.

On a conceptual level, the project covers a deceptively wide terrain, ideally provoking commentary on affective computing, involuntary/voluntary response, children and body image, the future of invasive cosmetic technologies, and women's relationship to the robot in pop-culture. I would also hope the light nature of the project will relax people in light of the feminist commentary—countering (and in turn revealing) the popular¹¹ perception of the dour feminist.

¹¹ And ridiculously persistent

4 The Politics of Digital Sandboxes

Artist Linda Dement states “to use technologies which are really intended for a clean slick commercial boy's world, to make personal, bodily, feminine work, and to re-inscribe this work into mainstream culture, into art discourse and into society, is a political act” [13]. I would like to make that same argument for the digital sandboxes found in today's environment: online environments, digital games and, of course, robotics such as the MindStorms™ system.

The hobby culture surrounding the LEGO® MindStorms™ Robotics Invention System presents a gendering of home robotics that threatens to create yet another male-centred technological sphere. The irony is that the embodied programming style and flexibility inherent in the system has the potential to allow for creative, expressive play that demonstrates a uniquely female aesthetic. It is a physical computing environment that allows for experimentation, reconstruction, and bricolage. It is fragile, temporal, and presents challenges in its materials and its design. Its most prevalent rules are cultural, and its technical capabilities are at once challenging and undirected. The mechanics and cultural space surrounding the MindStorms™ system make it an interesting subject for theorizing and encouraging dialogue surrounding women's robotics play.

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