Mi Ani? (Who Am I?): Robotics as a Medium to Express Jewish Identity

A thesis

submitted by

Nehama Libman

In partial fulfillment of the requirements for the degree of

Master of Arts in Teaching

in

Child Development

Tufts University

May 2011

Advisor: Marina Bers

Committee members:

Debbie LeeKeenan

Jon Levisohn

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Abstract

A central focus of Jewish education today lies in encouraging and strengthening children's Jewish identity. This focus is especially pronounced in early childhood education, where many educators see children's ability to understand, express, and contextualize their identity as a core developmental task. An estimated 130,000 to 140,000 Jewish children are enrolled in Jewish early education programs today, making the question of their nascent Jewish identity a central concern (Vogelstein, 2008). In this context, providing children with appropriate and broad avenues to achieve this goal becomes increasingly important.

This study aims to understand the role of robotic technologies as a means for kindergartners to express their Jewish identity. It analyzes an intervention at a Jewish day school in which 22 kindergartners learned to program robots in developmentally appropriate ways to represent their identity. Using the children's descriptions of their programs, this work explores the affordances of robotics for children's expression of their identity. It focuses on children's use of the technology to represent their identity through personal experiences, exploring and classifying these representations. Qualitative descriptions of several case studies are presented, and the robotic projects are compared with representations in other Judaic art projects. Finally, limitations of the study and future avenues for research are discussed. Understanding the role of technology as a medium for identity expression holds the potential to expand the modes of

expression available to young children of all cultures, providing them with a new means of exploring their identity.

Acknowledgments

First and foremost, I am indebted to my adviser, Marina Bers, for her energy, enthusiasm and continuous assistance throughout this project. Her advice, encouragement, and unwavering support was instrumental in ensuring that this thesis happened, and I am truly grateful for everything.

I would like to thank my readers, Debbie LeeKeenan and Jon Levisohn, for their flexibility and continuous interest in this project as well as for their thoughtful comments and suggestions along the way.

Special thanks to Jared Matas and Miriam Newman, kindergarten teachers at JCDS, for their assistance on all aspects of the Mi Ani project, from carrying it out in the classroom to contributing resources and research ideas. Thanks to the students, families, and administration at JCDS who enabled this project to take place, especially Ruth Gass, head of school, for her encouragement and support of this project.

Thanks to Kenneth Lee and Alyssa Ettinger, who assisted me in carrying out this project and without whom it could never have happened.

My thanks to the members of the DevTech Research Group at Tufts University, particularly Elizabeth Kazakoff, Louise Flannery, and Jordan Crouser, for their assistance with technology and research both during the project and afterward.

Thanks to Michelle Weiner for some helpful research advice, and to my dear friends Rachel Weber and Casara Nemes for their support and helpful comments on drafts.

Finally, I wish to thank my family, for their endless support, confidence, and encouragement throughout my two years at Tufts. I couldn't have done it without you.

Table of Contents

List of Tables

List of Figures

Introduction

Early childhood educators have long recognized the importance of fostering young children's sense of self. This emphasis is keenly felt in Jewish education, where educators have long valued promoting children's awareness of their Jewish identity. As young children develop their growing self-understanding, providing them with a broad range of avenues to express this understanding becomes increasingly crucial. Robotic technology, as a medium that uniquely combines concrete manipulatives with abstract concepts, is one such avenue ripe for exploration. To date, however, few studies have explored the role of robotics as a medium for identity expression, particularly in early childhood. This study aims to contribute to our understanding of the affordances of robotics as a medium for young children's expression of their Jewish identity, thereby expanding our knowledge of the potential of the medium to enhance children's ability to represent their identity. As such, this study has the capacity to benefit children from a wide range of backgrounds, by offering a deeper lens into the unique possibilities of a medium that can enable children to express, and thereby better understand, their own unique identity.

Review of the Literature

Technology in Early Education

Young children today live in a world increasingly saturated with a wide variety of digital technologies. In the educational world, new

technologies have become an area of increased interest, both as a teaching tool and as a content goal in itself. As these technologies become increasingly integrated into classrooms, questions have arisen about their potential educational benefits, as well as their design. Early research into the benefits of learning computer programming in particular suggested that children's development of the ability to program, as well as of problem-solving and other higher-order cognitive skills, would largely depend on their context for learning (Pea & Kurkland, 1984, p. 161). Later research confirmed this approach, demonstrating positive learning gains for children when their introduction to computer programming occurred with appropriate teacher mediation and support (Clements, 1999). Clearly, then, educators can best enhance children's mastery of programming skills and development of higher-order thinking when they integrate educational technologies within the context of a broader pedagogical approach.

This study adopts the philosophy of constructionism, set forth by Seymour Papert, as a theoretical framework for using digital technologies to convey powerful ideas. Building on Jean Piaget's theory of constructivism, which posited that children learn best by doing, Papert (1993) extended this idea to the notion of "learning by making" (p. viii), contending that "we learn best of all by the special kind of doing that consists of constructing something outside of ourselves" (p. xiii). Papert called these "'objects to think with,' objects in which there is an intersection of cultural presence, embedded knowledge, and the possibility for personal identification" (1993, p. 11). In

particular, he argued that digital technologies as "objects to think with" present unique learning opportunities because of their inherent ability to make abstract concepts concrete and to appeal to a wide variety of interests and learning styles (Bers, 2008, p. 22). By learning programming as an avenue for creating their own personally meaningful projects, Papert believed that children would engage in the fullest realization of the constructionist learning philosophy, gaining a deeper understanding of complex concepts such as problem-solving, sequencing, or cause and effect.

Followers of Papert's philosophy extended his ideas about programming to digital and robotic manipulatives, establishing design principles for new technologies that emphasized the child's ability to use them to create, rather than to consume. Resnick, Bruckman, & Martin (1996) compared computational construction kits to pianos, writing that just as pianos enable people to create music as opposed to simply replaying it on a stereo, technologies that follow these principles "enable people to express themselves in ever-more complex ways, deepening their relationships with new domains of knowledge." This philosophy of design, termed "constructional design" by Resnick et al., designs new technologies to foster its users' own design activities, enabling them to develop far more extensive knowledge of the technology and to employ it for a far broader range of expression. Bers (2008) highlighted the difference between these types of knowledge, using the terms "technological literacy" and "technological fluency" to differentiate between the ability to use existing technology within

its limits and the ability to employ it for a broad range of creative, expressive, self-directed goals (pp. 77-78). In early childhood education, where pedagogical approaches emphasize fostering this very creativity and expression, these principles of technological design are increasingly relevant.

In particular, robotic manipulatives have become an area of focus for many designers of developmentally appropriate technologies, because of their increased ability to engage young children in concrete activities to learn abstract concepts. Robotics present a unique combination of "bits and atoms," or tangible elements from the physical world and digital computer elements, making them developmentally appropriate for young children (Bers, 2008, p. 22). In the preprimary years, children typically think and act in concrete terms, and are still developing their capacity for more abstract thought. At this age, tangible manipulatives such as robotics are particularly well suited to their interests and abilities, enabling children to interact with objects in concrete ways while advancing their understanding of abstract concepts such as feedback, cause and effect, and loops.

When used in the context of developmentally appropriate, enriching curricula, these new technologies hold enormous potential for enhancing children's development in new ways. For one, technology offers unique opportunities for identity exploration and expression of values. The Con-science project conducted by Bers and Urrea (2000) demonstrated the affordances of robotic programming as a means for parents and children to explore and represent their personal religious values together. Although this

integration of technological and personal development has as yet occurred rarely in the educational world, its potential as a practical application of new technology is enormous. Curricula that use technology to enhance children's personal development and make it visible can build personal and communal meaning for children from a variety of religious and ethnic groups, including Jewish children.

Jewish Education and Identity

Jewish educators have long seen a key focus of their role as encouraging the formation and development of Jewish identity (Reisman, 1979, Feldman, 1992). In the past twenty years, however, this focus has received renewed attention. After the 1990 publication of the National Jewish Population Study sparked fears of assimilation and intermarriage, Jewish communities began to place renewed emphasis on Jewish education "as *the* way to address Jewish continuity, and to revitalize, strengthen, and deepen Jewish identity" (Bloomberg, 2007). Recent scholarship on denominational schools has emphasized this role, arguing that the primary task of contemporary religious education "is not so much to transmit faith but rather to facilitate the formation of personal identity as a core aspect of contemporary socialisation processes" (Vermeer, 2009, p. 201).

Nowhere has this emphasis been stronger than in the realm of early childhood education. A 2004 survey of Jewish early childhood educators found that an overwhelming majority saw their central mission as being the

cultivation and enhancement of Jewish identity for young children and their families (Krug & Schade, 2004). As opposed to later Jewish education, which is often focused on cultivating Judaic skills or content knowledge, many early educators' goal is to lead their students "to feel, to understand, to live, and to love Judaism" (Wolf & Nowak, 1991, p. vii).

Indeed, while research in this area is limited, those studies in existence have shown that identity development in the early years has the potential to have a lasting impact. Several studies have shown that Jewish early education has a pronounced effect on families' Jewish involvement and ritual practices in their homes (Ravid & Ginsburg, 1988; Pinkenson, 1987, as cited in Vogelstein, 2008). Since parents play the most formative role in their children's lives in these early years, the potential for changes in children's homes to influence their later development is high (O'Dell, 1974, as cited in Ravid & Ginsburg, 1988, p. 4).

More significantly, early education may be a "'window of opportunity' for Jewish identification" (Holtz, 1996). In the early years, young children's formative educational experiences can have a powerful effect on their later development in all domains (Ramey & Ramey, 1998; High/Scope, as cited in Ball, 1994, p. 97). Since an important developmental milestone in these years is young children's development of a sense of self and personal identity (Cole et al., 2005, p. 371), these experiences can become incorporated into their earliest understanding of themselves. Although studies examining the independent impact of early childhood Jewish education on children's

identity development are lacking, evidence exists that these early experiences may have long-term indirect effects. Bethamie Horowitz's 2000 study on Jewish identity found that for children with intensive Jewish upbringings, early Jewish experiences were most significant in encouraging their later Jewish involvement (2001). Horowitz's findings did not apply equally to children with less intensive Jewish backgrounds, demonstrating that early Jewish education is by no means the only channel to a positive Jewish identity. However, her study supported research showing that positive early experiences in Jewish education often lead to further Jewish education and involvement later in life and thereby to significant later Jewish experiences in adolescence and adulthood (Feldman, 1992). Thus, while the Jewish identity of preprimary children continues to evolve over the course of their lifetimes, the influence of positive early experiences can linger for years to come.

Understanding this potential impact of early Jewish education is particularly important in light of the recent enrollment growth in Jewish preschools and day schools. Over the past twenty years, enrollment in Jewish programs has increased significantly, so that an estimated 130,000 to 140,000 Jewish children are enrolled in a wide variety of Jewish early care and education programs today (Vogelstein, 2008). This increase reflects demographic trends and a movement toward higher enrollment in early education in American society at large, but also reflects a growing interest in Jewish education as a contributor toward Jewish continuity. This focus makes

understanding the impact of early Jewish education on the development of Jewish identity increasingly important, for families and children as well as educators.

At the same time, however, traditional educational approaches to Jewish identity have inadequately addressed its multifaceted, individualized, and ever-changing nature. Jewish educators have traditionally focused on instilling young children with elements of a predetermined Jewish identity, mirroring scholars' conception of Jewish identity as a static entity with particular components (cf. Reisman, 1979). More recently, however, scholars have come to understand identity as a continuously evolving process undertaken over the course of an individual's life (Horowitz, 2003; Charmé et al., 2008, Blanchard, 2002). Moreover, the focus on Jewish identity has expanded from examining only "a person's active involvement in religious and cultural-communal *practices and activities*" to looking at an individual's "self-perception and self-definition as a Jew" (Horowitz, 2003, p. iv). As a result, scholars of religious education have argued that its goal today is "actually the enhancement of identity construction processes, not the formation of religious identity" (Vermeer, 2009, p. 209). While adolescents are typically understood as the target group engaging in these processes, constructivist views of young children's learning make it equally plausible in early childhood. Since young children construct their understanding of themselves through their experiences with the world, enhancing their ability to construct their identity as well holds tremendous potential benefit. Seen in

this light, the role of early educators is to promote young children's ability to understand, express, and develop their personal Jewish identity, as a key to facilitating their healthy identity development and positive self-understanding.

Developmental Considerations

Cognitive Development

According to Piaget's theory of child development, six-year-old children at the end of kindergarten are transitioning between the "preoperational" and "concrete operational" stages of cognition (Cole, Cole, & Lightfoot, 2005). In the preoperational stage, children acquire the ability to "represent reality to themselves through the use of symbols, including mental images, words and gestures" (Cole et al., 2005, p. 459). This newfound ability to engage in symbolic representation enables kindergartners to understand a range of symbolic systems in different media, including technology. Studies have shown that children as young as three years old are able to use computers, and can follow "pictorial instructions as well as use situational and visual cues" (Saracho and Spodek, 2008, p. 172) While not all kindergartners are fully literate, they are cognitively able to understand and manipulate these visual symbols, making pictorial computer programming languages, such as the CHERP language used in this project, well-suited to their developmental abilities.

As children enter into the concrete operational stage, they develop the ability to manipulate objects mentally, advancing their facility at problem solving. Yet, while children can "symbolically or mentally manipulate objects, it will be some time before they can mentally manipulate symbols… For this reason, primary-age children still need real things to think about" (Bredekamp, pp. 63-64). In these years, then, developmentally appropriate learning must bridge the concrete and the abstract, providing children with tangible objects that they can manipulate symbolically. Robotic manipulatives are thus an important tool for children at this stage, as they enable children to engage in symbolic representation using a physical object. Similarly, tangible programming languages, which use physical objects to represent programming commands, provide children with concrete objects that facilitate their ability to learn abstract concepts. For example, the CHERP programming language used in this project incorporates a tangible interface, which "allows children to…construct physical computer programs by connecting interlocking wooden blocks" (Bers & Horn, 2010). The wooden blocks represent programming commands, providing children with a developmentally appropriate manipulative that allows them to advance their understanding of abstract programming concepts.

Children's emerging literacy skills also play a crucial role in determining the developmental appropriateness of programming languages. Since children in kindergarten are developing a range of early literacy skills, including pre-reading, decoding, and reading comprehension, a typical

kindergarten classroom may include children whose mastery of these skills varies widely (Cole et al., 2005, pp. 488-489). As a result, developmentally appropriate technology for this age must meet the needs of children who are not yet reading as well as those who are. Programming languages such as CHERP, the language used in this project make their meaning comprehensible to pre-literate kindergartners by representing individual programming commands with a combination of written words and pictures (Bers, in press), thereby suiting young children's developmental abilities.

Other aspects of children's cognitive development in this stage also enhance their ability to represent their own identity. The concrete operational stage is characterized by declining egocentrism, enabling children to consider how others see them, an important element in developing an understanding of one's self. Moreover, in this stage, children develop the ability to notice and think about more than one attribute of an object, allowing them to categorize objects by multiple criteria at the same time (Cole et al., 2005, p. 459). When this cognitive skill is applied to their self-understanding, children can demonstrate the ability to consider multiple characteristics of themselves simultaneously. Clearly, then, Piagetian stages of development indicate six-year-olds' growing ability to understand themselves from multiple angles, representing themselves symbolically with the use of tangible objects, such as robotics, as manipulatives.

Some recent research indicates that children's cognitive development is neither as clearly sequential nor as predictable as Piaget believed. Several

studies have shown that Piaget's stages of development are dependent on the content domain of the test, and that children under certain circumstances can in fact display higher-level cognitive abilities at earlier ages than his theory would predict (Cole et al., 2005, p. 330; Pea & Kurkland, 1984). This has important ramifications for computer programming, suggesting that children may be able to develop more sophisticated programming skills at younger ages. As mentioned previously, Pea and Kurkland have argued that children's ability to develop higher-level programming skills depends largely on the context of learning (1984, p. 161), a contention supported by other researchers (Clements & Sarama, 2002). While kindergartners may in fact be able to program in ways that surpass developmental expectations, this ability is largely dependent on the type of instruction they receive and the appropriateness of the programming environment for their needs.

Clearly, learning to program using a visual programming language and robotic manipulatives is developmentally appropriate for most kindergartners' cognitive stage of development, as is exploring their personal identity. Indeed, children may be able to understand more complex programming concepts than anticipated, and can reap further cognitive benefits from this experience. A 1992 study by Haugland showed that, within a supportive instructional context, children who learned programming experienced "gains in intelligence, nonverbal skills, structural knowledge, long-term memory, manual dexterity, verbal skills, problem solving, abstraction, and conceptual skills" (as cited in Haugland, 2000). More recent

research has shown that learning programming benefits children's sequencing skills, or the ability to put objects or actions in correct order. Kazakoff & Bers (2010) showed an increase in the sequencing ability of prekindergarten and kindergarten students after they learned robotic programming, demonstrating gains in a skill key for mathematics and literacy. Learning computer programming can thus be not just appropriate but genuinely beneficial for children's cognitive development.

Personal Development

Self-Expression and the "Hundred Languages"

A central concern for early educators is fostering the development of children's sense of self and facility for self-expression. Early childhood educators have long recognized the power of providing children with a variety of modalities in which "to express themselves aesthetically and physically and to express thoughts and feelings" (Bredekamp, 1991, p. 72). Experiences with visual art, dramatic play, music, and physical activity have long been valued in the early years, when children's language and literacy skills are still developing. The pioneering work of the Reggio Emilia school has deepened this emphasis within the world of early education, understanding children's self-expression as a process that occurs through a multitude of diverse channels, called the "Hundred Languages of Children." At Reggio Emilia, "the visual arts are integrated into the work simply as additional 'languages' available to young children not yet very competent in

conventional writing and reading" (Katz, 1994, p. 27). Their approach emphasizes the role of these different "languages" in enabling children to communicate their learning and ideas, in addition to their conventional role of allowing children to express their feelings and explore creatively.

Just as artistic media, such as painting, music, and clay have long been recognized as "languages" for children to express their ideas and learning, robotic technologies hold similar capabilities. Every expressive medium presents children with unique affordances for their self-expression and reflection on their learning, and robotics is no exception. Its integration of tangible physical construction, artistic design, and sequenced programming offers children unique expressive opportunities and challenges. Unlike traditional artistic media, robotics enables children to create objects that are dynamic rather than static, allowing children to express concepts involving change over time. Moreover, unlike other modes of expression that involve motion, such as dance, constructionist robotics projects result in a visible object or artifact illustrating children's learning. As a result, "constructionist environments provide opportunities for celebrating and sharing the tangible projects of learning" (Bers, 2008, p. 16), enabling children to reflect on their own learning by means of an external object. Robotic technologies thus hold the capability to be another of children's "languages," providing children with a creative avenue that enables them to express dynamic concepts through a tangible object that facilitates self-reflection.

The Development of Children's Sense of Self

Another key emphasis within children's personal development during early childhood is children's development of their self-concept. Cross (1991) writes that all people have one personal identity and multiple social identities that combine to form their self-concept (cited in Derman-Sparks & Edwards, 2010). While this concept follows a developmental trajectory, evolving and changing over the course of an individual's lifetime, the presence of this self-understanding at a young age is clear. During early childhood, children begin to identify themselves with particular characteristics, behaviors, and abilities. By the age of 4 or 5, they are more able to group some of their attributes into categories, developing a gradually more complex sense of self (Cole et al., 2005, p. 372). Throughout early childhood, children typically reflect a categorical self-understanding, as they identify their particular attributes with socially recognized categories, such as, for example, "I like to read." This identification indicates their understanding of themselves as possessing a specific set of clearly defined characteristics (Cole et al., 2005, p. 565; Harter, 1988). Indeed, Guardo and Bohan (1971) found that by the age of six, children had a definite self-concept, understanding their own humanity and gender and seeing themselves each as "a singular and unique being with an identity of his own" (p. 1911). At this stage, children's self-definition includes both subjective and objective traits relating to both their personal identity and to their various social identities, including, notably, their religious, ethnic, or cultural identity.

Although much research on ethnic identity has focused on its evolution in adolescents (cf. Phinney, 1993), young children clearly have an emerging sense of their own religious, racial, or cultural identity. In early childhood, children begin to identify with a particular group, such as "Catholic" or "Jewish," for example, and begin to associate particular behaviors and characteristics with that identity (Cole et al., 2005, pp. 369-371). From their early experiences, children develop their first awareness and understanding of these identities. They begin to form attitudes toward their ethnic identity, learning from their parents' attitudes as well as from other agents of socialization such as schools. Studies have found that parents' messages about their race or ethnicity can have powerful effects on children's identity, especially when these communications are positive. A survey of the research shows that "parents' messages about cultural heritage and pride consistently have salutary effects on children's racial-ethnic identity development, racial-ethnic attitudes, preferences, knowledge, and behaviors" (Hughes & Chen, 2003, p. 487). While parents' racial socialization of their children can take a number of forms, studies of African-American, Puerto Rican, and Dominican parents in the U.S. found that most transmit messages of ethnic pride over messages of racial mistrust or bias, indicating generally positive attitudes toward members of their own race (Cole et al., 2005, p. 369). No parallel study has exhaustively examined parallel messages sent by Jewish parents, but Hughes & Chen's study of a multiethnic middle school group found that the vast majority of parents, including Jewish

parents, engaged in some form of ethnic socialization practices (2003, p. 480).

Moreover, research on Jewish day schools has shown that "Jewish schooling plays an important role in the religious socialization process… [It] seems to be the main avenue by which religious parents socialize their children to adult religiosity" (Himmelfarb, 1984, p. 275). In this educational context, such as the school in this study, Jewish identity is actively promoted and reinforced, contributing to the emergence of a strong Jewish identity as part of children's self-concept. As this research indicates, kindergarten students enrolled in a Jewish day school are at a developmental stage in which they are establishing their personal as well as their Jewish identities. The reinforcement of their families, school, and community enables kindergartners to see themselves as Jews and to begin to conceptualize this identity in a variety of ways.

This early identity exploration is crucial to children's development of a healthy sense of self. Contemporary educators recognize the importance of providing young children with numerous opportunities to explore their personal and cultural identities, even outside the world of denominational education (cf. Derman-Sparks & Edwards, 2010; Greishaber & Cannella, 2001). As Derman-Sparks and Edwards write, "learning what our various social identities mean is a lifetime journey that begins in toddlerhood" (p. 12). Early childhood, as a time when children are forming their first concepts of themselves and their world, is ripe for this type of exploration. Children's

social identities influence their affiliation with various groups, their attitudes toward these groups, and their beliefs about their capabilities and limitations, affecting their self-esteem as well as their present and eventual understanding of themselves (Derman-Sparks & Edwards, 2010). Thus, a project that provides children with the opportunity to develop their emerging self-concept in their own way is appropriate for both their cognitive and personal growth, enabling them to both express and reflect on this beginning sense of self.

Research Design and Methodology

Research Questions

The primary question at the heart of this proposal is: What affordances do tangible programming manipulatives have for young children's ability to express their Jewish identity?

Secondary questions include: How do children understand their Jewish experiences, as evidenced through their projects and verbal descriptions? What aspects of children's understanding of Judaism are made visible through the programming? Is there a correlation between the ways in which their constructions represent their identity and the ways in which they understand these representations?

Hypotheses

The central hypothesis of this thesis is that robotic technology offers children a medium that enables them to express their personal experiences as active participants in their Judaism.

Research Design

This research is a quasi-experimental study aimed at understanding the role of new technologies in providing an avenue for children's expression and exploration of their own identity. It aims to examine children's representations of themselves using robotic technologies, with the goal of

understanding the concepts about themselves and their world that the use of robotics enables children to express.

As such, this study focuses specifically on children's verbal and written descriptions of their programs for their robots. It compares these descriptions with children's verbal descriptions of their decorations for their robots as well as a Judaic art project, which was a decorative cover for the ritual Sabbath bread known as hallah. Both projects were created in an open-ended framework within the classroom and feature explicitly Judaic content. This study examines the differences in the concepts these projects represent, as expressed in children's explanations about them, illustrating how the children use these media to represent themselves in different ways.

In this study, the independent variable is the medium of expression used by the children, either the robotic or the art project. The dependent variable is the content of the child's representation, whether personal experience or religious symbol, as will be discussed later.

Hypothesis	Independent Variable	Dependent Variable
Children who use robotic technologies express their identities in ways that represent them as actively involved in their Judaism.	Medium of identity expression (i.e. robotic or artistic)	Content of child's representation, whether primarily a) personal experience or b) symbol

Table 1: Hypothesis and Variables

Sample

22 children participated in the project, 12 males and 10 females. All of the children were five- and six-year-old students in the kindergarten class at JCDS, Boston's Jewish Community Day School for the academic year 2009-2010. JCDS is a private Jewish day school located in Watertown, MA. All of the children were from families that self-identified as Jewish but were of varying religious practice and denominational affiliation.

The project analyzed in this study took place in the kindergarten classroom over the course of a month, from May 3-June 4, 2010. The classroom included two full-time teachers and one student teacher, who taught and implemented the curriculum together with three Tufts students. Most of the children were developmentally and cognitively typical, and none had a documented disability. While 50% of the students at JCDS receive some form of tuition subsidy, most students nonetheless came from middle or upper class socio-economic backgrounds.

Due to classroom and time constraints, not all children completed or were able to locate their hallah cover for their interview. As a result, only 12 interviews about the hallah covers and 16 images of hallah covers were included in the analysis of the children's Judaic artwork.

This population was chosen for the children's developing cognitive abilities and emerging sense of self, as well as for their immersion in a deeply and consciously Jewish school culture. Children in kindergarten are typically going through the process of defining their sense of self, making ethnic

identity exploration both appealing and appropriate for their personal development. In particular, children typically have a concept of their own religious identity by age five or six (Elkind, 1964), enabling them to explore its meaning further. Moreover, the technology, with its unique combination of tangible robotic elements and abstract concepts, is well-suited for their developmental stage, encouraging the emergence of their higher-order cognitive skills while attending to their need for concrete learning. The school setting is also conducive to this study, because of its rich Jewish curriculum content and diverse population. JCDS is philosophically committed to intentional pluralism, meaning that it actively embraces children and families with a diverse array of Jewish connections and affiliations.

Primary Constructs of Interest

To understand children's perception of their own identity, it is necessary to interpret identity in their terms. As a result, for the purposes of this study, identity is defined broadly as the particular attitudes, preferences, and meaningful experiences represented by children through the full range of media available to them. This definition matches a broader trend in the world of Jewish identity scholarship toward understanding identity as one's own "self-perception and self-definition as a Jew" (Horowitz, 2003, p. iv), thereby respecting people's various modes of understanding themselves and their Judaism. Moreover, this definition meets the developmental needs of

young children, who may not yet grasp theological or communal aspects traditionally identified as part of a Jewish identity. By understanding children's Jewish identity through their conception of themselves and their meaningful experiences, this project enables a deeper look into their mental representations of themselves as Jews.

Description of the Technology

The programming environment used in this project primarily involved technologies developed by the DevTech Research Group at the Eliot-Pearson Department of Child Development at Tufts University. The hardware children used a LEGO Mindstorms RCX brick as the robot's "brain" as well as the physical basis of the robot. To program it, they used CHERP, a developmentally appropriate programming language developed as part of the research group's Tangible Kindergarten project (Bers, in press). CHERP, or Creative Hybrid Environment for Robotic Programming, is a hybrid tangible/graphical computer language that allows children to program using "interlocking wooden blocks, or onscreen programs using the same icons that represent actions for their robots to perform" (Bers, in press). The tangible programming environment consists of a series of wooden blocks, each of which represents a particular programming command. The blocks contain text and icons depicting the command they represent, as well as a TopCode, or a circular black and white symbol, that the computer can recognize. Children can then upload their program to a computer using a

standard webcam to take a photo of the blocks. CHERP converts the TopCodes into programming commands that the computer can then transmit to the robot (Horn, n.d.). Alternately, children have the option to program using a graphical interface, in which they connect icons depicting these blocks' images on a computer screen, transmitting the program in identical ways. Children can transition back and forth between these two interfaces, allowing them to program using either or both, as they choose (Bers, in press).

Figure 1: The CHERP hybrid programming language

Curriculum Design

The curriculum that formed the foundation of this project was implemented in two stages. First, children were introduced to the robots, the technology, and basic programming commands and concepts using the curriculum template developed by Prof. M. Bers, L. Flannery, E. Niro, and R.J.

Crouser of the DevTech Research Group at Tufts University (Bers, in press). This curriculum introduced them to robotic programming sequentially, building their knowledge of the hardware, software, and the underlying programming concepts gradually. Children first learned to identify what a robot was and to assemble the parts of the LEGO Mindstorms robot. Next, they learned individual programming commands and practiced combining them to meet a goal, and finally, they learned more conceptually complex sequences of commands, such as loops.

Once children had mastered the basics of the programming language, the second part of the curriculum focused more specifically on the content of their final project. Together with their teachers, children reflected on their experiences and learning of the previous year, coming up with a timeline of the year that included a range of experiences meaningful to them. Each child chose three moments in the year as "stations" at which his or her robot would stop and perform a program to represent the child at that moment. Children then decorated the robots to represent themselves, using art materials to depict them, their interests, and their characteristics. Finally, children combined their three programs from individual moments in the year into one comprehensive program, which represented their journey throughout the year. They then ran this program alongside the timeline, demonstrating their own understanding of significant moments of their growth throughout the year.

Figure 2: A section of the timeline of the kindergarten year

Analysis and Instruments

Since this research revolves around children's conceptions and expressions of their identity, this study's analysis primarily focuses on the projects they created as well as their representations and explanation of their robotic programs.

As such, this study includes both qualitative and quantitative analysis of interviews with children about their projects, as well as of the projects themselves.

Interviews

All 22 children were interviewed individually and asked to describe and explain three objects they had created:

1. Their personalized "platform" for their robot, a LEGO platform which they decorated and attached to the physical body of their robot to represent them,
2. The program they had created for their robot, with its representative meaning, and
3. The hallah cover art projects they had produced over the course of the year.

This study examines these descriptions of children's robots, programs, and artifacts, using qualitative ethnographic analysis to highlight the nuances in children's representations of their qualities, their understanding of Jewish practices, and their integration of themselves into a particular context.

Coding and Classification

Furthermore, quantitative analysis of these projects assesses whether children's programs tended to express their experiences in one particular way over another. The children's robotic platforms and programs and their hallah covers were coded for the presence of two elements crucial to the development of religious identity: personal experience and symbols.

These avenues for expressing identity were chosen because of their particular relevance to young children's developmental capacities for understanding themselves as well as to the broader concept of religious or cultural identity. Since kindergartners are still in Piaget's preoperational

stage of cognitive development, their personal experiences with religious or cultural rituals and practices deeply influence the ways in which they understand it (Berk, 2003, p. 21), and thereby represent it.

Similarly, symbols were chosen as a means of assessing children's expression of their ethnic identity because of their centrality to children's cultural and religious understanding. Contemporary conceptions of culture see it as a "tool kit" offering individuals a repertoire of habits, skills, and rituals to draw upon (Swidler, 1986). As Peek (2005) notes, according to this conception, "even if people do not carefully consider the impact or dictates of culture, it still provides the rituals and traditions that regulate ordinary patterns of authority, cooperation, and interaction" (p. 225). These cultural rituals and traditions, then, are significant in themselves for children's interaction with their Judaism and therefore their representations of it. For young children, however, whose conceptions of these cultural tools remain concrete, symbols are a key method for them to understand and express their knowledge of the world (Berk, 2003, p. 21), including that gained from this toolbox of cultural experience.

Categorical Definitions

Symbols were defined as visible, recognizable images that the children incorporated into their projects and associated with a particular Jewish ritual, concept, or event, or more generally with their personal identity. These symbols were further subdivided into two categories:

a) *Jewish symbols* were those widely recognizable as linked to Jewish practices, rituals, or culture. For example, Shabbat candles, which are traditionally lit on Friday nights, were considered a Jewish symbol, as they are fundamentally linked to Jewish practice and are recognizable as a key religious symbol.

b) *General symbols* were those that reflected a child's personal characteristics or general preferences that were unrelated to Jewish identity or practice. An example of a general symbol was a basketball that a child included as part of her robot's decorative platform, to show her love of playing basketball. Similarly, flowers or hearts that a child used to decorate a hallah cover were considered general symbols, since they were placed there out of the child's preference and are fundamentally unrelated to Jewish traditions and rituals around Shabbat.

Personal experience was defined as a child's representation of his or her own experience in a particular moment or event of either general or Jewish significance. Children expressed this personal experience in two ways, coded as "action" or as "emotion."

c) *Action* was defined as a child's representation of his or her own personal actions in taking part in a particular experience. For example, a child's representation of him or herself lighting Hanukkah

candles would be identified as a personal experience expressed through action.

d) *Emotion* was defined as a child's representation of his or her emotions around an experience, such as, for example, excitement, love, or joy.

The following conceptual model illustrates the relationship of these subcategories to the broader representations of religious identity:

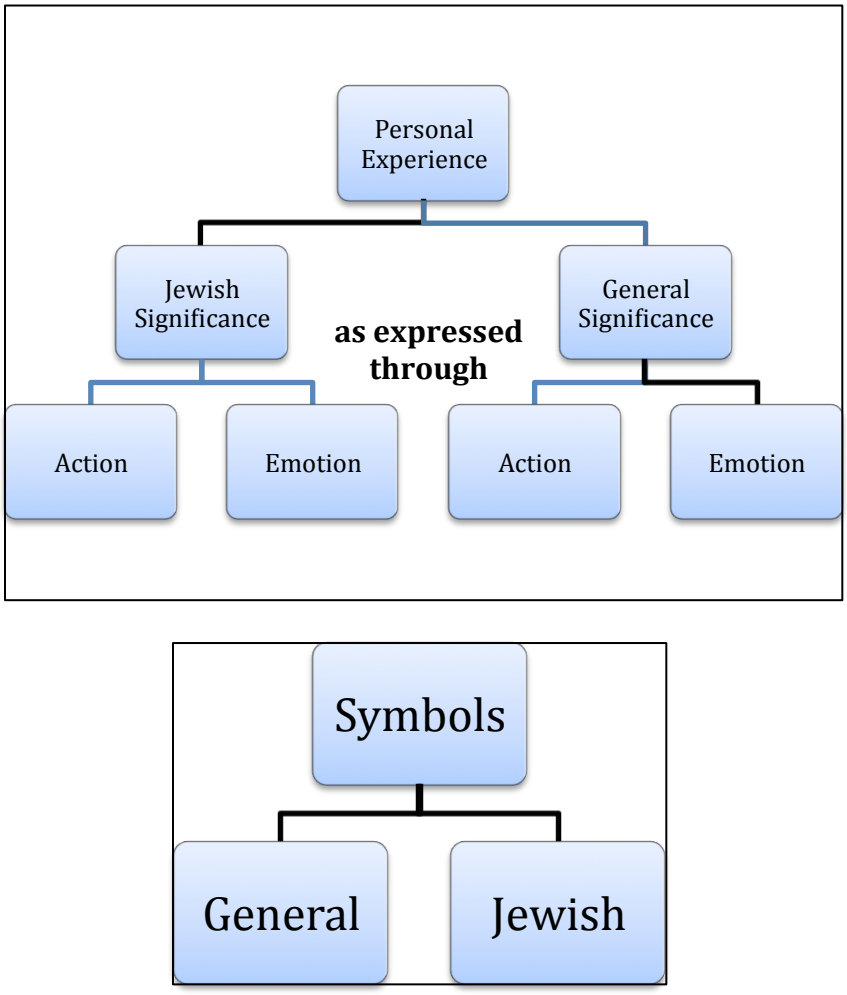


Figure 3: Conceptual model of representations of identity

Process of Analysis

The programs for all 22 children's robots were broken down into the three different programs each child created to mark three significant events on the timeline of the year. Three children, who were exceptions for various reasons, had four programs each, so descriptions of a total of 69 programs were analyzed for representations of Jewish symbols, general symbols, and personal experiences. Since children explained the meaning of their programs twice, once in their design journals before programming and once in interviews after programming, both were coded for the presence of these various modes of expression and the results were then averaged for each individual program. These scores were then used to create a system of classification that reflected coding results for each individual program, further characterizing the programs by each one's overall meaning.

Similarly, children's descriptions of their platforms both in their design journals as well as in interviews were analyzed for the presence of these representations of personal experiences and symbols. Coding results from the two descriptions were averaged for each platform, with a total of 22 platforms included in the analysis. Interviews with children about their hallah covers were also coded for the presence of these representations.

Projects Analyzed	Analysis of Representations	
	Children's Expressions of Meaning	**Independent Observer Assessment**
Robot platform	Design journals Interviews (averaged)	Photos of platforms
Robotic program	Design journals Interviews (averaged)	Programs (number of independent commands)
Hallah covers	Interviews	Photos of hallah covers

Table 2: Projects and Media Analyzed

Results of coding were then analyzed for the presence and frequency of each type of representation (personal experiences and symbols) within each medium, both in the child's description of it and in the project itself. The total number of each type of representation within each medium was determined, and used to determine the overall average (mean) percentage of each type of representation within that medium.

Independent Observer Correlation

Results of coding children's interviews were compared with results from their robots and artifacts to determine whether there was a correlation between observers' perceptions of the objects and the children's conceptions. Photos of the platforms and the hallah covers were assessed for the presence of representations of Jewish symbols, general symbols, personal actions and emotions. This data was then compared to the coding results from children's descriptions of their projects, to determine whether a correlation exists.

Furthermore, children's programs for their robots were analyzed for the number of commands they contained, to determine whether the number of commands in a single program matched the classification of the program's meaning. Each command in the final program was counted, except for "forward" commands. Since children primarily used "forwards" to move their robot to the next spot in the timeline where it would perform an action, and the forwards were unrelated to the meaning of the program, only "forwards" that children explicitly described as having innate meaning were included in this count. The number of commands included in a single program was then compared to the overall classification of the program, to determine whether the programs' complexity, as assessed by their coding results, aligned with the complexity of program commands they contained.

Results

Overwhelmingly, children chose to use the robots as a medium to express their personal experiences as opposed to static symbols. Both quantitative and qualitative analysis revealed that, as compared to their hallah covers, children primarily used their robotic programs to represent their own experiences through actions, emotions, or a combination of the two.

Quantitative

The Content of Children's Expression

When children's verbal descriptions of their robotic programs, decorative platforms, and hallah covers were coded for the presence of expressions of personal experience and visible, recognizable symbols, results indicated clear differences in the content of children's expressions using these different media.

According to children's descriptions, most of their robotic programs expressed their identity in terms of personal experiences, as 68 out of 69 programs for individual stops (98.5%) were coded as exclusively expressing children's experiences (r=.922; ρ=.851). Only one program was coded as representing a Jewish symbol, and no robotic program was characterized as representing a general symbol. In total, 66.1% of references in children's descriptions of their robotic programs were to actions that formed a part of

their experiences, while 33.5% were to emotions that they experienced, and 0.4% were to Jewish symbols.

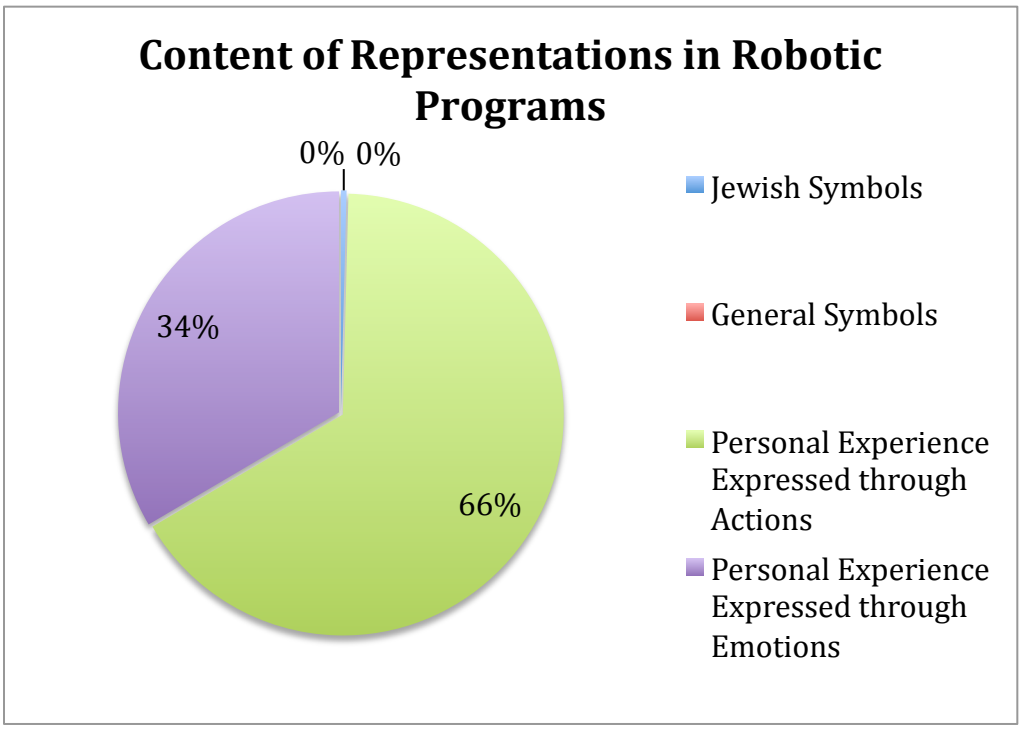
By contrast, data from the children's design journals and interviews revealed that children overwhelmingly explained their platforms in terms of general, and to a lesser degree, Jewish symbols. All 22 children included at least one general symbol on their platform, indicating the importance of this medium for facilitating this type of expression. Eight children described their platforms as including Jewish symbols as well, while only four included references to their personal actions in explaining the meaning of their platforms. In total, 84.2% of children's explanations about their platforms described their meaning in terms of general symbols of personal significance, while a further 12.1% of these explanations centered on specifically Jewish symbols and 3.8% discussed children's experiences in terms of personal actions (r=.999; ρ=.954).

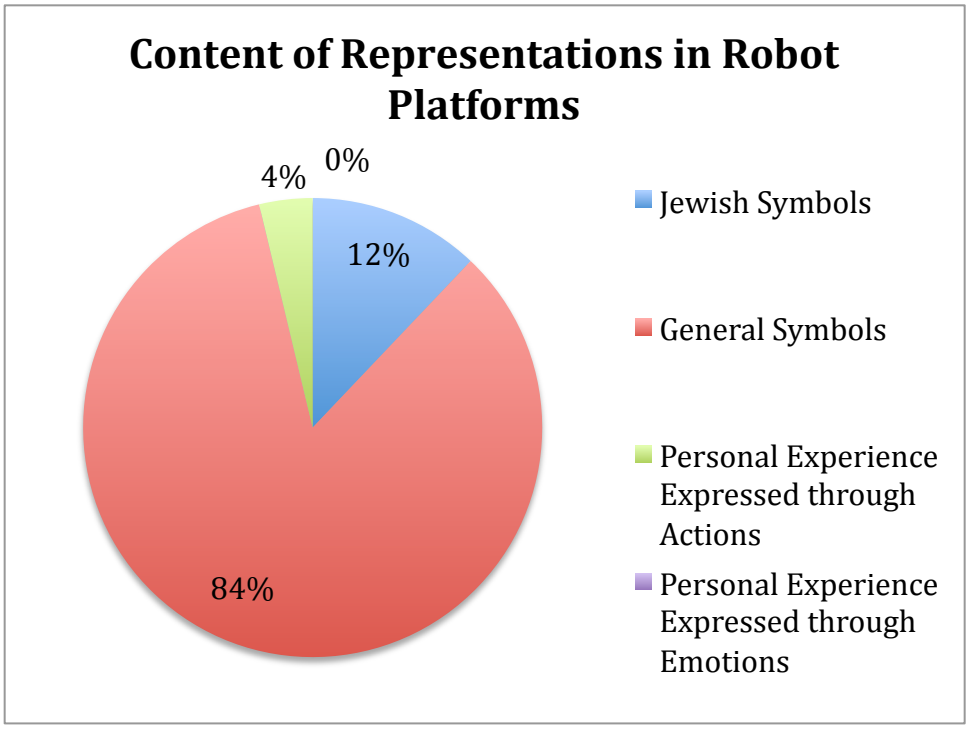
By contrast, children's descriptions of their hallah covers revealed that 11 out of 12 (92.6%) exclusively incorporated symbols, while only one child discussed her hallah cover in terms of the actions it represented (r=.866; ρ=.801). In total, only 9.1% of children's references to the meaning of their covers were to actions that formed part of an experience, while 27.3% were to general symbols and 63.6% were to explicitly Jewish symbols.

On average, children's descriptions of their robots' programs contained 1.17 references to representations of personal actions, 0.62 references to representations of personal emotions, and 0.007 references to

representations of Jewish symbols within a single program. By contrast, children's descriptions of their platforms for their robots included 2.11 descriptions of general symbols, 0.34 references to Jewish symbols, and 0.09 references to children's personal actions. Children's explanations of their hallah covers included an average of 2.33 references to Jewish symbols, 1 reference to a general symbol, and 0.33 references to personal actions.

The chart below summarizes the differences found between the content of children's expressions through their robotic programs, platforms, and hallah covers, as measured in the total number of references to each type of content:





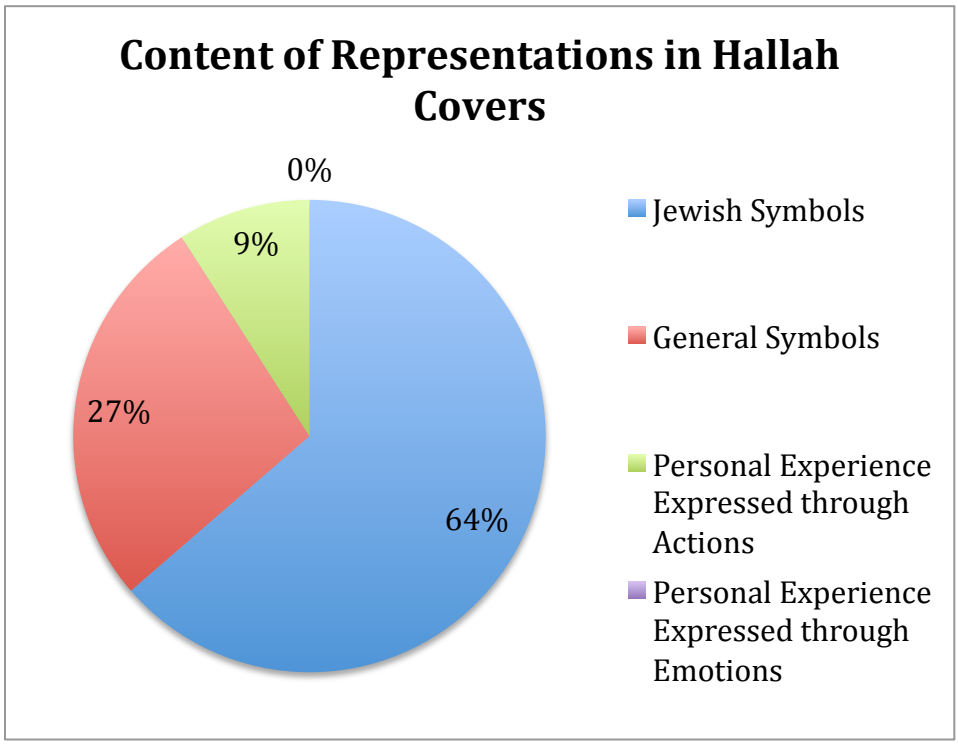


Figure 4: Content of representations across media

As these results indicate, children predominantly used the medium of robotic programming to express their personal experience, primarily

through the lens of their actions but also through their emotions. By contrast, they largely used the artistic medium of the robot platforms to represent static visual symbols of general personal significance, and hallah covers primarily to express recognizable Jewish symbols and, to a lesser degree, general symbols as well.

Independent Observer Correlation

To further assess the reliability of this coding system, photographs of the artifacts were coded independently of the children's descriptions and compared to coding results of these descriptions, to ensure the consistency of these categories of assessment. Independent analysis of photos of the platforms correlated highly with children's descriptions, identifying 93% of the platforms' content as general symbols and 7% as Jewish symbols (r=.994; ρ=.949). Both the platforms themselves and the children's explanations of their meaning clearly reflect their primary use as a means of representing personal characteristics and preferences, and to a lesser degree Jewish knowledge, as visible, recognizable symbols.

Similarly, results of this comparison of pictures of the children's hallah covers with their descriptions revealed a strong correlation between the objects and children's explanations. Analysis of photographs of these hallah covers resulted in 65.8% of their content coded as Jewish symbols and a further 34.2% coded as general symbols (r=.988; ρ=.920). By comparison, 63.6% of children's descriptions of their hallah covers were coded as

referring to Jewish symbols, 27.3% as referring to general symbols, and 9.1% as referring to personal actions.

The following graphs illustrate the results of comparing children's descriptions with analysis of their artifacts:

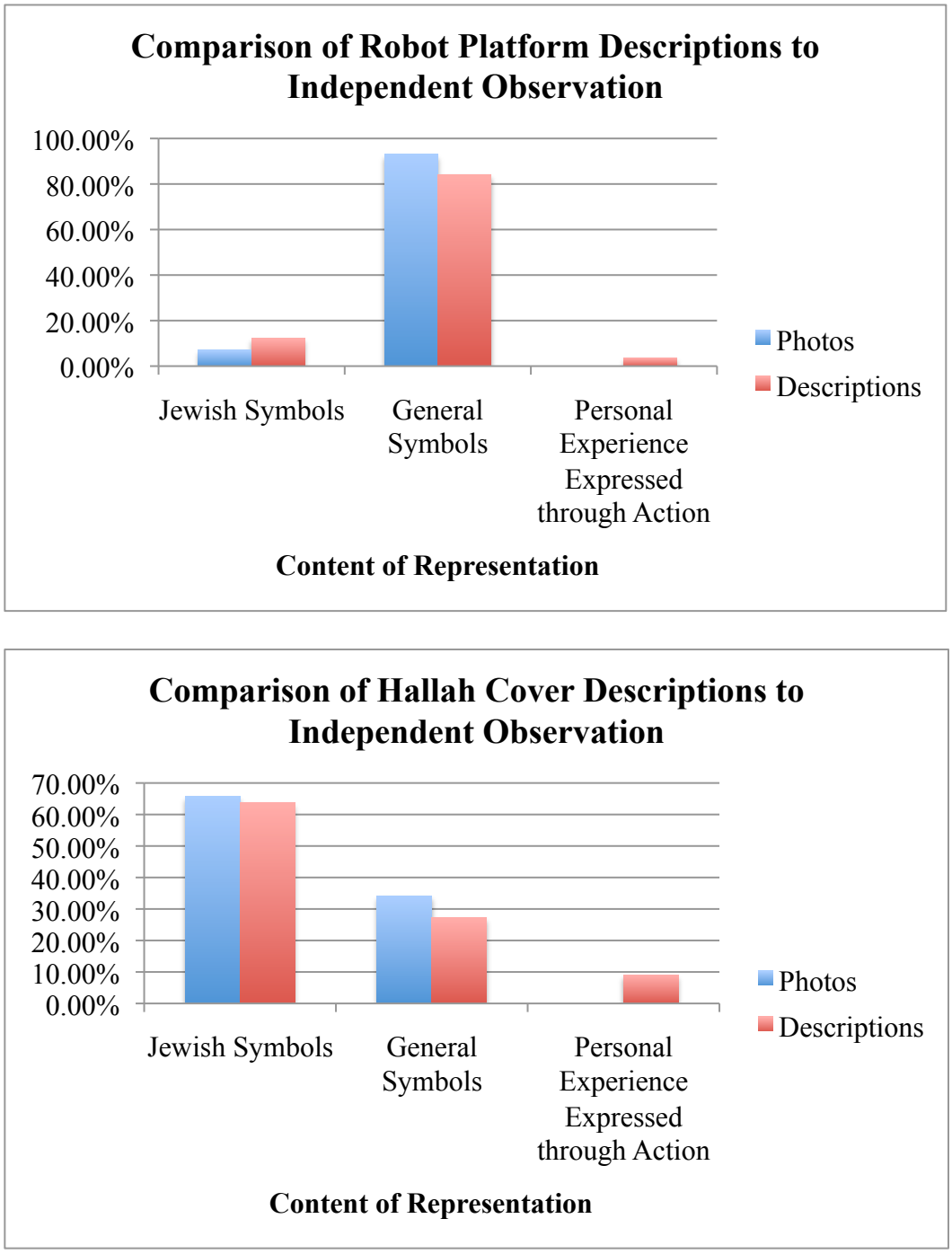


Figure 5: Correlation of independent observation of artifacts

Independent coding of both the robot platforms and the hallah covers thus revealed a strong correlation between children's descriptions of the objects and observers' assessment of them, reflecting the consistency of this coding system.

Since the robotic programs could not be assessed visually by an independent observer in the same way as the artifacts, children's final programs were instead analyzed for the number of commands each individual program contained. The resulting data showed that 19 of the 59 available programs (32.2%) contained only one command to be performed at a given spot along the timeline, while 40 programs (67.8%) contained two or more commands in sequence. These results were then compared to classifications of each individual program to assess the reliability of the classification criteria, as will be discussed in the next section.

Classifying Children's Creations

Beyond assessing the content of each individual representation, the results of coding were further used to classify each overall creation (whether robotic program, platform, or hallah cover) by its content, taking into account its complexity and its integration of different types of representation.

Creations that were coded as exclusively expressing personal experiences were classified according to the complexity and nature of their content. "Single action" representations were those that contained a single reference to an action that reflected the child's personal experience, such as a

program that commanded the robot to spin to represent the child physically spinning around. Similarly, "single emotion" representations were those that contained a single reference to an emotion reflective of the child's personal experiences. For example, a program in which the child commanded the robot to spin to represent excitement was classified as a "single emotion" program.

Programs that represented a child's personal experience through two or more actions were classified as "complex action," such as a robot moving forward to simulate the child walking into school, then backward to represent leaving school. Similarly, a program that included two or more commands representing the child's emotions exclusively was classified as "complex emotion." For example, if a child programmed his or her robot to shake, then spin, representing nervousness and then excitement, that program would be classified as "complex emotion."

Creations classified as "combined action and emotion" were those that represented children's personal experiences by integrating representations of their actions and their emotions. For example, a robot that a child programmed to move forward and then shake, representing moving toward an activity and shaking from excitement, would be classified as a "combined action and emotion" representation.

Finally, creations that included both representations of children's personal experience and personal or Jewish symbols were characterized as "integrations of personal experience and symbols."

When these criteria were applied to 69 individual programs, results revealed that children most commonly expressed their personal experiences by representing their own actions or by representing the total experience as an integration of action and emotion. 30 out of 69 individual programs for different moments during the year, or 43.5%, contained representations of personal experience through action alone, both as a single action and as a sequence of action. A further 21 programs (30.4%) contained a representation of personal experience through a combination of emotion and action, while 17 programs, or 24.6%, represented children's personal experience solely through emotion. The following graph illustrates the classification of programs by type:

Classification	Result (number of programs)	Percent of Total
Personal experience expressed through:		
Single action	13	18.8%
Complex action	17	24.6%
Single emotion	16	23.2%
Complex emotion	1	1.4%
Combined action and emotion	21	30.4%
Integration of personal experience and symbol	1	1.4%
Total	69	100.0%

Table 3: Classifications of Robotic Programs

These classifications were then compared to the number of commands in each program, to confirm the reliability of their classification with an objective standard. The number of programs classified as "single emotion" and "single action" was expected to correlate with the number of programs containing only one command. Similarly, the number of programs classified as "complex action," "complex emotion," or "combined action and emotion," was expected to correlate with the number of programs containing two or more sequential commands. The following graph shows the results of comparing programs classified by coding to those classified by number of commands:

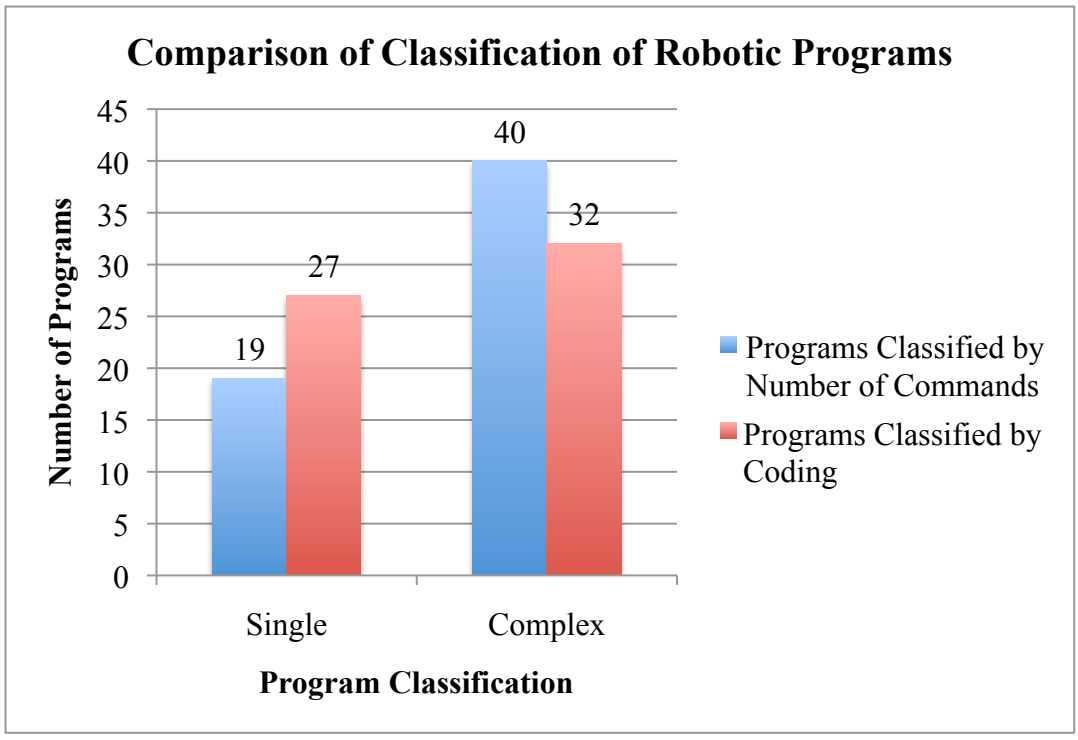


Figure 6: Comparison of classifications of robotic programs

As this graph shows, the categorization of children's robotic programs gained from coding did match the number of commands the programs

contained to some extent. As compared to 27 programs classified as "single action" or "single emotion," only 19 programs contained one single command. Similarly, while 32 programs were classified as complex based on the results of coding, 40 programs contained multiple commands. These results reflected the reality that while most programs classified as "complex" from children's descriptions typically did contain multiple commands that mirrored their more complex meaning, programs classified as simpler by virtue of representing only one action or emotion only sometimes conveyed this meaning using a single command.

This discrepancy can be attributed to the diversity of ways in which children expressed a single action or emotion. While some children chose a single command to represent each action they performed, others chose to express an emotion or action using several successive commands. One girl, for example, represented her excitement at meeting her new teacher on the first day of school by programming her robot to spin four times. While the content of her representation was in essence a single emotion – excitement – her program contained four commands, thus accounting for the discrepancy between the number of commands in her program and its classification by coding.

Since the results of coding the robot platforms and hallah covers differed from the robotic programs, the categories for classifying these artifacts differed as well. Creations that included symbols of exclusively Jewish or exclusively personal significance were classified as representations

of “Jewish symbols only” or “general symbols only.” For example, a hallah cover displaying only a Jewish star, Shabbat candles, and Hebrew letters would be classified as “Jewish symbols only,” while one that incorporated only hearts, flowers, and zigzags was classified as “general symbols only.” Platforms and hallah covers that incorporated both types of symbols were classified as representations of “Jewish and general symbols,” such as a child’s platform that incorporated both an image of a basketball and of an Israeli flag. Finally, those that integrated symbols with a representation of their personal experiences were classified as “personal experience and symbol.”

When these categories were applied to children’s decorative robot platforms, results showed that the majority of children used their platforms to convey symbols of general personal significance. While some children used their platforms to represent both general and specifically Jewish symbols, no child created a platform that only contained Jewish symbols. Four children represented their own actions on their robot platform together with symbols of their personal preferences, reflecting a more common use of this type of representation in this medium than on the hallah covers but still far less than in the robotic programs.

Classification	Number of Platforms	Percent of Total
Jewish symbols only	0	0.0%
General symbols only	11	50.0%
Combined Jewish and general symbols	7	31.8%
Combined personal experience and symbols	4	18.2%
Total	22	100.0%

Table 4: Classifications of Robot Platforms

For the hallah covers, classification of children's projects based on their interviews revealed that children primarily used the medium to express Jewish symbols, with 6 out of 12 (50%) describing their hallah covers solely in terms of Jewish symbols. An additional four children, or 33.3%, explained their hallah covers as a combination of personally significant and Jewish symbols. Only one child used the hallah cover to express exclusively general symbols, while another one represented her hallah cover as a combination of Jewish symbols and personal actions. The following chart summarizes the results of classifying children's hallah covers:

Classification	Number of Hallah Covers	Percent of Total
Jewish symbols only	6	50.0%
General symbols only	1	8.3%
Combined Jewish and general symbols	4	33.3%
Combined experience and symbols	1	8.3%
Total	12	99.9%*

Table 5: Classifications of Hallah Covers

*Note: results may not add to 100% due to rounding

As the results of classification show, children's programs, robot platforms, and hallah covers differed significantly, not only in the prevalence of different types of expression that they showcased, but also in the overall meaning of the children's representations.

While these classifications accurately reflect a more detailed analysis of the results of coding, they also hint to the nuanced meaning children expressed about their creations, which was more closely captured by qualitative ethnographic analysis of their words.

Qualitative

Robotic Programs

In their design journals as well as in interviews about their programs, children spoke about their robots as an alter ego representing them. As children described the meaning of their robots' actions, it became clear that the robots were conveying the children's personal experiences, in ways that typically followed several similar patterns.

Personal Experience as Expressed through Action

Numerous children described the commands performed by the robot as representing an action they themselves had done at the particular moment they were marking. Some children represented an entire experience through the synecdoche of a single command, creating programs that were classified as "single action" programs. Others chose a series of commands to illustrate

the totality of their experience, creating programs that were classified as "complex action" programs. In both cases, however, children expressed their own active participation in an event, ritual, or activity by using robotic actions as a surrogate for their own. Whether by programming the robot to perform the "sing" command to mimic the child's own singing, or by programming it to "shake" to represent lighting the Hanukkah candles, children used the robot's actions as a stand-in for their own.

Single Action

Many children programmed their robot to perform one action emblematic of an entire experience. For example, in preparation for Passover, one classroom activity had the children pretend to be Israelite slaves in Egypt by building a tower out of blocks. One child programmed his robot to mark this event with a single command, which represented a single action characteristic of the experience. As AZ explained:

> This is pretending to be a slave in March. I did begin, spin, end, because I was spinning and trying to throw the block up on the right piece of the tower. That's what I tried to do.

Other children programmed their robots to carry out a series of repeated commands, which nonetheless represented a single action on their part. Livi, for example, represented herself sewing pillows for the Passover seder by having her robot repeatedly turn left and right several times in succession, to mimic the motion of the needle in her hands.

> Livi: This is making the seder pillows, and going all the way to March, and then sewing the pillows. [The needle]'s going up and down. Since [the robot] can't jump, it's going left and right.

While Livi chose to repeat two commands – "turn left" and "turn right" – several times, as opposed to AZ's single "spin," their descriptions of their programs were essentially the same. Both children represented their personal experiences at a particular event or activity as themselves carrying out one significant action (throwing a block or sewing pillows).

Complex Action

A second model of using action to represent personal experience was that displayed by several other children, who chose to represent their personal experiences through a series of connected actions. Instead of choosing a single action to represent their entire experience, these children explained their programs as a sequence of actions illustrating their actions as they went through an event or classroom activity. Rebecca, for example, programmed her robot to illustrate her entire experience at Hanukkah from start to finish: singing Hanukkah songs, lighting the candles, and showing the candles' light.

> Rebecca: Then it goes forward once, it sings, it shakes, and it puts its light on for doing – for Hanukkah… First it sings before it lights the candles, then it lights the candles [which is the] first shake, then it turns its light on, because it lighted the candles.

Unlike AZ and Livi's programs, which illustrated their experiences through one symbolic action, Rebecca expressed her experience as a

sequence of actions that together created a scene depicting her Hanukkah experience. Similarly, Howie conveyed his apple picking experience by programming his robot to move backward, forward, spin, and then shake. He explained these commands as representing his own actions in the apple orchard:

> Howie: I walked backwards and then forwards, [so] it [the robot] was running backward and then forward and then shake. It had it [the apple] and was twisting it to get it off and then went to get to the next tree.

Like Rebecca, Howie used a sequence of robotic commands to tell a story about his apple picking experience, representing the whole event from start to finish.

Personal Experience as Expressed through Emotion

Other children, by contrast, used the robotic medium to express their experiences primarily in terms of their emotions, programming robots to perform commands that, in their explanation, represented their reactions to significant moments during the year.

Single Emotion

Largely, children chose to use the robotic medium to express a single, dominant emotion that represented their reaction to a significant experience. Children used commands such as “shake,” “sing,” and “spin” to express emotions such as happiness or excitement for a range of different events, from holiday celebrations to chocolate-making in the classroom.

> Dina: We were learning about butterflies, and I sang because I liked it.
> Niv: The shake shows it's happy because it likes Hanukkah.
> Asaf: It's going to December, then shaking because it's excited to eat the chocolate.

Other children used multiple commands to represent a single emotion, as Yonatan did to represent his reaction to his birthday celebration at school:

> Yonatan: It's excited because it beeps. Then it spins and it shakes because it's also very excited.

Whether these programs contained a single command or multiple ones, they were all classified as "personal experience expressed through single emotion," since children explained them as a reflection of a single emotion representative of the child's experience.

Complex Emotion

While only one child created a program that expressed his experience by conveying a sequence of emotions, his explanation of this program mirrored those of children who represented their experience of an event through multiple actions. As in those cases, this program used the robotic medium to convey a progression of events, presenting the child's experience throughout the entire event, but through his various emotions. This child, a boy named AZ, chose to have his robot stop at April, marking a class visit to a playground when he attempted to shoot a basketball successfully. He programmed his robot to perform the "shake" and "spin" commands, explaining:

> AZ: I did that because I was first a little afraid of shooting some baskets, and then I was happy because I was good. Because my push-off was at the line, and I made it.

For AZ, the robotic medium enabled him to express his experience at a significant moment as two commands representing two separate, successive emotions – first shaking to represent fear, then spinning to represent happiness. This more complex combination of commands reflects his ability to represent his experience, through the lens of his emotions, as a dynamic progression over time.

Emotion and Action Combined: Complex Personal Stories

Many children, however, expressed their personal experiences not by representing a single action or emotion, or even a sequence of linked actions, but by telling a personal story that combined both aspects of their experience. Dina, for example, chose to represent her experience on the first day of school in this way:

> My robot's going backward, because it doesn't want to go into the classroom. Then it went forward because it had to go into the classroom. And then it turns to get its nametag, and then turns back because it has to go to January [her next stop along the timeline].

Dina used the robot's "backward" command as a way of representing her nervousness on the first day of school, but combined it with a sequence of commands illustrating her actions. The robot enters the classroom, as Dina did on her first day, and then turns to search for her nametag, replicating her actions in a reenactment of Dina's first day at school.

Similarly, Tamara conveyed both her emotions and her actions around the class's release of the butterflies they had kept as a classroom pet, programming her robot to shake, move backward, and then spin. As she explained:

> It turns around, because it doesn't want the butterflies to see, because it's too scared. Then the teachers let the butterflies free, and it's happy.

Like Dina, Tamara used programming commands to represent her actions engaging in the butterfly release (physically turning away) as well as her reactions to the experience of letting the butterflies free (fear, followed by happiness). For her, as for Dina, the robot exemplified her inner emotions as well as her outer actions, representing her experience of that moment in a holistic, multifaceted way.

Children combined commands in this way to tell stories about events not only of personal significance, but of Jewish significance too. Like Dina's and Tamara's integrated representations, Zachy's representation of himself sewing pillows for the Passover seder told the full story of his experience, expressing his excitement leading up to the sewing, his preparation for it (sitting down in his chair) and his engagement in it (concentrating):

> Zachy: [My robot is] spinning because it's excited to sew, I love sewing. It goes forward to sit down in its chair, and then the light goes on because it's concentrating.

Since children could understand the robot's symbolic actions as conveying their own actions or their own emotions, programming enabled children to combine the two, creating representations that not only reflected the

dynamic nature of their experiences but conveyed multiple aspects of their experience in the moment as well.

The Role of Storytelling

In programming their robots, children could essentially choose from a list of eight commands that would perform different actions (Forward, Backward, Spin, Shake, Sing, Beep, Light on, Light off), with the opportunity to combine them in various sequences and to repeat individual commands or sequences. These limits on the physical actions the robots could perform by no means constrained the children's imagination; instead, they allowed children to imbue a range of different meanings into individual commands.

For example, while many children programmed their robots to sing, they each did so for various purposes. Children used the singing command to represent actions and emotions ranging from excitement and joy to actual singing or even speaking:

> Dina: We were learning about butterflies, and I sang because I liked it.
>
> Ela: [representing her birthday party] It will sing because I was telling a story.
>
> Rebecca: It sings before it lights the [Hanukkah] candles, then it lights the candles.

Similarly, children commonly used the "spin" command, like the "sing" command, to represent both actions and emotions. Among others, children used spinning to represent emotions such as excitement and happiness. For example, in representing her experience at a class performance of a Hebrew

song, one child said, “It shows that because it spins, that it’s very happy because the people are singing the song.”

Yet even more so than singing, spinning was a command that children understood as representing an extensive range of motions. Some children used it to represent their own physical spinning, as one child, Ma’ayan, said about her representation of her experience when the kindergarten class released their newly hatched butterflies:

> It's spinning all over the place to find butterflies.

Other children used spinning to represent the movement of a part of their body, as Nathaniel did to show himself writing and drawing at writers’ workshop:

> This was writer’s workshop, so I’m showing I’m spinning for my hands moving.

Still other children used the spinning command to represent them eating at Thanksgiving, mixing applesauce in a bowl, or twisting an apple to pluck it off the tree while apple picking, clearly demonstrating their creativity and range of expression.

Robot Platforms

Supplementing the expressions of dynamic personal experience that characterized children’s programs for their robots, analysis revealed that children used their personalized decorative robot “platforms” to express their personal and Jewish identity primarily through static, recognizable symbols.

General Symbols

As previously mentioned, all of the children in the study included general symbols on the decorative platforms that they attached to their robots, yet the nature of these symbols varied considerably.

Many children chose to include symbols that represented them or central aspects of themselves, such as their name, their family, or their school.

> Ithai: It has a 'I' on it because it's the beginning of my name and a 'J' shaped as the 'J' in JCDS.

> Rebecca: My robot is like me because there's a picture of my family, and I wrote the name of my school.

> Yonatan: My robot is like me because it has an American flag, and I'm an American.

While most children who represented key elements of themselves did so using learned symbols such as their written names, country flags, or the school logo, one child chose to create her own symbol, representing herself as an image made out of clay.

Figure 7: Robot platform with "a clay me" on top

Other children decorated their platforms with symbols representing their favorite sport, animal, or food, using it to display their personal preferences and activities.

> Livi: It's like me because I like sports and there's a lot of sports and I like blue and there's a lot of blue and that's why it's like me.
>
> Eitan: It shows that I like to eat because it has a pair of chopsticks, a knife, and a bowl of oatmeal on it.
>
> Yelena: My robot is like me because I like nature. I like the flowers the best, and butterflies.

Several children described their platforms somewhat differently, decorating their platforms with Lego constructions or clay creations and describing their meaning in terms of a personal preference for that type of construction. Instead of creating symbols that represented an attribute of the child or a favorite activity, color, or other preference, these children created representations that were themselves the children's preference, showing a different way of using the platforms. Asaf, for example, described the tall Lego structure he built as a reflection of his love of building with Legos, especially when making "fancy stuff":

> Asaf: It's like me because I like putting Lego, and this has lots of Lego and clay on it. The middle part was to make it more like me because I like doing fancy stuff.
> I like using this type of clay a lot, and I wanted to use it to make this even more fancy.

By and large, however, most children used the platforms to represent their personal attributes and preferences, primarily in the form of symbols. Indeed, in their descriptions many children took pains to explain the

meaning behind every aspect of their platform, revealing the symbolic importance they imparted to every element of their creations.

Combinations of Jewish and General symbols

Some children incorporated recognizable Jewish symbols into their platforms, intermixing them with general symbols in a representation of this dimension of their identity.

> Ela: I made a Jewish flag – I mean, an Israeli flag, so I remember Israel. And I made my name so I remember it's mine. And I made a little Mt. Sinai with my sticker on it.

> Akiva: It has my name, a JCDS sign, because that's where I go to school, I have a bowl of oatmeal because I like to eat, [and] it has an Israeli flag.

Figure 8: Platform with a mixture of Jewish and general symbols

Yet even those who included Jewish symbols on their platforms often described them in terms of personal preferences, as Dalia did in describing her platform:

> Dalia: I like butterflies a lot, and I made a beautiful, big butterfly… And then I like Shabbat, so I made a hallah and a hallah cover. And then here is a birthday cake, because I like having my birthday.

Just as children intermixed stops along the timeline at Jewish holidays and moments of Jewish learning with school events, secular holidays, birthdays, and class trips, their platforms demonstrated the same intermingling of personal and Jewish symbols, both forming part of the children's representations of their own characteristics and preferences.

Expressions of Personal Experience

On four occasions, children described their platforms in terms of their personal experiences, referring to their actions in explaining the meaning behind certain depictions. For example, one girl who decorated her platform with a drawing of a lacrosse stick explained, "I started playing lacrosse this year, and I'm going to probably do it next year, so it has a lacrosse stick on it."

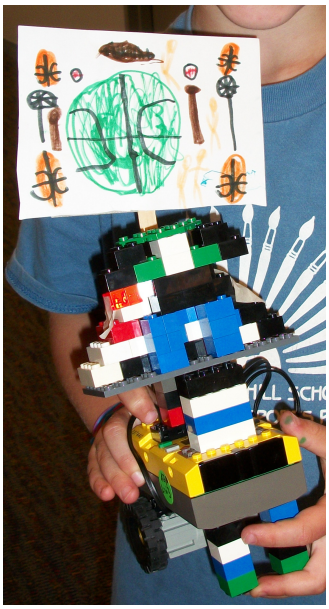


Figure 9: Basketball player platform with symbols and personal actions

Another boy, AZ, explained a drawing on his platform by saying, "I made a basketball player 'cause I like basketball a lot," but also said, "My robot is like me because there's a basketball and I'm dribbling it and shooting it from a three-pointer," characterizing his drawing alternately as a symbol and as a representation of himself carrying out an action.

Interestingly, most of the depictions described by children in terms of their personal actions were not visual representations of these actions but rather symbols, such as Livi's lacrosse stick and AZ's basketball player. In one notable exception, however, one boy drew a picture of himself drawing and attached it to his platform, explaining, "The stick shows when you can draw. And the front shows me… Like this is the drawing, and then I draw on the paper."

While references to children's actions formed only a small minority of the meaning that children ascribed to their platforms, constituting only 3.8% of all of the representations, they nonetheless reflected a different way in which children used the medium of the platforms to represent themselves.

Hallah Covers

Consistent with the results of data analysis of children's interviews, children largely described their hallah covers as containing static symbols, rarely making reference to the rituals or actions involved in them. For example, these three children all explained their hallah cover as displaying

symbolic images, elaborating only a little about their meaning and not at all about their use:

> Asaf: [The hallah cover] shows that it's a Jewish star because it's about Hebrew, not English.
>
> Livi: It's a Jewish star, and flowers, and with Shabbat and with [candles].
>
> Hallel: It shows Shabbat… It has a dinner table with a little bit of dinner on it, and a Jewish star looking down, and flowers in the corner.

Figure 10: Hallah covers with representations of Jewish symbols

While most children chose to display primarily or exclusively Jewish symbols on this ritual object, a few children chose primarily general symbols, most often out of a preference for their decorative qualities:

> Dina: It has a rainbow. And it's connected by little, little hearts, and zig-zags on the top to make it look happy, and then these little zig-zags down here, and then two other white hearts down here. And that is my hallah cover.

In only one case, a child described the Jewish symbols on her hallah cover – a pair of Shabbat candles, flowers, a cup with grape juice, and a hallah – in terms of the actions performed with each one:

> Ela: [My hallah cover] shows that you light candles on Shabbat. You put prahim [flowers] on the table on Shabbat. You drink wine or juice on Shabbat. And you eat hallah on Shabbat. And it says Shabbat.

Unlike almost all other children who described symbols simply as static images, this child explained her symbols in terms of the ritual actions for which they are traditionally used, interpreting them as a representation of action. Interestingly, she described these rituals using the more abstract and general term "you," rather than the personal "I", thus generalizing her experience even as she distanced herself from it.

Discussion

Conclusions

Affordances of the Media

As shown by the results of assessing children's programs, children primarily used the medium of robotic programming to express their personal experiences. The alternatives of hallah covers and platforms on the robots primarily enabled children to express their personal qualities and characteristics through static symbols, whereas the dynamic medium of robotics enabled children to represent their experiences by demonstrating their actions and emotions within a given moment, and even displaying their personal change over time.

These representations can be explained as a product of the combination of the media and the curriculum. The curriculum, which framed the robotics projects in terms of the timeline of the school year, encouraged children to consider their experiences throughout the year, likely contributing to the preponderance of representations of their robot alter ego undergoing these experiences. Yet at the same time, the uniquely dynamic nature of the robots was pivotal in enabling children to create representations of themselves as active participants engaged in these experiences. In particular, the capacity of the robots to perform multiple sequential commands encouraged children to present the story of their actions and emotions throughout an entire experience, at times even conveying changes in themselves over time. The technology was thus

essential in facilitating children's ability to represent their identity as active agents in their experiences.

Children's Representations of their Judaism

These results proved true for children's expressions of their Jewish identity in particular. Unlike the hallah cover projects, which showcased children's ability to represent their Judaism through recognizable visual Jewish symbols, children's robotic projects expressed their understanding of themselves as actively engaging in Jewish events. Rather than representing their Judaism through static symbols such as a Hanukkah menorah, Shabbat candles, or a Jewish star, children's robotic representations of their Jewish identity predominantly displayed them lighting Hanukkah candles, rolling out matzah dough for Passover, or singing Hebrew songs. The prevalence of this type of expression of Jewish identity can likely be attributed to the dynamic nature of the robotic media, which led children to represent themselves actively engaging in Jewish rituals and events. As such, these representations reflect a concept of children's Jewish identity actively constructed in firsthand experience with Judaism rather than received passively in the classroom.

Robotics thus enabled the children to showcase an understanding of themselves as active agents in their Judaism, highlighting a dimension of their identity gained from personal experience that might not otherwise have found expression.

Integration of Jewish Content

As both the robot platforms and the programs demonstrated, children in this study represented their Jewish identity as integrated with their general self-concept. Although many children created platforms that contained both Jewish and general symbols, no child in this study created a platform for their robot with exclusively Jewish symbols. Similarly, while 22 of the 69 programs for different moments of the year marked explicitly Jewish events, no child's final program contained representations of him or herself at three exclusively Jewish moments in the year. Instead, most children represented themselves at moments of both Jewish and general importance, successively programming their robot to stop at Thanksgiving and Hanukkah, for example, or at a performance of Hebrew songs and then at the butterfly release.

The combined nature of these representations can be explained, at least in part, by the integrated, immersive nature of these children's education. At JCDS, rather than creating a sharp distinction between Jewish and secular content, the two are integrated into a broader unified curriculum, likely leading children to understand their own identity as similarly integrated. Moreover, since the children in this study are deeply immersed in a Jewish environment, it is possible that they view their Judaism as a natural part of themselves, rather than as an exceptional quality worthy of special note. This understanding would then lead them to represent their Jewish knowledge and experience together with their other qualities and

preferences, instead of drawing special attention to it. In this way, the robotic representations shed light on children's representation of their Jewish identity as integrated with their general self-understanding.

Multifaceted Media

Children used the robot platforms differently from the programming component, primarily using them to display general, and, to a lesser degree, Jewish symbols. This contrast between the dynamic representations created with the programming and the static capabilities of the platforms reflects these media's different affordances for children's self-expression and underscores the significance of providing children with a range of creative avenues.

The differences in children's ways of creating with the platforms as compared to the programming can be attributed to the innate affordances of the media. As a static medium, the platforms lent themselves much more naturally to representations of visual symbols such as those the children displayed, even as they were attached to the physical body of the moving robot. Children saw the platforms as an avenue for them to display representations of themselves, their affiliations (school, family, hometown) and their preferences, as opposed to representations of themselves actively engaging in experiences.

Integrating the platforms with the robotic programming, however, enabled children to represent themselves both in terms of their personal and

Jewish qualities and in terms of their experiences, presenting their concepts of themselves both in static and in dynamic ways. The children's final Mi Ani robot showcased this integrated use of different forms of media and facilitated children's ability to express their self-concept in multiple ways at the same time.

Storytelling

Whether the medium was robotic programming, platforms, or hallah covers, this study showed that children's explanation of the meaning of their representations differed significantly from independent observers' assessment of this content. While children's explanations of their artifacts did align somewhat with observers' coding, the overall disparity between them reflects the crucial importance of narrative to understanding the meaning of children's programs. As important as the robotics were as a medium for children to express their understanding of themselves and their Judaism, it could only fully express the children's meaning together with their verbal descriptions of the content of their programs. This study thus illustrates the importance of integrating robotic technology with children's verbal self-expression to gain a fuller picture of children's meaning.

Confounds

The unique population of this study was a key factor influencing its results. Children at JCDS, by virtue of being immersed in a Jewish day school

environment, have a rich background of Jewish knowledge and experiences to draw upon. The school's commitment to pluralism, embracing students from a range of Jewish backgrounds, fosters an atmosphere in which Jewish practice is taught thoughtfully and intentionally. Had this project been undertaken with a different population of children, especially those with less exposure to or less diverse experience with Jewish concepts, rituals, and events, their ability to represent themselves within a Jewish context could possibly have been minimized.

Furthermore, the small sample size of this study makes it difficult to generalize from its results. A larger-scale replication in a broader range of curricula is necessary in order to gain a fuller sense of the capabilities that the medium holds for children's identity expression.

Limitations on the Definition of Children's Identity

Since Jewish identity is a construct that extends to all areas of children's lives, especially their homes and families, this study's focus on the classroom necessarily limited its ability to explore children's identity to the fullest extent. While several children's projects did incorporate home events into their representations of identity, the nature of the curriculum and the framing of the project, particularly the timeline, ultimately limited its scope to children's expression of their Jewish identity in school. The results of this study should thus only be understood as reflecting their identity in that

particular context, rather than assessing children's full Jewish identity as a whole.

Summary and Directions for Future Research

As this study shows, robotics holds unique potential as a medium for Jewish identity expression. Both qualitative and quantitative data demonstrated that children primarily used the robotic medium to express their personal experiences through the lens of their emotions and actions, representing their identity through their Jewish experiences. As compared to the static media of the decorative platforms and the hallah covers, the inherently dynamic capacity of the robotic medium facilitated children's ability to represent themselves as active participants in their Judaism. At the same time, children supplemented their robotic creations with rich storytelling and artistic platforms showcasing their personal preferences and qualities, reflecting their ability to integrate robotic creations with a variety of media to create all-inclusive, holistic representations of themselves. These results reflect the role of robotic technology as a crucial "language" in facilitating children's fullest expression of their self-concept.

Although the present study examined many aspects of children's representations, many future avenues for research remain. Since this study was carried out at the end of the year, children's choices of moments along the timeline could not accurately be examined, as the impact of children's memory on their selections could not reliably be isolated. One direction for

future research would be to carry out this project over the course of the school year rather than at its end, thereby eliminating the variable of memory. Such a study could offer a better understanding of children's choices of events to mark, potentially integrating further understanding of children's Jewish affinities with our understanding of their representations of Jewish identity.

Moreover, while the present study was carried out with a specifically Jewish population, this project could be replicated with a wide range of cultural, religious, or ethnic groups. Future studies could focus on the identity expression of children from a wide range of minority cultures, assessing whether the results found here apply cross-culturally. Like the present study, these potential interventions and studies hold the potential to expand the range of media available to children for expressing their identity, offering them a powerful outlet for self-expression and providing us with deeper insight into their self-concept.

References

Berk, L. (2003). *Child Development, 6th ed.* Boston: Allyn & Bacon.

Bers, M. (2008). *Blocks to Robots: Learning with Technology in the Early Childhood Classroom*. New York: Teachers College Press.

Bers, M. (In press). The Tangible K kindergarten program: Applied computational thinking for young children.

Bers, M. & Horn, M. (2010). Tangible programming in early childhood: Revisiting developmental assumptions through new technologies. In I. R. Berson & M. J. Berson (Eds), *High-tech tots: Childhood in a digital world.* pp. 49-70. Greenwich, CT: Information Age Publishing.

Bers, M. & Urrea, C. (2000). "Technological Prayers: Parents and Children Working with Robotics and Values". In "Robots for Kids: Exploring New Technologies for Learning Experiences". Edited by A. Druin & J. Hendler. NY: Morgan Kaufman, pp. 194-217.

Blanchard, T. (2002). How to think about being Jewish in the twenty-first century: A new model of Jewish identity construction. *Journal of Jewish Communal Service*, 79 (1), 37-45.

Bloomberg, L.D. (2007). An emergent research agenda for the field of Jewish education. *Journal of Jewish Education*, 73, 279-291.

Bredekamp, S., ed. *Developmentally appropriate practice in early childhood programs serving children from birth through age 8*. Washington, DC: National Association for the Education of Young Children.

Charmé, S., Horowitz, B., Hyman, T., & Kress, J.S. (2008). Jewish identities in action: An exploration of models, metaphors, and methods. *Journal of Jewish Education* 74, 115-143.

Clements, D. (1999). The future of educational computing research: the case of computer programming. *Information Technology in Childhood Education Annual*, 147-179.

Clements, D. & Sarama, J. (2002). The role of technology in early childhood learning. *Teaching Children Mathematics* 8 (6), 340-343.

Cole, M., Cole, S.R., & Lightfoot, C. (2005). *The Development of Children, 5th ed.* New York, NY: Worth Publishers.

Derman-Sparks, L., & Edwards, J. (2010). *Anti-bias Education for Young Children and Ourselves*. Washington, D.C.: National Association for the Education of Young Children.

Elkind, D. (1964). Age changes in the meaning of religious identity. Review of Religious Research, 6, 36-40.

Feldman, R. P. (1992). What we know about…early childhood education. In *What we know about Jewish education: a handbook of today's research for tomorrow's Jewish education* (pp. 81-87). Los Angeles, CA: Torah Aura Productions.

Grieshaber, S., & Cannella, G., eds. (2001). *Embracing Identities in Early Childhood Education: Diversity and Possibilities.* New York, NY: Teachers College Press.

Guardo, C.J., & Bohan, J.B. (1971). The development of a sense of self-identity in children. *Child Development 42* (6), 1909-1921.

Harter, S. (1988). Developmental processes in the construction of the self. In Yawkey, T.D., & Johnson, J.E., eds. *Integrative Processes and Socialization: Early to Middle Childhood* (pp. 45-78). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Haugland, S.W. (2000). Computers and young children. ERIC Digest. Champaign, IL: ERIC Clearinghouse on Elementary and Early Childhood Education.

Himmelfarb, H. (1984). The impact of religious schooling: A synopsis. *Studies in Jewish Education* 2, 255-288.

Holtz, B. (1996). *Early childhood Jewish education*. New York: Council for Initiatives in Jewish Education.

Horn, M. (n.d.) TopCodes: Tangible Object Placement Codes. Retrieved November 4, 2010, from http://users.eecs.northwestern.edu/~mhorn/topcodes/.

Horowitz, B. (2001, May). Informal education and Jewish identity development. *Sh'ma: A Journal of Jewish Responsibility*. Retrieved October 12, 2010, from http://www.shma.com/2001/05/informal-education-and-jewish-identity-development/.

Horowitz, B. (2003). *Connections and Journeys: Assessing Critical Opportunities for Enhancing Jewish Identity*. New York: UJA-Federation of Jewish Philanthropies of New York.

Hughes, D., and Chen, L. (2003). The nature of parents' race-related communications to children: A developmental perspective. In L. Balter & C.S. Tamis-LeMonda, eds. *Child Psychology: A Handbook of Contemporary Issues* (pp. 467-490). New York: Psychology Press.

Katz, L. (1994). What Can We Learn from Reggio Emilia? In C. Edwards, L. Gandini, & G. Forman, eds. *The Hundred Languages of Children: The Reggio Emilia Approach to Early Childhood Education* (19-37). Norwood, NJ: Ablex Publishing Corporation.

Kazakoff, E.R., & Bers, M.U. (2011). The Impact of Computer Programming on Sequencing Ability in Early Childhood. Paper to be presented at AERA American

Educational Research Association, 8 - 12 April, 2011, Louisiana: New Orleans.

Krug, C. & Schade, L. (2004). *Defining excellence in early childhood Jewish education*. Medford, MA: The Center for Applied Child Development, Eliot-Pearson Department of Child Development, Tufts University.

Papert, S. (1993). *Mindstorms: Children, computers, and powerful ideas (2nd ed).* New York: HarperCollins.

Pea, R. D., *&* Kurkland, M. (1984). On the cognitive effects of learning computer programming. *New Ideas in Psychology*, *2*, pp. 137-168.

Peek, L. (2005). Becoming Muslim: the development of a religious identity. *Sociology of Religion, 66* (3), pp. 215-242.

Phinney, J.S. (1993). A three-stage model of ethnic identity development in adolescence. In M.E. Bernal & G.P. Knight (Eds.) *Ethnic Identity: Formation and Transmission Among Hispanics and Other Minorities* (61-79). State University of New York Press.

Ravid, R. & Ginsburg, M. (1988). *The relationship between Jewish early childhood education and family Jewish practices: Phase II.* Chicago: Board of Jewish Education of Metropolitan Chicago.

Reisman, B. (1979). The Jewish experiential book: the quest for Jewish identity. New York: Ktav Publishing House, Inc.

Resnick, M., Bruckman, A., & Martin, F. (1996). Pianos not stereos: Creating computational construction kits. *Interactions* 3 (6). Retrieved from http://llk.media.mit.edu/papers/pianos.html.

Saracho, O.N. & Spodek, B., eds. (2008). *Contemporary perspectives on science and technology in early childhood education*. Charlotte, NC: Information Age Publishing.

Swidler, A. (1986). Culture in action: symbols and strategies. *American Sociological Review, 51* (2), pp. 273-286.

Vermeer, P. (2009). Denominational schools and the (religious) socialisation of youths: A changing relationship. *British Journal of Religious Education*, 31 (3), pp. 201-211.

Vogelstein, I. (2008). Early childhood Jewish education: "If not now, when?" In *What We NOW Know About Jewish Education: Perspectives for*

Research and Practice. Edited by R.L. Goodman, P.A. Flexner, & L.D. Bloomberg.

Wolf, S.F., & Nowak, N.C. (1991). *The Jewish preschool teacher's handbook, revised edition*. Denver, CO: A.R.E. Publishing, Inc.

Appendix A: Institutional Review Board Approval Letter

OFFICE OF THE VICE PROVOST

Social, Behavioral, and Educational Research
Institutional Review Board

FWA00002063

Re: IRB Study # 0711031
Title: Tangible Programming in Early Childhood: Revisiting Developmental Assumptions through New Technologies (Phase 1: Descriptive Study)
PI: Marina Bers
Co-Investigator(s): Robert Jacob, Nehama Libman, Kenneth Lee
IRB Review Date: 4/27/2010

April 28, 2010

Dear Marina,

The Institutional Review Board (IRB) has reviewed the *Request for Protocol Modification* received on 4/20/2010 for the above referenced study.

This amended protocol meets the requirements set forth by the IRB and is hereby approved. Approval is valid from the date of this letter for a period of one year from the original IRB Review Date and expires on 11/24/2010.

Approved changes to the protocol and consent form are detailed below:

1) Addition of Nehama Libman and Kenneth Lee as co-investigators.
2) Addition of the Boston Jewish Community Day School as a study site.
3) Approval of 35 participants to be run at the Boston Jewish Community Day School.
4) Modifications to the consent reflecting the addition of a new site location.

Enclosed you will find stamped consent forms and other study materials that show the date through which these materials are valid. Only copies of these stamped consent forms and materials may be utilized for conducting your study.

This protocol has been approved for a total of 525 participants for the duration of your study.

Any changes to the protocol, consent forms or study materials must be submitted to the Office of the IRB for approval by completing the *Request for Protocol Modification* form. In addition, all Adverse Events and Unanticipated Problems must be reported to the Office of the IRB promptly, and by utilizing the appropriate reporting forms.

Investigators are required to submit a *Request for Continuing Review* or a *Request for Study Closure* six weeks prior to the expiration date of the protocol.

Please know that the PI is responsible for all information contained in both this letter and on the Investigator Responsibilities Sheet. If anything is unclear or if you have any questions, please contact the IRB office at (617) 627-3417.

Sincerely,

20 Professors Row, Medford, MA 02155 | TEL: 617.627.3417 | FAX: 617.627.3673 | EMAIL: SBER@tufts.edu

Yvonne Wakeford, Ph.D.
IRB Administrator

Appendix B: Child Interview Protocol

Child's Name:

Interview date and time:

1. Tell me about your platform for your robot. What does it show about you?

2. Tell me about your robot's trip. Where does it stop? What does it show about you at those stops?

3. What (Jewish holiday/event) stop did you choose for your robot? Tell me about it. Why did you choose it?

4. If you could make your robot stop at your favorite Jewish holiday, what would it show? Use the blocks to show me what you would tell your robot.

5. Tell me about your hallah cover. What does it show?