YOLO – A Robot that will Make Your Creativity BOOM*

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ABSTRACT

One of the functions of creativity is to improve society. Creativity is a skill that can be trained and has proven benefits for the professional and personal development of individuals. Yet, a paradox exists: despite seeking individuals with a greater creative potential, society lacks systems that nurture the development of this skill. Technological advances arrive with the potential to develop solutions that support the development of creative skills. In this proposal, we introduce YOLO, a social robot that acts as a tool for developing creativity in children. YOLO resembles a robotic toy with a life of its own, developed specially for children, and envisioned to be used during playtime. YOLO can boost new ideas for children's invented stories, by making use of minimalist behaviors that are meant for creativity expansion and social connectedness. We present the design and fabrication processes of YOLO, including examples of potential scenarios of use. With YOLO we aim to demonstrate a potential scenario in which autonomous robots can be used to promote social good.

KEYWORDS

Creativity, child-robot interaction, user experience design, theory design, prototyping, fabrication, play, robotic toy

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1 DESIGN SPACE

"Creativity is popular. Schools want to teach it; parents want their kids to have it; and businesses want to harness it" [9]. In fact, creativity is recognized as one of the most sought-after skills, with multiple benefits in professional success, mental health, education and learning. Additionally, research has shown that everyone has the potential to be creative, as creativity is a skill that can be developed [7]. Despite this fact, current educational systems still appear to favor standardized knowledge over creative-related skills, thus hindering a potentially safe and nurturing environment for creativity development and exploration.

The paradox between desiring individuals with creative skills but lacking dedicated structures and tools to develop them, appeared as an interesting design space to explore. It is well documented that children are willing to interact with technology. Despite its controversial effects on their development, technology can be designed for and used by children with alluring effects related with creativity expression [6]. However, current activities available for teachers to foster creativity in children are challenging to integrate in the classroom and usually appear in a test-like format, missing elements of fun, fantasy, and adventure that are attractive to children. Technological advances enable the creation of promising new tools that have the potential to contribute to the development of creativity in children, presenting a new solution for teachers and parents that desire to enter in a creativity journey but do not know how to start it. This constituted our design space that we started exploring by considering the following question: *how can technology be used in a way that contributes to the development of creative skills in children?* With this in mind, we developed a robotic toy that is approachable and appealing for children to play with, and that has the potential to boost their creative skills during playtime. This robot was named YOLO.

2 DESIGN PROCESS

A multidisciplinary team of social psychologists, mechanical engineers, and computers scientists came together to design and fabricate YOLO. The design concept behind YOLO relates with the idea of creating a robotic toy that children can use during playtime (e.g., as a character for their storytelling or during pretend play) in

Figure 1: Perspectives of YOLO. From top to the bottom: transparent optical fibers; neck features velcro strip to attach toys of interest (e.g., a musical note was attached); 3 copper strips to sense touch; omni wheels for navigation.

school or at home. By being a physical object, YOLO can be manipulated as any other traditional toy in a child's playground, endowing children with a familiar pattern of play. As our goal was to develop a robot that boosts creativity, the first stage in the design process of YOLO was to gather the design requirements related with *creativity development* based on psychological theories. To generate effective creative behavior, both convergent and divergent thinking need to join forces [3]. Thus, divergent thinking was stimulated considering the Remote Stimuli (strategy in which unrelated stimuli are provided – we have named this strategy as *contrasting*) and convergent thinking using the Related Stimuli strategy (strategy in which a connected stimuli is provided – we have named this strategy as *mirroring*) [8]. Additionally, YOLO is a robotic toy envisioned *to be social*. Socially intelligent robots have been developed inspired by theories of human behavior, such as emotional expression or expressive motion, according to the purpose of the robot. In YOLO's case, we relied on the Big Five Personality Theory to develop its social abilities to related and connect with children [2]. Based on these design requirements, a structured brainstorming session about different embodiment and interaction modes for YOLO was conducted, ending with a design decision that underwent iterations during the fabrication process to account for mechanical constrains. Sequentially, a CAD modeling and prototypes with paper, 3D printer and laser cutting were fabricated to test and improve mechanisms that brought movement to the robot (e.g., crankshaft vs. rack and pinion). Finally, a child-proof robot was built, i.e., YOLO includes sensors and actuators that are solid enough to support unstructured interactions with children. Children were included throughout the entire design and fabrication process of YOLO, taking different roles according to the different design stages [4]. Their contribution ranged from influencing hardware fabrication to software development [1].

The Mind and The Body: Specifications on Software Development and Hardware Fabrication

YOLO is a standalone non-stationary robotic toy that is able to navigate in playgrounds, envisioned to be used by children of age 6-9 years old. YOLO's appearance follows an *obvious design* approach in which every aspect of the robot's appearance is intended to be functional, making the interaction obvious for children. Also, YOLO was designed to be non-anthropomorphic with the aim of preventing the uncanny valley effect. YOLO has the form of an unknown creature, promoting creativity by inducing children to conceive states and stories in which reality constraints have been dropped. Its behavior is composed of *navigation* (the base is composed of a circular platform equipped with 3 omni wheels that enable navigation in any direction and YOLO can either navigate autonomously or be puppeteered by children), *turtle behavior* (the optical fibers on the top of YOLO's shell can retract (and expose), similarly to neck retraction behavior in turtles when seeking protection), and *lights and colors* (LEDs illuminate the optical fibers). The software is composed of two Artificial Intelligence (AI): a *social AI* and a *creative AI*. The creative AI makes use of the two validated creative strategies, mirroring and contrasting, e.g., while playing with the robot, children move it around the floor and the robot can either replicate the movement (applying a mirroring strategy, intended to emphasize the same movement/idea), or make a different movement (applying a contrasting strategy, attempting for a different contribution). The social AI expresses personality in a minimalist way, e.g., when YOLO is scared the optical fibers retract or the LEDs blink at a high speed to signal a racing heart.

3 PLAYING WITH YOLO

We envision that a small group of children is invited to play with YOLO and are instructed to create a story together, using YOLO as a character in their story. As YOLO is a robot with a life of its own, it reacts to movements that children do, creating a story enriched by reactions to YOLO's behaviors, e.g., children could say: *"now the robot is going to school"* and YOLO retracts the optical fibers. After this behavior, children say: *"oh, but actually YOLO is afraid of going to school"*. And the story continues. We hypothesize that YOLO's behaviors will boost idea generation in children during storytelling, given that idea generation is an important creative trait [5]. In the future, we will explore the impact of YOLO using validated metrics for creativity evaluation and in a group vs. individual context. YOLO is part of the positive technologies vision, promoting human well being and contributing to the development of robots for good.

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