IPRO: A mobile, social programming game for iOS

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IPRO ("I can PROgram" or "IPod RObotics") takes a novel approach to developing proficiency in computer programming by reframing programming as a game while integrating mobile and social affordances into an accessible environment in which users can program virtual soccer-players. In short, IPRO is designed to fight stereotypical perceptions of programming as solitary, stationary, and possessing a steep learning curve.

This project is rooted in a constructionist framework (Papert, 1980) in which content learning is reinforced by constructing artifacts. The artifacts (soccer player programs) support complex learning in several ways, as users can: test their robots; compete against their peers; and quickly refine programs.

IPRO is an iOS application for iPhone and iPod Touch. Placing the game on a mobile device permits new capabilities that contribute to learning as well as fun. Though an IPRO program can become very lengthy and sophisticated using nested conditional blocks, the building blocks of an IPRO program are relatively simple combinations of observations and actions. Being able to physically move while programming allows users to "play robot," troubleshooting their own programs with their hands and feet (Petrick, Berland, & Martin, 2011). Students can also easily interact with their peers: collaborating, critiquing, asking for help, and showing off their work.

IPRO utilizes a Scheme-derived visual programming language drawing from a library of sensors, actions, and basic logic operators. Sensors allow the robot to assess the state of the field, detecting the ball, the goal, or other players. Actions permit the robot to turn or move forward or backwards. The most vital logical element is the conditional block, which links actions to sensor output. Figure 1 (left, below) shows a basic IPRO program as well as a match in action. In the program we see the left ball sensor (lB) linked to two actions: move forward left or turn right.

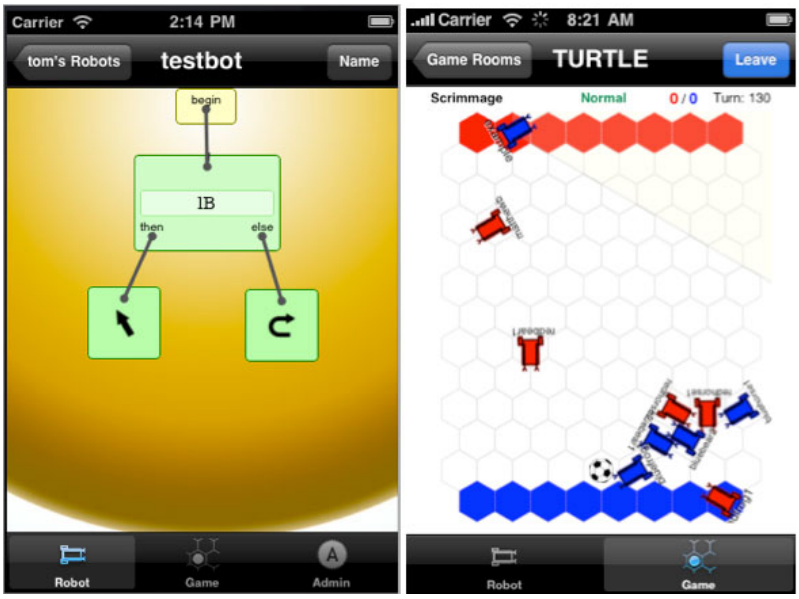

***Figure 1*: A basic IPRO program (left) and an IPRO match in progress (right)**

In 'Solo Play' mode, learners can see their robot in action and confirm that is it performing as expected. When there exist multiple robots on the field, robots take turns executing their programs until the completion of the match. Accounting for opponents, teammates, and a moving ball can make Match Play a far more challenging situation than Solo Play. A match in progress appears in Figure 1 (right, above).

In a pair of studies, secondary school students reported IPRO to be engaging and demonstrated learning gains in IPRO programming as well as basic logic transfer tasks. While learning gains were largely correlated with experience programming, students with less experience reported increased comfort with programming in general (Martin, Berland, & Benton, in press). Currently we are exploring how data mining and techniques from learning analytic techniques can be used to describe student learning pathways based on the extensive IPRO data logs of programming activity.

We hope to have many people playing IPRO both competitively and cooperatively through the arcade and around the conference. Anyone with an iOS-compatible device should be able to play freely.

References

Martin, T., Berland, M., & Benton, T. (in press). Learning programming with IPRO: The effects of a mobile, social programming environment. *Journal of Interactive Learning Research*.

Papert, S. (1980). *Mindstorms: Children, Computers, and Powerful Ideas*. New York: Basic Books.

Petrick, C., Berland, M., & Martin, T. (2011). Allocentrism and computational thinking. In G. Stahl, H. Spada, & N. Miyake (Eds.), *Proceedings of the Ninth International Conference on Computer-Supported Collaborative Learning*, Hong Kong, China.

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