Chapter 2
Blue, BlueJ, Greenfoot: Designing Educational Programming Environments

Michael Kölling
King's College London, UK

ABSTRACT

Educational programming systems are booming. More systems of this kind have been published in the last few years than ever before, and interest in this area is growing. With the rise of programming as a school subject in ever-younger age groups, the importance of dedicated educational systems for programming education is increasing. In the past, professional environments were often used in programming teaching; with the shift to younger age groups, this is no longer tenable. New educational systems are currently being designed by a diverse group of developing teams, in industry, in academia, and by hobbyists. In this chapter, the authors describe their experiences with the design of three systems—Blue, BlueJ, and Greenfoot—and extract lessons that they hope may be useful for designers of future systems. The authors also discuss current developments, and suggest an area of interest where future work might be profitable for many users: the combination of aspects from block-based and text-based programming. They present their work in this area—frame-based editing—and suggest possible future development options.
INTRODUCTION

In the last ten years or so, educational programming environments have become very popular for the teaching and learning of introductory programming. This was not always the case: while there have been educational systems for a long time, they were considerably fewer early in this century than today, and older systems were considerably simpler, often consisting of compilers or libraries, rather than complete programming environments. Long and heated debates used to rage among educators about the respective benefits of teaching with dedicated educational versus industry-strength tools. These debates usually remained unresolved.

In the last decade, the situation has shifted, due to a combination of factors which we discuss below, and educational programming environments have taken a much more prominent role. They are more used, more accepted, and simply many more in number, than ever before. As a result, the design of educational environments has become a topic of considerable interest.

In this chapter we describe experiences with the design of a sequence of educational environments dating back more than 20 years. These systems are Blue (Kölling, 1999a), a programming language and development environment for teaching and learning object-oriented programming in a single, integrated system; its successor BlueJ (Kölling, Quig, Patterson, & Rosenberg, 2003), a similar environment using the Java Programming Language; and a third pedagogical system called Greenfoot (Kölling, 2010). Blue was relatively short-lived, but is of interest here because it heavily influenced the design of its successor, BlueJ. BlueJ and Greenfoot are both systems with significant user communities built up over a number of years (and still very much in use today), and have undergone many changes and adaptations since their first publication.

In this chapter we present a short history of these systems and discuss the goals and design rationale for each, their respective target groups and how these influenced design decisions, and their scope and application. Most importantly, we discuss lessons learnt from their use with actual users, and how those lessons shaped the design of the later systems, and later versions. We also discuss their relation to other educational programming systems, similarities, possible sequences of use, and future developments. The emphasis is not on providing a complete description of each system, but to identify the trends and goals at the time of their design, and how these have changed over time. Overall, we present some lessons we learnt along the way that we hope may be of use to designers of future systems.
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