Figure 3. Scene from the Sims 2.

of the running Alice application (see Figure 2). The technique allowed us to create substantially richer, detailed tutorials, helping underscore that the system is useful for storytelling [4].

The Generic Alice tutorial was designed around examples that would demonstrate concepts as simply as possible. We found that the Storytelling Alice tutorial had to introduce concepts within the context of stories similar to the ones the girls imagined creating. Stencils moderates the additional complexity of stories by presenting instructions one at a time in the context of the application and prevents users from accessing user interface components that are not necessary for the current step.

An initial fear we had about using storytelling as an end goal to motivate programming was that girls would mostly want to tell stories requiring only a simple sequence of instructions. However, we found that while many girls do start with such sequences, the activity of storytelling provides a graceful, gradual transition to more complex programming concepts and constructs.

To provide insight into the kinds of programming constructs girls' stories motivate using, we analyzed storyboards and programs created by 23 girls representing seven Pittsburgh Girl Scout troops. They created their storyboards, as well as their programs, in a single four-hour session. Participants had never seen or used Storytelling Alice prior to the user-testing session. On average, the girls in the study spent 1–1.5 hours on their storyboards and 2–2.5 hours learning to use Alice and write their programs.

3D Characters and OO Programming

Storytelling is a natural way to introduce the basic concepts behind object-oriented programming. Characters are reified objects that know how to perform a variety of methods. Objects have distinct sets of methods; a teacher may have a "scold (character to scold)" method, while a student does not. One challenge in teaching programming to beginning programmers is how to motivate the use of methods. We found that the need for multiple scenes in stories provides natural motivation to use methods. The girls in the study wanted to be able to work on the action for their second scene without having to watch their entire first scene in order to do so; 87% of girls' storyboards included multiple scenes, naturally motivating the use of methods. Many of the actions study participants wanted their characters to perform provide natural motivation for creating methods that take