Moovl

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Concept

Moovl (www.moovl.com), doodles that move, is a 'decorated dynamical system'[1] for children as young as 3. By combining a basic drawing interface with simple simulated physics, Moovl allows children to explore science concepts through natural playful, explorative and experimental cycles.

The Moovl canvas runs a simulation that imbues all shapes with naïve 2D Newtonian physics. Connected shapes are joined by a graph of springs to form discrete objects. Shapes in discrete objects are able to collide with each other[2]. Thus shapes have not only a property of colour, but physical properties such as density, friction and hardness. These properties can be inspected and varied for every shape within a drawing allowing for represented objects to combine real world appearances and simulated behaviours. A typical example of this is the ability to draw a marble run and then drop marbles down it.

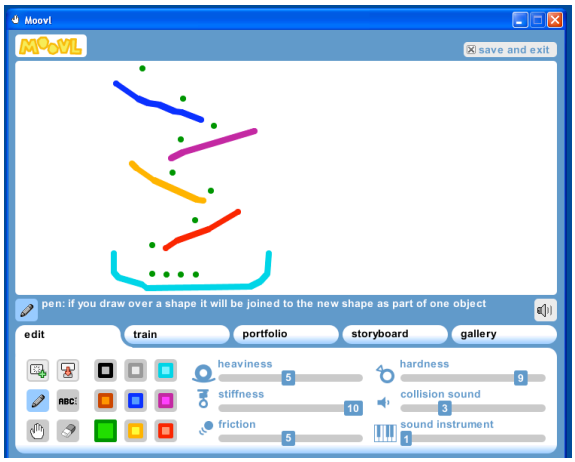

Fig 1: Simulated marble run achieved by creating a friction differential between ramps and marbles

Motivation and background

www.sodaplay.com, the home of the virtual spring and mass construction toy Sodaconstructor[3], has allowed soda to marvel at the diversity and sophistication of creations made by a large community of users who demonstrate a great capacity to learn through trial and error. However, we know that the majority of Sodaconstructor model makers are boys aged 13 – 18. From this Soda were insprired to make creative expression, compelling interaction and open-ended pedagogy accessible to a much younger audience in the Moovl project.

Our solution was to build on an activity that young children already find intuitive, drawing, by adding dynamic simulation to it. The first realisation of this was the Moovl prototype built using Processing[4] (www.moovl.com/moovl2003/index.htm).

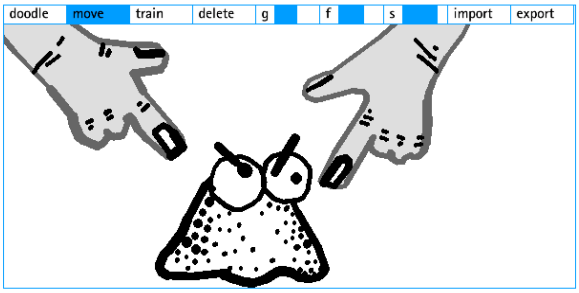

Fig 2: 'Poke the blob' drawing in the first Moovl prototype

Working in partnership with Nesta Futurelab[5] this first prototype was then used as the basis for early user centred research carried out with primary school teachers and year 1[6] children in London and Bristol that aimed to explore the possibilities of applying Moovl to early science learning. The research focus of the project was the National Curriculum requirement that children should learn how to describe and grasp a basic understanding of the concepts of 'push' and 'pull'. The project was carried out in the following stages.

Firstly, basic observational and consultation exercises were carried out with teachers and pupils to ascertain to what degree children were able to engage in cycles of hypothesising, experimentation and moderation using Moovl. This stage of the

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[1] A dynamical system is "A space together with a transformation of that space, such as the solar system transforming over time according to the equations of celestial mechanics[1]." Dynamical systems are a framework for understanding and simulating a large range of natural or imagined phenomena that change over time. The novel term "decorated dynamical system" is used to describe simulations such as Moovl that emphasise expressive or decorative aspects that are not necessarily integral to the dynamical system itself.

[2] Collisions are simulated using a "soft" image based method inspired by PIVOT, Kenneth E. Hoff III, Andrew Zaferakis, Ming Lin, and Dinesh Manocha. Appeared in Proc. of ACM Symposium on Interactive 3D Graphics, 2001.This paper can be viewed at www.cs.unc.edu/~geom/PIVOT.

[3] Sodaconstructor is a dynamical system used to create and manipulate spring and mass graphs within a simulation environment that includes variables of gravity, friction and stiffness. Both Sodaconstructor and Moovl are implemented in Java.

[4] Processing is a java based framework for computational sketching. For more information see http://processing.org/

[5] www.nestafuturelab.org

[6] Year 1 is the first compulsory year of education in the UK. Year 1 pupils are aged 4 and 5.

project also explored potential interaction design possibilities such as line thickness and colour, variable controls and palette design.

Fig 3: Teacher and pupils using the first Moovl prototype for whole class activity on the interactive whiteboard

The findings of this early research were fed into a redesign process leading to the development of a new prototype witch introduced colour, a new screen layout and the ability to share drawings between computers on a local area network in order that users could exchange drawings with their peers (www.moovl.com/about_futurelab.html). This prototype was then taken back to the two schools and tested on tablet PCs and interactive whiteboards.

Fig 4: Second prototype iteration with colour, redesigned palette, variable controls and peer to peer drawing sharing

The outcomes of the project[7] were generally very positive and supported the notion of Moovl as a tool for empowering children to '…complete quite complex simulations and representations with minimal support' stating that 'At a basic level the children were able to manipulate Moovl to create representations of phenomena... Many of the children were observed proceeding through a process of making hypotheses and asking questions, trying out and observing their representations, revising their images or manipulating properties where necessary, and concluding their investigations by showing each other their representations.'[8]

At project inception the possibility of Moovl as pure science learning tool seemed to be the strongest proposition. However, when the initial prototype was given to one of the teacher participants, she applied it as a narrative exploration and development tool rather than a science learning tool. This idea of Moovl as narrative tool was then further supported by the research report published by Nesta Futurelab that concluded that Moovl inspired 'cooperation', 'sharing', 'dialogue' and that 'Some children surrounded their images with vocal narratives'. It was also reported that '…some children stated that they would like to make stories using Moovl.'[9]

Moovl as narrative and communication medium

Although the focus of present Moovl development remains the science curriculum in the UK, the notion of using Moovl for narrative authoring has been further strengthened by the use of Moovl by the Cinekid children's film festival in the Netherlands. Cinekid commissioned Soda to produce a version of Moovl for the festival with new text, sound, trained animation and story-link functions.

In the new Moovl text can by typed, with each letter being subject to the same simulation techniques as drawn shapes. Instruments can be associated with collisions, with the pitch being proportional to the simulated masses of the colliding shapes. Shapes can be "trained" to make repetitive motions relative to the screen or each other (for example two legs circling each other create a forward walking motion). Finally drawings can be joined together into stories with story-links.

There are three types of story-link. Simple timed transitions from one drawing to another, interactive hyperlinks triggered by the user clicking on an object and finally collision links associated with the collision of multiple objects. Story-links make it possible to author short linear narratives, non-linear narratives or games.

Fig 5: Use of story-links to author a simple 'shoot 'm' up' game. The left hand frame depicts a castle and cannon. When a cannon ball is fired into the castle, the collision triggers the link to the frame on the right.

[7] Moovl: Learning Research Report (Nesta Futurelab, 2004) can be found at www.nestafuturelab.org/research/projects/moovl_report_01.htm

[8] Ibid, p34.

[9] Ibid, p34.

The Dutch language version of Moovl in a newly designed interface was launched at the Cinekid Festival in October 2004 with an online gallery, the 'Moovl Museum'[10]. Used at a live event in a cinema as well as for online festival participation, the outcomes of the festival support the idea that Moovl can excel as a narrative tool with a very wide array of drawings being produced depicting diverse subject matter from football to flowering gardens.

Fig 6: Young festival goer at a live event during Cinekid 2004

The future

The version of Moovl with added functionality as commissioned by Cinekid is now online in the Dutch language[11] and Cinekid are about to launch a teachers pack to support its use in schools in the Netherlands. It is therefore an exciting time for all of those involved in the development of Moovl. With parallel activity exploring the best way to publish Moovl into the education arena in the UK, with new support and contextualisation materials, we will soon know just what the Moovl moment will mean to its users. Early development work as detailed here certainly seems to suggest that Moovl can offer a new and exciting range of possibilities for open-ended, playful, explorative and experimental learning that delivers hard learning objectives. If that is the case then Soda hopes that it will help open up a new and exciting space for any number of new and yet to be imagined 'decorated dynamic systems' for learning.

Note on authors: Ed Burton is Soda's Research and Development Director, Matt Gould is Soda's Director of Learning. Soda is an independent creative technology practice based in London, UK.

[10] http://login.cinekid.nl/gallery/
[11] www.moovl.nl