Squeak Etoys Authoring & Media

by Alan Kay

Summary of Squeak Etoys

Squeak Etoys (www.squeakland.org) was inspired by LOGO, PARC Smalltalk, Hypercard, and starLOGO. It is a media-rich, authoring environment with a simple powerful scripted object model for many kinds of objects created by end-users that runs on many platforms and is free and open source. It includes 2D and 3D graphics, images, text, particles, presentations, web-pages, videos, sound and MIDI, etc. It includes the ability to share desktops with other Etoy users in real-time, so many forms of immersive mentoring and play can be done over the Internet. It is multilingual, runs on over 20 platforms bit-identically and has been successfully used in USA, Europe, South America, Japan, Korea, India, Nepal, and elsewhere. See companion note **Squeak, Children & Learning** for more information on use by children.

Basic Idea

Provide and extend most personal computer needs via simple powerful user interface that "runs everywhere on everything" and allows end-users "authoring and access to all things".

Examples

First we will take a look at some of the media in Squeak Etoys, and then go deeper to find that they are all made from the same kind of simple powerful end-user object, and scripted the same way.

All Objects Can Be Made And Used Everywhere

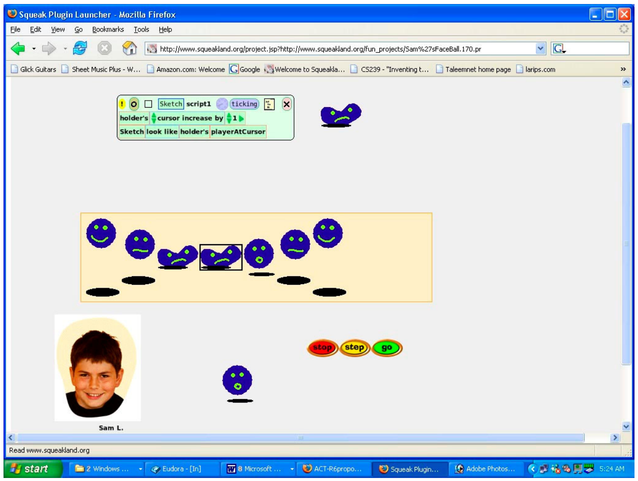
Everything in Squeak is an object, there are lots of already supplied useful objects, and end-users can make the same kinds of objects.

Integrated Objects Instead Of "Applications"

Separate applications are an old 60s idea which force a mode of authoring that is limited to what the application can do, and this makes new ideas by end-users difficult to fit in. For example, most Windows applications are not good for presentations, so Windows users will often do work in powerful applications (such as a spreadsheet or video editing tool) and then copy images to a weaker presentation tool. Looking at it from this point of view, there is only one "application" in Squeak Etoys – itself – and all old and new things are created, manipulated and presented there.

The creations of the end-users are the center of focus

As we will see, in contrast to most current systems which crowd the desktop with hundreds of buttons and options, the Squeak approach is to give the user a large place to work and make things, with a much larger set of resources at hand, but not intruding on what's being made and done.



```
Sketch script1 ticking
holder's cursor increase by 1
Sketch look like holder's playerAtCursor
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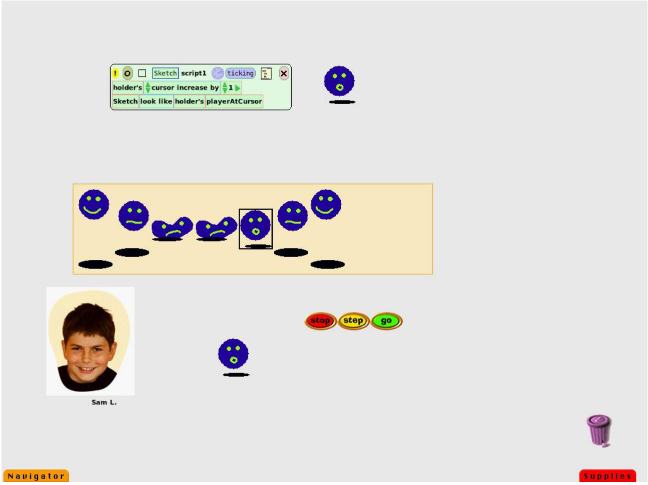
A Squeak Project/Desktop running as a browser plugin showing Sam's "FaceBall" animation. Full WYSIWYG authoring is always available.



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Sketch script1 ticking
holder's cursor increase by 1
Sketch look like holder's playerAtCursor
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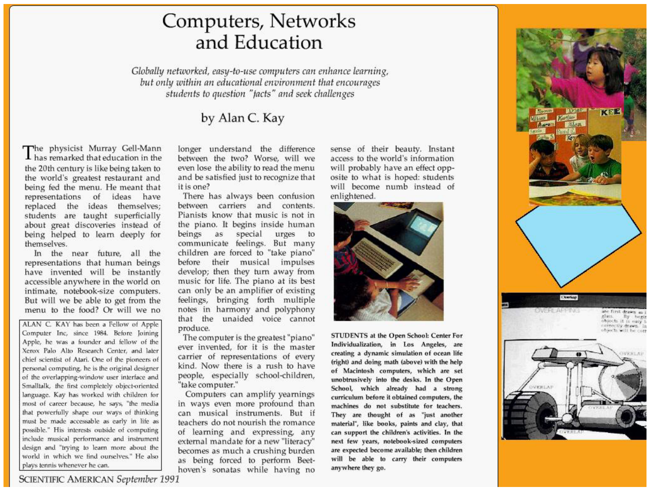
Squeak Desktop/Projects can be and usually are used full-screen



Computers, Networks and Education

Globally networked, easy-to-use computers can enhance learning, but only within an educational environment that encourages students to question "facts" and seek challenges

by Alan C. Kay

The physicist Murray Gell-Mann has remarked that education in the the 20th century is like being taken to the world's greatest restaurant and being fed the menu. He meant that representations of ideas have replaced the ideas themselves; students are taught superficially about great discoveries instead of being helped to learn deeply for themselves.

In the near future, all the representations that human beings have invented will be instantly accessible anywhere in the world on intimate, notebook-size computers. But will we be able to get from the menu to the food? Or will we no longer understand the difference between the two? Worse, will we even lose the ability to read the menu and be satisfied just to recognize that it is one?

There has always been confusion between carriers and contents. Pianists know that music is not in the piano. It begins inside human beings as special urges to communicate feelings. But many children are forced to "take piano" before their musical impulses develop; then they turn away from music for life. The piano at its best can only be an amplifier of existing feelings, bringing forth multiple notes in harmony and polyphony that the unaided voice cannot produce.

The computer is the greatest "piano" ever invented, for it is the master carrier of representations of every kind. Now there is a rush to have people, especially school-children, "take computer."

Computers can amplify yearnings in ways even more profound than can musical instruments. But if teachers do not nourish the romance of learning and expressing, any external mandate for a new "literacy" becomes as much a crushing burden as being forced to perform Beethoven's sonatas while having no sense of their beauty. Instant access to the world's information will probably have an effect opposite to what is hoped: students will become numb instead of enlightened.

ALAN C. KAY has been a Fellow of Apple Computer Inc, since 1984. Before Joining Apple, he was a founder and fellow of the Xerox Palo Alto Research Center, and later chief scientist of Atari. One of the pioneers of personal computing, he is the original designer of the overlapping-window user interface and Smalltalk, the first completely object-oriented language. Kay has worked with children for most of career because, he says, "the media that powerfully shape our ways of thinking must be made accessable as early in life as possible." His interests outside of computing include musical performance and instrument design and "trying to learn more about the world in which we find ourselves." He also plays tennis whenever he can.

STUDENTS at the Open School: Center For Individualization, in Los Angeles, are creating a dynamic simulation of ocean life (right) and doing math (above) with the help of Macintosh computers, which are set unobtrusively into the desks. In the Open School, which already had a strong curriculum before it obtained computers, the machines do not substitute for teachers. They are thought of as "just another material", like books, paints and clay, that can support the children's activities. In the next few years, notebook-sized computers are expected become available; then children will be able to carry their computers anywhere they go.

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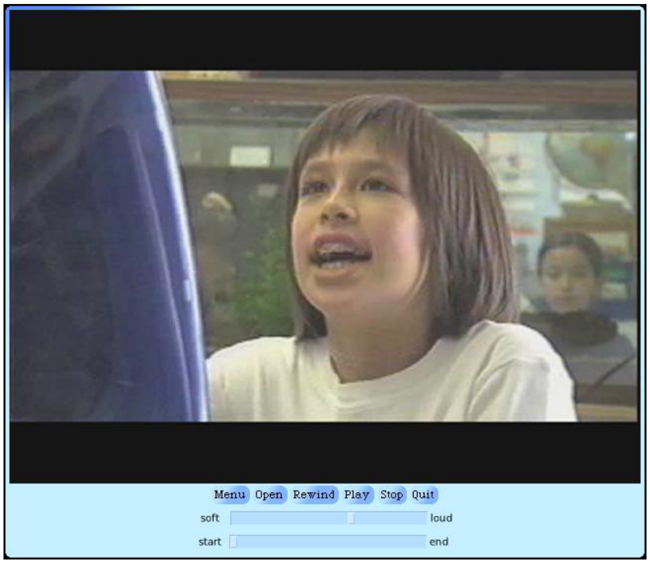
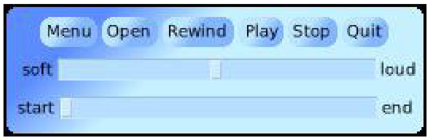
There Are Lots Of Resources "Backstage"

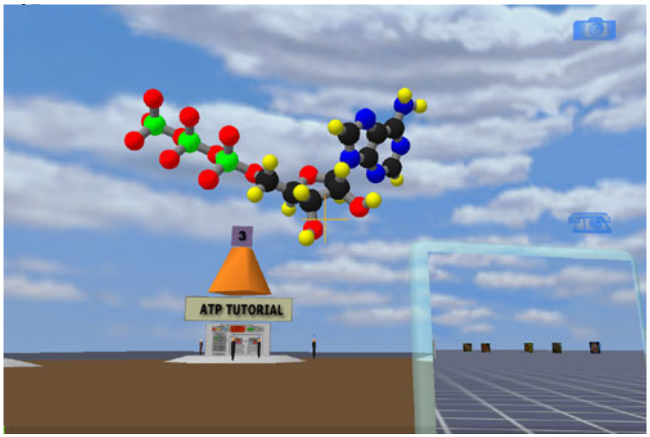
The end-user is usually engaged in making things, ranging from simple presentations of text and images to complex simulations. All of these are done on the desktop/project "page". To avoid cluttering up the work/play area with resources and functions, Squeak instead uses "flaps", which are hidden windows that are invoked by pressing on a tab. For example, "Supplies" is a flap that contains many useful objects to make things with, and "Navigator" contains useful ways to move about the Squeak worlds, find and publish projects, etc. The end-user can make as many flaps as needed, and these can be shared or just local to a particular project. They can be invisible for presentations or made visible to aid constructions.



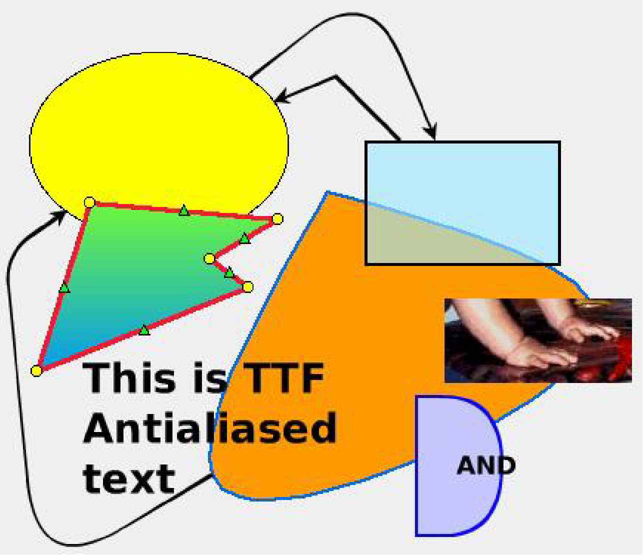
Movie player can play MPEG and JPEG Movies



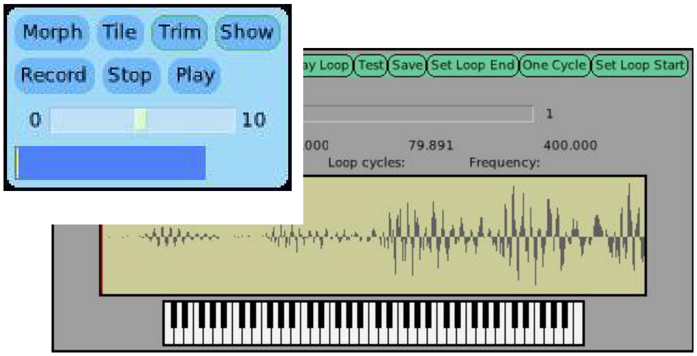
MP3 and other sound format player



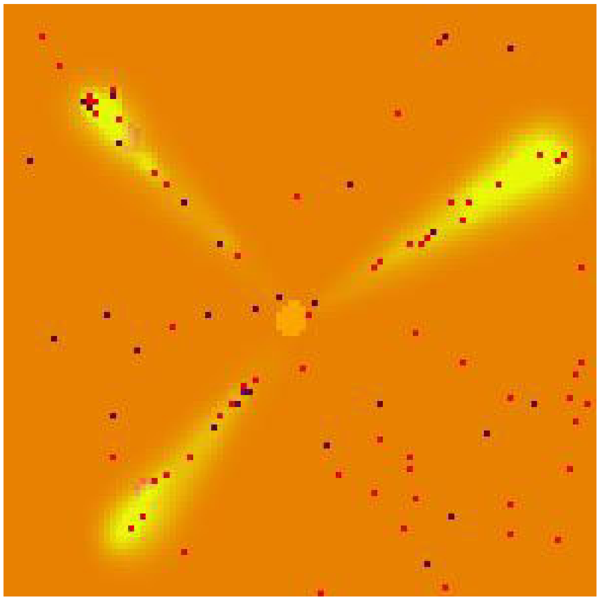
The 2D environment is actually inside of a 3D environment that is mapped onto the Internet. The object in the lower right is a portal to another 3D world. See http://opencroquet.org for more information and "Squeak Etoys" to see how a dynamic model of a bridge is made.



The many different graphical building blocks include ovals, rectangles, polygons and curves, pictures and drawings, TTF antialiased text that can flow from one container to another (for DTP), and smart connectors for makng diagrams. Any object can hold any other objects.



Tool for editing waveforms



Massively Parallel Particle System can handle tens of thousands of moving and background particles. This is a simulation of ants gathering food,and leaving a diffusing trail of pheromones to guide other ants.

Multiple Projects/Desktops

The Squeak project/desktop is where things are made, and the end-user can have any number of them. They also act as “pages” for documents, presentations and the web. The pages are sortable by hand and by script, and each sorted sequence can be named and used – this allows many different presentations and “books” to be made up from the same materials.

For example, Powerpoint is basically a collection of sorted pages that can have a few object types on those pages coupled with a page turning mechanism and some visual transitions, we can readily see that the integrated Squeak scheme is more powerful, comprehensive and much simpler.

The User Interface Ideas Are Few and Simple

We are used to modeless editing of text, but most applications have an “editing mode” and a “presentation mode”. Within these are “button modes”, “background-foreground modes”, etc. Squeak eliminates virtually all of these. For example, all editing can be done at any time in full-screen and even while running as a plug-in in a browser. The way objects are selected allows even event-sensitive objects like buttons to be manipulated even while they are “live”.

Balloon Help Is Always Active (But Delayed)

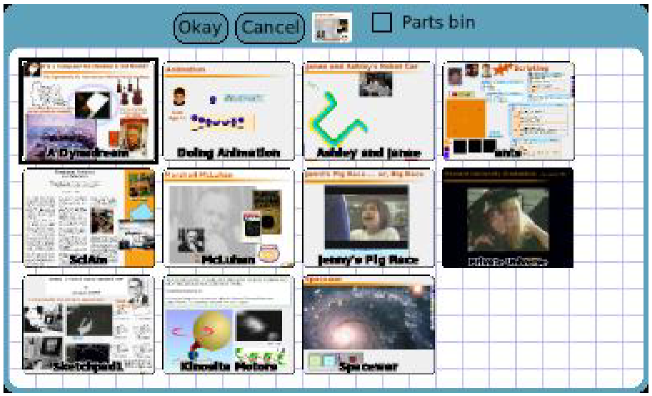
Balloon Help is usually disabled in today’s systems because it is so intrusive. We have found that a 1.5 second delay provides a nice balance. A confident and knowledgeable user will never see it, but it is always active and provides considerable aid to beginners. The user can edit the balloon help to add helpful notes for themselves and others.

The Halo of Handles

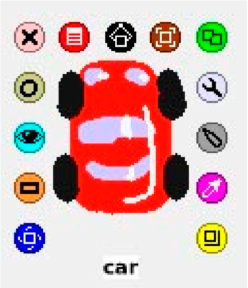
Every object will show the same “halo of handles” that allow efficient invocation of the most used manipulations, such as: rotation, scaling, copying, etc. It is possible to choose a filter to limit which ones show up for beginners (but we have found that all beginners have no trouble at all with the full suite of handles right from the beginning).

The Handles Are Also Squeak Etoys Objects

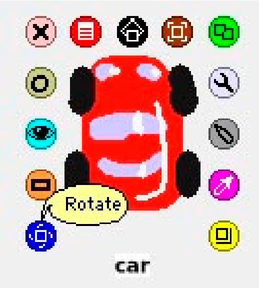
(Everything is.) This means that end-users have the option of customizing everything in the system. Most of the time this will not be done, but e.g. for young children, a teacher may wish to add more extensive notes to the existing balloon help, or make the handles appear quicker. Squeak has “fences” that warn about changes and entering more complex territories, but the end-users can still have the option to explore.



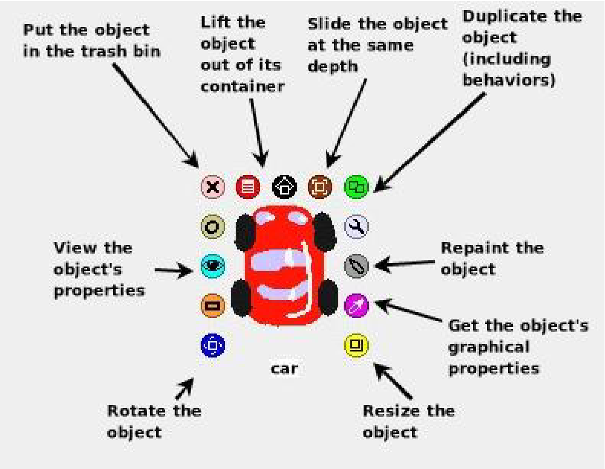
Sorting the thumbnails of a few of the hundreds of project/desktops made by this user

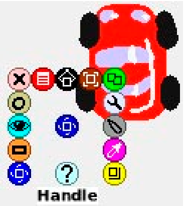


The standard handles for every object in Squeak

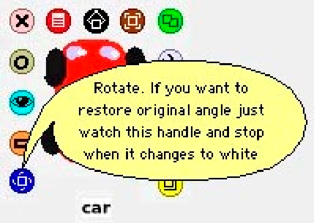


Balloon help is everywhere but unobtrusive and delayed


Put the object in the trash bin
Lift the object out of its container
Slide the object at the same depth
Duplicate the object (including behaviors)
View the object's properties
Repaint the object
Get the object's graphical properties
car
Rotate the object
Resize the object



A Handle is a Squeak object and you can get its handles


Rotate. If you want to restore original angle just watch this handle and stop when it changes to white
car

This allows access to the properties of the Handle, so an end-user can add a note to the balloon help for additional aid

Objects Are "The Same" But May Wear Different Costumes

We've just seen that all objects will show the same control handles, but the similarities between them go much deeper. Each object's visible appearance is a costume that it wears (and can change), but underneath the objects are the same. (This is very much like the actors in a play. They have different roles, look different on the stage – they may even be playing a tree – but underneath they are all human beings, with all the similar properties that humans share.)

Objects Reveal Their Properties and Behaviors the Same Way

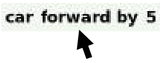
Clicking on the viewer handle will bring up the object's viewer, which shows all of the object's properties and behaviors organized into categories. Every object is "the same": is graphical, can carry other objects, can be scripted, has a pen, etc., so most of each viewer is exactly the same from object to object.

The Car Painting and Car Viewer Are Both Costumes For Car

And the end-user can make more for any object.

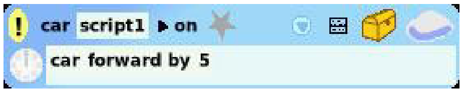
All Objects Are Scripted The Same Way

Scripts are made by dragging out tiles onto the desktop, and then dragging tiles into the script. Syntax is always correct.



car forward by 5

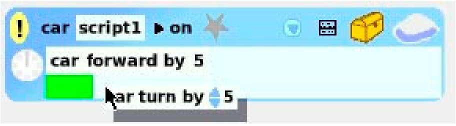
Tiles dragged from the viewer and dropped on the desktop ...



car script1 ▸ on

car forward by 5

... make a script

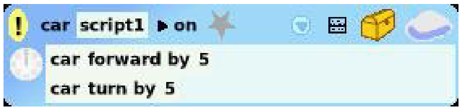


car script1 ▸ on

car forward by 5

car turn by 5

The green "destination marker" shows up when tiles are dragged over a script.

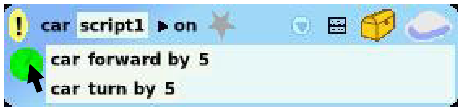


car script1 ▸ on

car forward by 5

car turn by 5

The tiles fly into the destination when dropped.

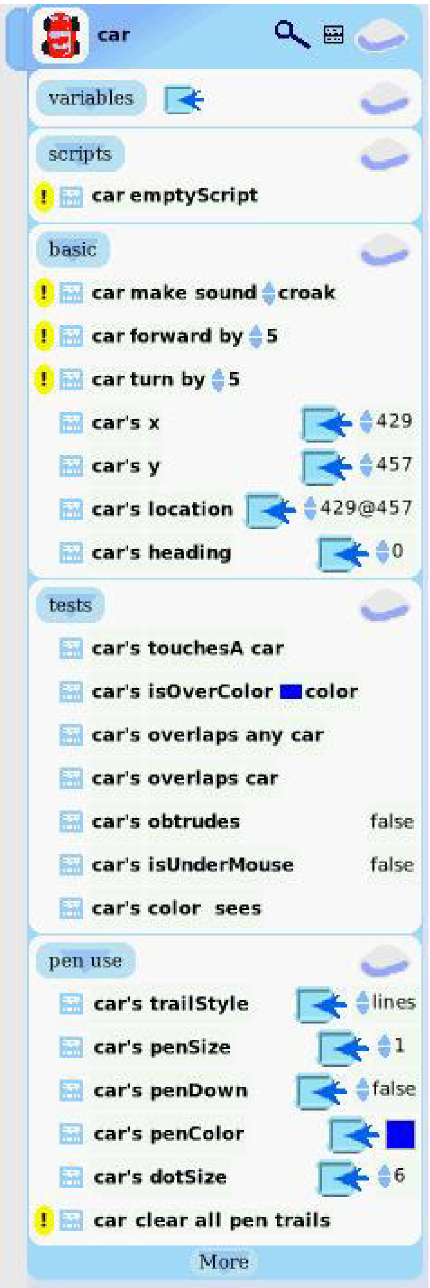


car script1 ▸ on

car forward by 5

car turn by 5

The script can be started "ticking" by clicking on the clock



car

variables

scripts

! car emptyScript

basic

! car make sound croak

! car forward by 5

! car turn by 5

car's x 429

car's y 457

car's location 429@457

car's heading 0

tests

car's touchesA car

car's isOverColor color

car's overlaps any car

car's overlaps car

car's obtrudes false

car's isUnderMouse false

car's color sees

pen use

car's trailStyle lines

car's penSize 1

car's penDown false

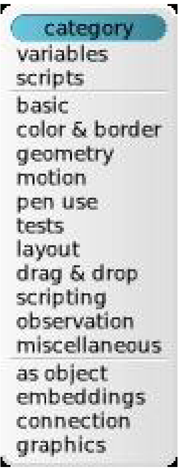
car's penColor

car's dotSize 6

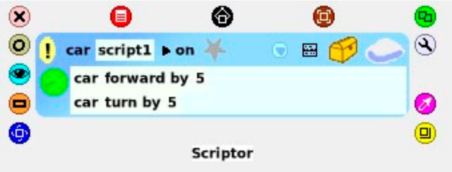
! car clear all pen trails

More

Object viewer with some of the standard categories o properties and behaviors

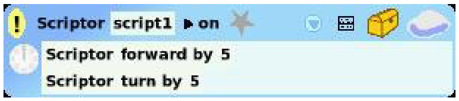


The car will move in a circle when the script ticks. If we have made "pen down" (in the "pen use" category) true, then the car will leave a trace as it moves.



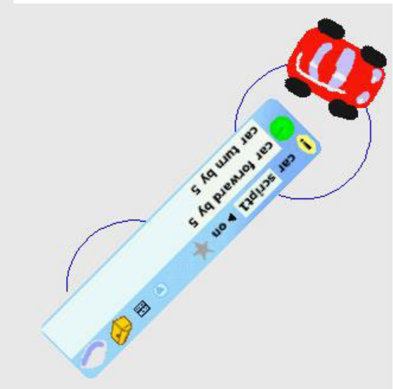
```
car script1 ▶ on
car forward by 5
car turn by 5
```

Because the script is a standard Squeak Etoys object, we can get its handles, and its viewer …



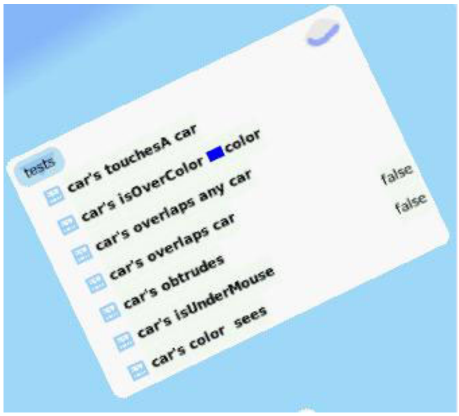
```
Scriptor script1 ▶ on
Scriptor forward by 5
Scriptor turn by 5
```

… and write the same script we wrote for the car



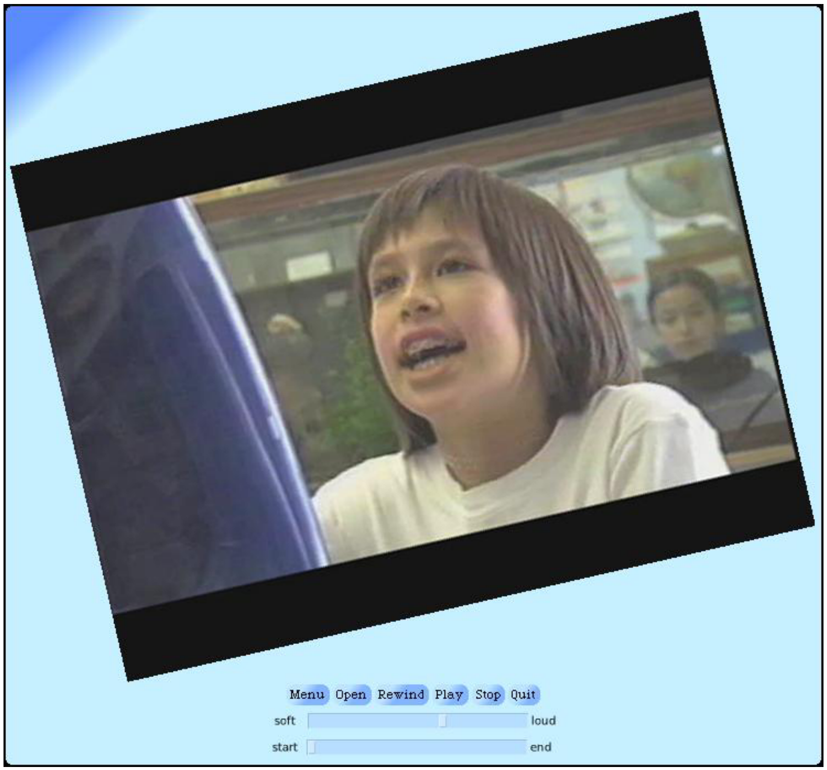
```
car script1 ▶ on
car forward by 5
car turn by 5
```

The result is that the scriptor will move in a circle and leave a pen trail of its own



```
tests
car's touchesA car
car's isOverColor ■ color     false
car's overlaps any car        false
car's overlaps car
car's obtrudes
car's isUnderMouse
car's color sees
```

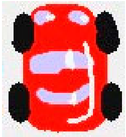
We should guess correctly that we can do the same thing for any Squeak object, including a category in a viewer!



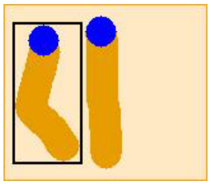
Or a movie even while it is playing!

Everything Is Constructible, Changeable, Deconstructable

Now let's look at the simple animations done by children. In most productivity media systems animation is a built-in and opaque feature, but in Etoys it is something that is actually constructed by the children because there are many powerful ideas associated with animation-like processes.



Car made by a child

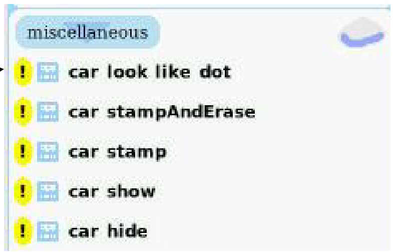


Holder with several drawings of a worm

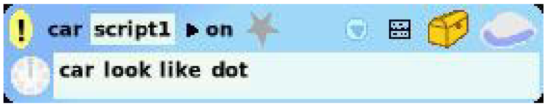
To do animations we need to use a variety of costumes that can be changed via a simple script. For example, let's make a few drawings of a worm and put them in a holder. If we look in the car's viewer we find

car look like dot

and drag it out to start a script.



miscellaneous
! car look like dot
! car stampAndErase
! car stamp
! car show
! car hide

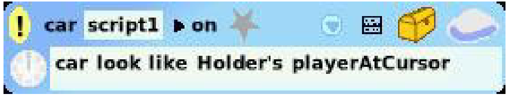


! car script1 ▶ on
car look like dot

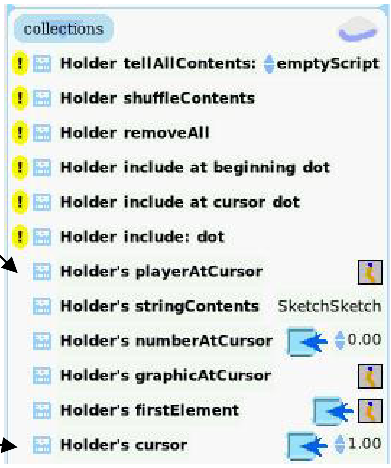
We want it to look like one of the drawings in the holder so we look in the holder's viewer and find

Holder's player at cursor

We drop it on "dot" to get:



! car script1 ▶ on
car look like Holder's playerAtCursor

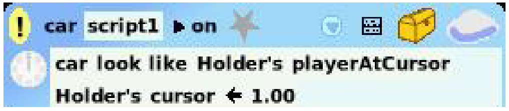


collections
! Holder tellAllContents: emptyScript
! Holder shuffleContents
! Holder removeAll
! Holder include at beginning dot
! Holder include at cursor dot
! Holder include: dot
Holder's playerAtCursor
Holder's stringContents SketchSketch
Holder's numberAtCursor 0.00
Holder's graphicAtCursor
Holder's firstElement
Holder's cursor 1.00

This viewer category contains properties and behaviors what an object is carrying.

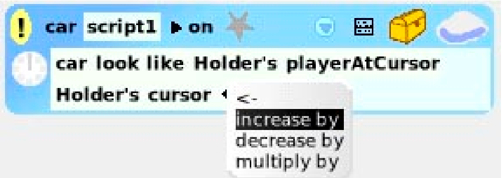
We click on the (!) to try this script and we see that the car's costume is changed to a worm.

But further clicks won't cause a further change because we haven't moved the cursor. To do this we look in the Holder's viewer again, find the cursor change line and drag this into the script.

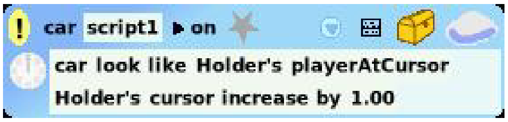


! car script1 ▶ on
car look like Holder's playerAtCursor
Holder's cursor ← 1.00

Finally, we change the <- to "increase by" by clicking on it.

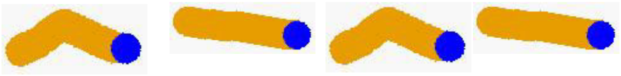


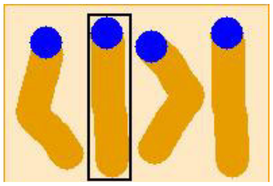
! car script1 ▶ on
car look like Holder's playerAtCursor
Holder's cursor ←



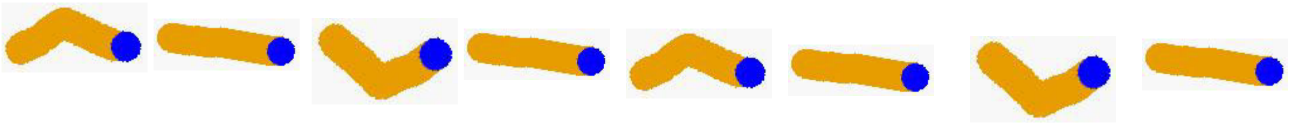
! car script1 ▶ on
car look like Holder's playerAtCursor
Holder's cursor increase by 1.00

because we want to make the cursor move to each succeeding position in the Holder on each tick of the clock (the Holder will wrap around these numbers when we get to the end). We set it ticking and we get a nice worm animation.

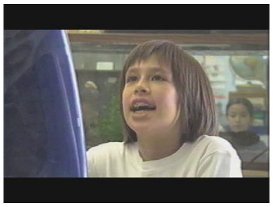




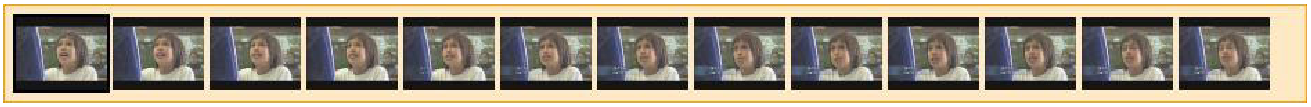
We can make more worm pictures and drop them into the holder (even while it is running) to get a smoother animation look..



Movies and Videos Are Just Animations



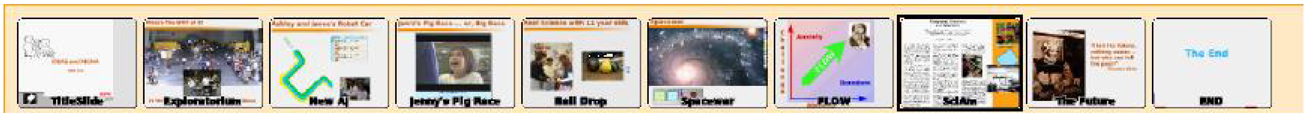
Now we should realize that we have also made the guts of a movie player because we can just drop frames from the movie into a holder, write the two line script and it will play them!



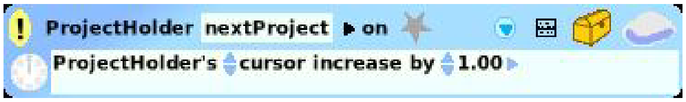
What's missing? Movies usually have hundreds to thousands of frames, each of which has lots of pixels. These frames are usually held as a file on the hard drive and are brought into the player application. Squeak Etoys provides automatic services for relating contents of files to Etoy objects, and also to compress and decompress pictures.

Books and Presentations Are Just Animations

Squeak "Book" (multipage documents that are like a Hypercard stack) and Squeak Presentations (like powerpoint but more powerful) are the very same kind of structure. The "pages" can be any object (including a whole project),



and turning is done by a script that looks like:



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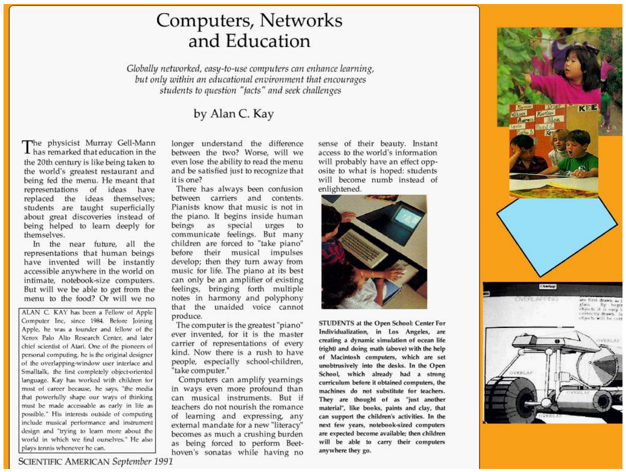

Computers, Networks and Education

Globally networked, easy-to-use computers can enhance learning, but only within an educational environment that encourages students to question "facts" and seek challenges

by Alan C. Kay

The physicist Murray Gell-Mann has remarked that education in the the 20th century is like being taken to the world's greatest restaurant and being fed the menu. He meant that representations of ideas have replaced the ideas themselves; students are taught superficially about great discoveries instead of being helped to learn deeply for themselves.

In the near future, all the representations that human beings have invented will be instantly accessible anywhere in the world on intimate, notebook-size computers. But will we be able to get from the menu to the food? Or will we no longer understand the difference between the two? Worse, will we even lose the ability to read the menu and be satisfied just to recognize that it is one?

There has always been confusion between carriers and contents. Pianists know that music is not in the piano. It begins inside human beings as special urges to communicate feelings. But many children are forced to "take piano" before their musical impulses develop; then they turn away from music for life. The piano at its best can only be an amplifier of existing feelings, bringing forth multiple notes in harmony and polyphony that the unaided voice cannot produce.

The computer is the greatest "piano" ever invented, for it is the master carrier of representations of every kind. Now there is a rush to have people, especially school-children, "take computer."

Computers can amplify yearnings in ways even more profound than can musical instruments. But if teachers do not nourish the romance of learning and expressing, any external mandate for a new "literacy" becomes as much a crushing burden as being forced to perform Beethoven's sonatas while having no sense of their beauty. Instant access to the world's information will probably have an effect opposite to what is hoped: students will become numb instead of enlightened.

ALAN C. KAY has been a Fellow of Apple Computer Inc, since 1984. Before Joining Apple, he was a founder and fellow of the Xerox Palo Alto Research Center, and later chief scientist of Atari. One of the pioneers of personal computing, he is the original designer of the overlapping-window user interface and Smalltalk, the first completely object-oriented language. Kay has worked with children for most of career because, he says, "the media that powerfully shape our ways of thinking must be made accessable as early in life as possible." His interests outside of computing include musical performance and instrument design and "trying to learn more about the world in which we find ourselves." He also plays tennis whenever he can.

STUDENTS at the Open School: Center For Individualization, in Los Angeles, are creating a dynamic simulation of ocean life (right) and doing math (above) with the help of Macintosh computers, which are set unobtrusively into the desks. In the Open School, which already had a strong curriculum before it obtained computers, the machines do not substitute for teachers. They are thought of as "just another material", like books, paints and clay, that can support the children's activities. In the next few years, notebook-sized computers are expected become available; then children will be able to carry their computers anywhere they go.

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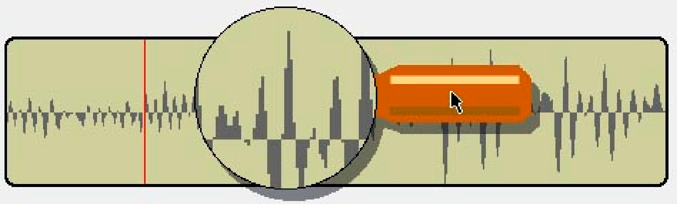
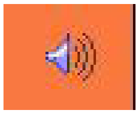
Project "page" is shown full screen. All the authoring facilities are available, this is a live project, not just an image.

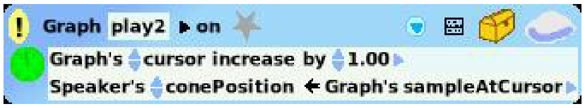
Sound Synthesis Is Just An Animation

Now let's look at a different sequence in a holder. With the sound recorder we record a tone and see it is a sequence of bars, whose height indicates the sound pressure at that time.



One of the objects supplied with Squeak looks like a loudspeaker and if we move this object, the physical loudspeaker will move. We write a little script that is like the animation scripts, but instead of doing a "looks like" we will move the loudspeaker according to the height of the current bar, and we hear the tone! If we change the "increase by" to 2, we will hear the tone an octave above, and if we change it to 1.5 we will hear the tone a fifth above. We have just made a real-time synthesizer!





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Squeak Allows End-Users To Access The Underlying Simplicity Of Many Important Ideas