Modeless Sketch Interaction Using Flow Select

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ABSTRACT

Flow selection is a time-based modeless selection and operation technique for freehand drawing and sketch tools. Flow selection offers a modeless technique to address the observation that modal selection requires too much cognitive effort and causes breakdowns in creative flow. Flow selection provides input to a new class of operations by assigning increasing, fractional selection strengths to objects over time. We discuss the current prototype system and possible applications for this novel technique for interacting with sketches.

Author Keywords

Sketch, mode, time-based selection, pen, stylus, flow select

TECHNIQUE

This paper presents *flow selection*, a time-based selection and operation technique for freehand drawing and sketching tools. Flow selection differs from traditional techniques in three ways. First, flow selection is triggered without requiring the user to deliberately enter a selection mode on a toolbar or via keyboard commands. Second, selections made using this technique are 'fuzzy' in that the points along the selected region have variable selection strength, and respond variably to subsequent operations. Third, flow selection capitalizes on the passage of time to gradually expand the outer boundary of the selection region and the selection strength of those objects.

When editing a two-dimensional freehand drawing using traditional sketching interfaces, users must choose between making a rough drawing using an application that simply captures pixels on a canvas (e.g., Microsoft Paint) or creating a precisely prescribed rendering using splines and geometric structures (e.g., Adobe Illustrator). Some programs clean up (or "beautify") the user's roughly sketched strokes by smoothing them out or snapping objects into place. Flow-selection allows a user to pick regions of strokes that they want to fix and operate on them, such as repositioning the end of a line or smoothing out a rough section.

Existing methods for editing curves vary in complexity. The simplest and most common method of editing a curve is to erase it and try again, or to draw a new stroke to replace an existing one. Even the smallest mistake forces the user to completely start over. In vector-based drawing applications, curves (such as splines) are defined indirectly by a series of control points, which the user moves to modify the curve. Mistakes in this case are not as difficult to correct, but editing curves by moving control points is tedious and sometimes awkward work and this technique is unobvious to novice users.

In contrast, flow selection empowers even novice users to quickly repair small mistakes in their drawn strokes and move on to their next stroke. This technique is similar to pressure-sensitive interaction [3] but does not require the use of specialized hardware. Flow select involves a selection phase and an operation phase, allowing the user to effortlessly switch from one to the other. Figure 1a shows a cartoon drawing of a face. To select a region of a drawn stroke, the user simply holds the stylus relatively still near the region to be edited. Soon, color begins to slowly flow outwards from the epicenter, the nearest point on the stroke (Figure 1b). After waiting until the desired region has become selected, the user moves the stylus to begin an operation. The most common operation is reshaping the selected region of a stroke. In this case, points closer to the epicenter move at nearly the same rate as the stylus; points in the selection far from the epicenter move less (Figure 1c). If the user wants to smooth a rough line, the user may

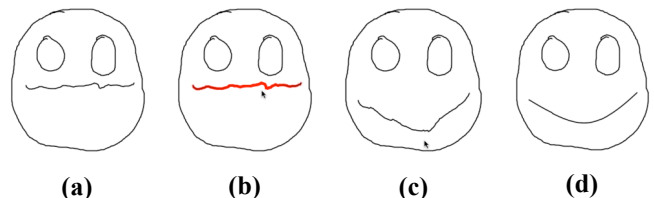(a)   (b)   (c)   (d)

Figure 1: Using flow select to move a drawn stroke. In (a), the user has just drawn the mouth and immediately selects it from near the middle (b), yanking downward to create a smile (c), and (d) removing the jagged parts with a smoothing operation.

once again hold the stylus still. This time, instead of selecting, the selected region begins to smooth out. Smoothing ends when the user lifts the pen. Alternately, a user who wants to reshape the selection again can do so by simply moving the stylus. After the pen is lifted, the user may continue drawing.

With flow selection users may alternate between drawing strokes to the canvas and selecting and operating on regions without explicitly changing modes. In this way, flow selection presents one solution to the 'mode problem' [5]. In contrast to the approaches to modeless interaction found in [4] and [1], flow selection is triggered at the start of a pen gesture, rather than afterwards.

APPLICATIONS
We are currently early in our prototype phase of work and are still exploring possible applications of this novel interaction technique.

We first developed flow selection as part of a sketch-based design application that enables novice users to create 3-D physical models of dinosaurs [2]. We wanted a simple means to edit the drawn shapes of the wood pieces that model the dinosaur bones. Although we had not set out to invent a novel interaction method, everyone who used or saw the dinosaur design application immediately became enthralled with the method of flow selection. We have not conducted a formal user evaluation of the technique, and we are currently considering appropriate metrics by which to evaluate it.

Flow selection can be useful to drawing and sketch applications used by artists and non-artists alike. Non-artists are likely to make frequent mistakes while performing tasks such as creating an artistic drawing or providing diagrammatic sketch input to a flowchart application. Rather than erasing their mistake and trying again (which has an equal likelihood of resulting in a mistake), flow selection provides users a quick and intuitive method of fixing their mistakes. Flow select's fluid, modeless interaction style can be appropriate in applications for artists, which can improve their creative output by helping to avoid the loss of concentration associated with frequently switching from drawing to selection mode.

FUTURE WORK
In the near future, we plan to create a more full-featured cartooning application that uses flow selection to help novices create simple colorful drawings. We plan to test this application in a controlled study in order to find out if our method empowers novice users' abilities to create artistic drawings.

Beyond the short term, we plan to develop an application that uses flow select in 3D. Such an application will extend flow selection to work over curved surfaces, and volumes.

In addition to the interaction technique of flow-selection, we intend to make use of pen gestures in conjunction with flow selections. A flow selection followed by a pen gesture would choose the operation to be performed on that selected region. Alternately, the gesture may lead into a flow selection. For example, the gesture [south, north] followed by a hold could trigger a pie menu. A [circle] gesture followed by a hold could bring up a color chooser. A flow-select followed by a [pigtail] gesture would delete the selected region.

Last, we imagine flow-selection as a portable interaction technique. We would like to create a toolkit for flow selection that can be readily used in other applications.

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