

Drawing setae the digital way

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Abstract

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Using Adobe Illustrator the drawing of setae or spines is the most time-consuming part of a digital drawing. These short step-by-step instructions explain how setae are drawn and stored as brushes. The set up of libraries of seta can be speeded up additionally with macros.

Key Words

method
illustration
digital drawing
taxonomy

Introduction

The digital drawing method for scientific illustrations (Coleman 2003, 2006) using Adobe Illustrator has become a standard method for taxonomic descriptions in many labs. The great advantages of this method lie in increased speed and the possibility to create such smooth lines that would not be possible using traditional free-hand ink drawing. The resulting vector graphics can be directly processed by most online journals and can be used for printing in journals and digital copies (pdf's for proofs and eps files for publication). Using vector paths they are much smaller and have a much higher quality and resolution than bitmap versions. Coleman (2003) explained the basics of digital drawing; the techniques shown in this earlier paper are a prerequisite for the method described herein. In 2006 I showed how to use photos and micrographs as a master for a line drawing. Although the time saved is considerable using the digital drawing method (once mastered), the illustration of complex details like setae still takes most of the time. D'Udekem d'Acoz (pers. comm.) proposed the use of the brushes function of Adobe Illustrator for such structures. In this short paper I introduce this idea and expand it into a whole system to make libraries for setae and related structures automatically.

Material and methods

A Samsung R55 notebook computer was used. Any notebook or desktop computer with at least a 700 MHz processor and an USB port can be used. A digitiser board, WACOM Intuous 3 DIN A4 (currently about 400 Euros; smaller boards are available at a lower price and preferred by some operators), was connected via the USB port. The standard inking pen from WACOM was used. The methods are explained with Adobe Illustrator CS2 12.0.1. Newer versions also work. The selection of menu levels is shown in the following text as hyphenated expressions, in brackets or italics. The use of keyboard shortcuts is much faster than using the mouse and so these shortcuts are given in brackets. The commonly used ones are:

V – *Selection Tool*
A – *Direct Selection Tool*
Q – *Lasso Tool*
P – *Pen Tool*
\ – *Line Segment Tool*
N – *Pencil Tool*
R – *Rotate Tool*
C – *Scissors*

How to define own keyboard shortcuts is mentioned below.

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A set of macros for digital drawing including those mentioned herein is defined in *Actions* (actions.aia) and can be downloaded here:

<http://download.naturkundemuseum-berlin.de/oliver.-coleman/DigitalDrawing>

Step by step guide

There are three ways to draw setae:

A) Free-hand drawing of a seta

The two sides of a seta and its base are drawn free-hand with the *Pen* (*P*) or *Pencil Tools* (*N*). The advantage is that every shape of seta or spine is possible. The disadvantage of this approach is that it is time-consuming and the outline may be uneven or the tip of the seta not perfect, as the lines might not meet cleanly. Details were shown in Coleman (2003).

B) Construction of a seta

Figure 1

The advantages of this method are that it is faster, the tip of the seta is always perfect, and it is repeatable.

The disadvantage is that it works only for slender setae with a pointed tip, not for other shapes like nodular setae and spines. This is the preferable method for creating unique setal forms that are unlikely to be replicated. However, it is possible to copy a seta so constructed by dragging a copy to a new location using the Selection tool with the *ALT* button held down. And to modify copies by manipulating the bounding box surrounding it:

- select a line weight for the seta (e.g. 0.5 pt) or select a style from the *Actions* menu
- Draw one side of the seta (Fig. 1a) ... Either, use the *Pencil* (*N*) and set the *Pencil Tool* fidelity setting up to about 10–15 (double click the *Pencil* icon and move the upper slide lever *Tolerance Fidelity* somewhat to the right). Or, use the *Pen* (*P*) to draw one side of the seta by (1) clicking the pen at the base of the seta, (2) placing the pen at the tip of the seta, (3) with left-button held down, drawing out the direction lines from the anchor point and moving them until the desired curve is obtained, and (4) ctrl click to end:
- select the *Rotate Tool* (*R*)
- point and click the mouse cursor on the designated tip of the seta (this moves the small green crossed circle to the desired centre or rotation)

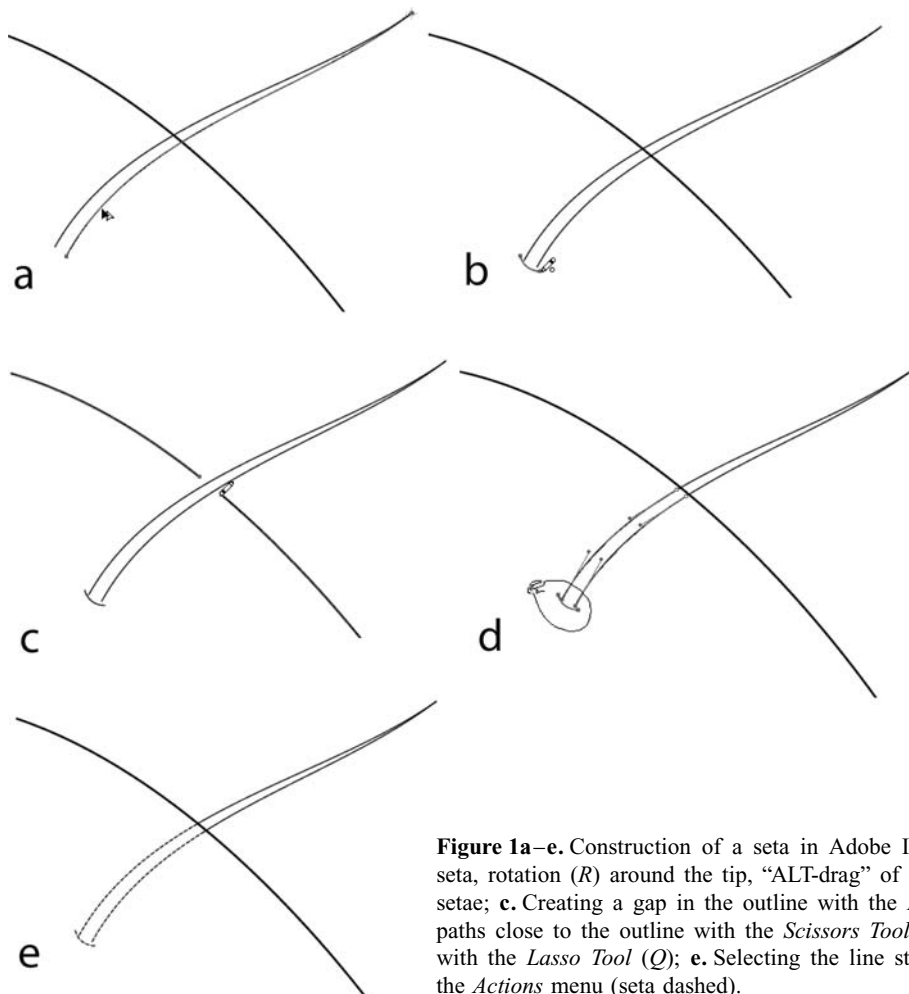


Figure 1a–e. Construction of a seta in Adobe Illustrator. **a.** Drawing of one side of seta, rotation (*R*) around the tip, “ALT-drag” of seta line; **b.** Drawing the base of the setae; **c.** Creating a gap in the outline with the *Eraser Tool*; **d.** Cutting of the vector paths close to the outline with the *Scissors Tool* (*C*), marking the lower part of seta with the *Lasso Tool* (*Q*); **e.** Selecting the line style for the lower part of setae from the *Actions* menu (seta dashed).

- hold the *ALT* key and at the same time drag the seta path with the mouse or WACOM a few degrees (pushing the *ALT* key copies the line and rotates it at the same time around the tip, a black and white double-arrow indicates the “Copy-rotate”), release the mouse button once the path is in the right position and after that release the *ALT* key (this process is called “ALT-drag”)
- draw a base for the seta (Fig. 1b)
- it is best to group (*ctrl g*) the three paths of the seta at this stage after selecting them with the Selection (*V*) or Lasso tool (*Q*)
- if the seta is crossing an outline, activate the vector path of the outline with the Selection (*V*) or Direct Selection Tool (*A*) and use the Erase Tool (revealed on the sub-toolbar by holding down the left button over the Pencil Tool icon) and move it over the path in order to create a gap (Fig. 1c)
- if the seta is inserted in a lower focal plane (below an outline), cut the seta vector paths with the Scissors Tool (*C*) close to the outline, surround this region including the basis of the seta with the Selection (*V*) or Lasso Tool (*Q*) in order to activate the paths and select a dotted or dashed line from the Actions window (Figs 1d, e).
- change the line weight of the copy in “stroke weight” to 2 pt (Figs 2c–d)
- change line colour from its normal setting (Fig. 2e) to “white” and change fill “white” (Fig. 2f). The result is a black seta of 0.5 pt weight surrounded by a white seta of 2 pt (Fig. 2g)
- use *Direct Selection Tool (A)* and click somewhere on the work field in order to deselect paths
- select all paths of the seta with the *Lasso Tool (Q)* for example (Fig. 2h) and group (*ctrl g*) again
- open *Brushes (Windows – Brushes or F5)*, click on *new brush* (Fig. 2i), select *new art brush* (Fig. 2j); click *OK*
- the new seta will appear in the options window of *Art Brushes* (Fig. 2k), the arrow on the seta shows the application direction; if you want to draw a seta from the tip to the basis click on the upright arrow in *Directions*; then click *OK*. Rename the seta from *Art brush 1* to a name of your choice
- the seta will appear in the *Brushes* list and can be selected there
- take care that no *Fill* (= the red line) is selected in the upper left of the two colour selection boxes in *Tools* (Fig. 2m)
- one option is to apply the seta with the *Paintbrush Tool (B)* by simply drawing a line while the desired brush is highlighted; the result is a seta with an individual length and swing (Fig. 2n), surrounded by a white margin, automatically creating a gap when overlapping or passing over an outline (Fig. 2o)
- another option is to use the *Pen Tool* to draw a single line with an even curve for each seta as described above: (1) clicking the pen at the base of the seta, (2) placing the pen at the tip of the seta, (3) with left-button held down, drawing out the direction lines from the anchor point and moving them until the desired curve is obtained, and (4) *ctrl* click to *end*. Once as many as required are done, select all, highlight the desired brush style and all will be converted instantly from lines to setae. Selection or multiple objects can be done using the *Lasso Tool* to enclose all objects or the *Selection Tool* with *Shift* depressed or one of the *Select – Same options (stroke colour or weight)* from the toolbar. The setae can be adjusted at any time by changing the line weight if needed.

C) Drawing setae using Illustrator’s brushes function

Figure 2

This is the best method particularly when many setae of similar form are needed and allows storage of several styles in a library. It is very fast, as a complex seta of any shape and with additional fine structure is applied by a single brush stroke. The setae are perfect and each has an individual character and swing. It automatically creates gaps when crossing outlines or other setae. The most significant advantage is that a simple straight-sided tapering seta in a brush library (e.g., Fig. 2k) can be translated on a page to any number of setae with individual curves and lengths:

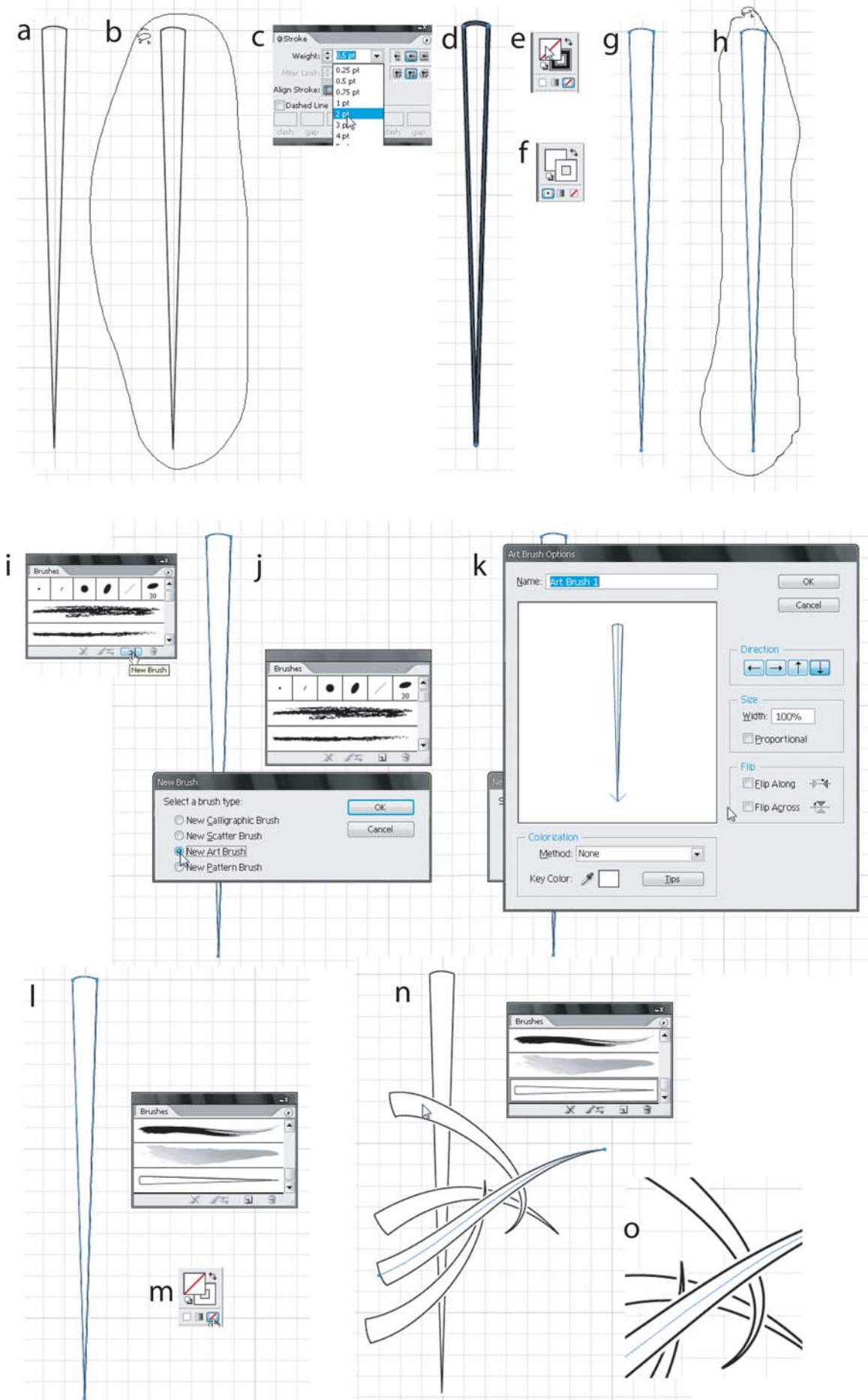
- for the creation of a seta brush or a seta library it is best to open a new document (*File – New, ctrl n*)
- on the toolbar *View – Show grid*
- select in *Stroke* style as ends for lines and corner: *Round Cap* and *Round Join*, or use a predetermined action from the menu
- draw a vertical seta with the tip down (use the *Line segment tool (\)* or *Pen tool (P)* for straight lines, and *Pencil tool (N)* for basis or curved spines) (Fig. 2a)
- select all paths of the setae using for example the *Lasso Tool (Q)* (Fig. 2b)
- right click mouse and select *group* from popup menu, or *ctrl g*
- change the fill to “white” (Fig. 2f)
- select seta line weight from the button menu (e.g. 0.5 pt)
- *ctrl c*, then *ctrl b* (this copies the seta behind the first seta)

Creation of a library of setae:

Once a seta is defined it is possible to create libraries of this seta with different length and width by proportionally changing it and storing it under *Brushes*, or to create complex setae of several paths such as plumose setae and store in the same way.

How to scale a seta:

- activate the vector paths of the seta by surrounding it with the *Lasso Tool (Q)*
- use *Selection Tool*, the black arrow (*V*), then a box will appear around the seta



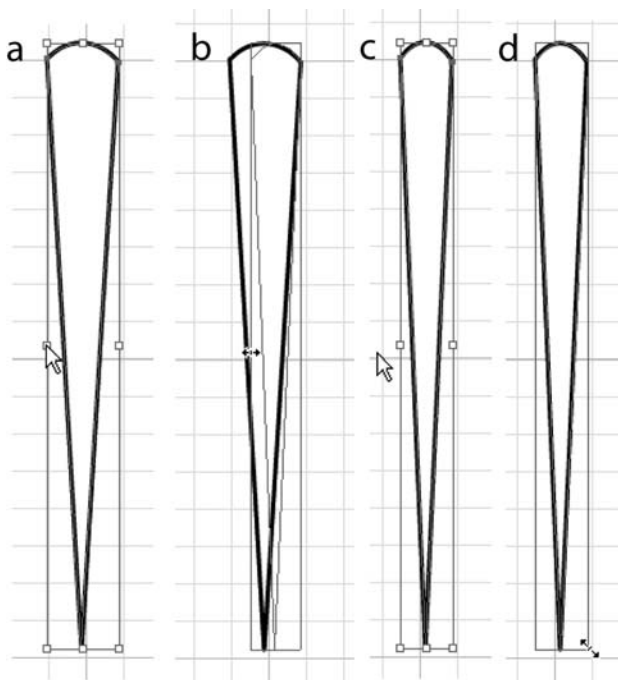


Figure 3a–d. Scaling of seta for the preparation of seta libraries. **a.** Seta surrounded by box of the *Selection Tool*; **b.** Narrowing of the seta by reducing width dragging on the side of the box; **c.** Result of scaling; **d.** Dragging on the corner of box in order to change length of seta.

- push and hold *Shift* and click at the same time in one of the corner squares and drag for length changes, or drag on square of the side of the rectangle for width changes (if the weight of the outline of the seta should change unwanted, click on *Tools – Scale Tool (S)* and uncheck the box *Scale Strokes & Effects*)
- it is important to surround seta with *Lasso Tool (Q)* again (if this step is forgotten the seta will be invisible in the *Brushes Option* dialogue)
- store new seta in *Brushes* as described above
- modify seta again and store again
- the list of setae in *Brushes* becomes longer and longer, delete the default brushes (mark them with the mouse and push trash icon *Delete Brush*)
- *Save Brush Library* using the dialogue that appears when clicking on the triangle button in the upper right corner of the *Brushes* window. While it is possible to create your own library of several setal types and store it as a file (e.g., mysetae.aia) using the *Save Brush Library* option on the *Brushes* window, it appears not possible to add more types once the library is saved. Your

Brush Library can be loaded into other documents using *Open Brush Library* in the same dialogue window.

Set up a seta definition macro

As the procedure to define a brush seta is quite complex and time-consuming it is useful to store the command sequence in a macro:

- use new canvas (*File – New, ctrl N*) to draw a seta (do not define it beside another drawing)
- go into options of *Actions* and unselect *Button Mode* (Fig. 4a)
- click on icon *Create New Action* (Fig. 4b)
- name the macro and click on *Record* (Fig. 4c)
- draw and manipulate a seta the way as shown above (*Group; Stroke 0.5 pt; Stroke Round Cap; Stroke Round Join; ctrl c; ctrl b; Stroke 2 pt; white fill colour, white stroke colour; Group; ctrl a* (select all); *Brush – New Brush – New Art Brush, OK, OK; clear (delete); paste (ctrl v); scale* (narrow seta somewhat)
- click on *Stop Playing/Recording* in *Actions* (Fig. 4d)
- the macro will be stored automatically and will be available in future for other drawings (in case you want to export it or import others, it is possible with a dialog hidden below the triangle button on the upper right corner of the *Actions* window)
- clicking on the triangle in the upper right corner of such saved libraries allow to load a set of different setal definitions, when *persistent* is selected in each of these libraries.

Important remarks

Expand Appearance (in the *Object* menu) transforms a seta drawn by the brush function into a conventional seta, consisting of several, individual paths. When assembling plates it is often required to scale drawings. If they contain structures created by brushes it may be useful to dissolve the brush into paths again, as brushes sometimes do not scale in the same way as the other parts of the drawing. This function is also useful when parts of the seta are modified (e.g. making a dashed basis as shown in Fig. 1e).

Individual keyboard shortcuts can be defined beyond the defaults already defined. For example, to define a shortcut for the command *Expand Appearance* go to *Edit – Keyboard Shortcuts*, on the toolbar, then select



Figure 2a–o. Drawing setae using the brushes function of Adobe Illustrator. **a.** Draw a symmetrical seta; **b.** The *Lasso Tool* is used to activate the vector paths, it is grouped, then the seta is copied in itself (*ctrl c, ctrl b*); **c.** The line weight is increased; **d.** The thicker black seta is situated behind the thinner seta; **e, f.** A white filling of the seta and a white line colour of the thicker seta are selected; **g.** The original seta in black is white within and surrounded by a white outline; **h.** The seta is marked by the *Lasso Tool*; **i.** The *New Brush* icon is selected; **j.** *New Art Brush* is marked; **k.** and in the *Art Brush Options* confirmed; **l.** The seta appears in the *Brushes* window; **m.** *No filling* must be selected; **n.** The seta can be applied by the *Paintbrush (B)*; **o.** when overlapping, setae have white gap automatically.

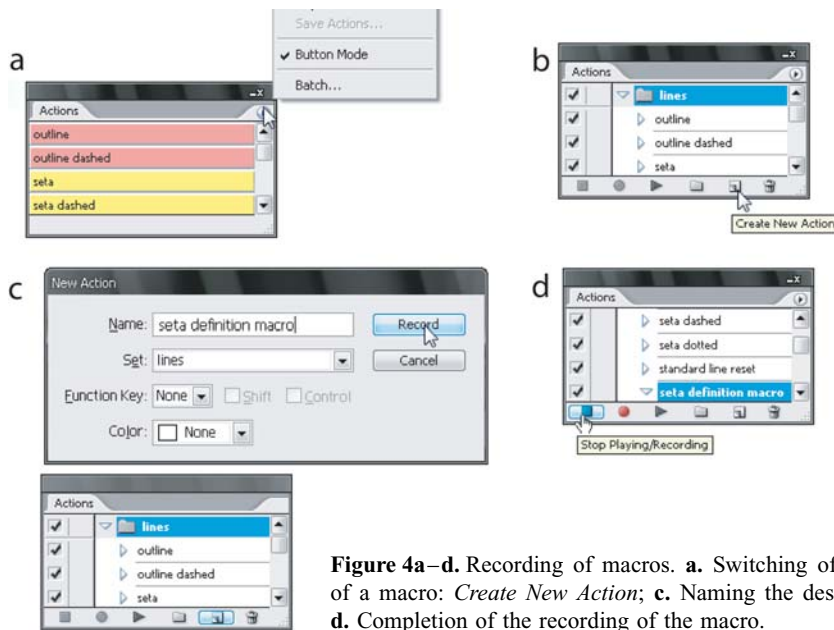


Figure 4a–d. Recording of macros. **a.** Switching of the button mode; **b.** Evoking the recording of a macro: *Create New Action*; **c.** Naming the designated macro and starting of the recording; **d.** Completion of the recording of the macro.

Menu Commands in the menu box, and under *Object – Expand Appearance*; click in “shortcut” column right of the menu point and select a keyboard combination (e.g. *ctrl u*) and save under a file name. In future *ctrl u* will start the command “Expand Appearance” directly when the vector paths of a structure have been activated.

Other useful keyboard shortcuts which should be defined are the commands *Bring to Front* and *Send to Back (Object – Arrange)*. With these the sequence of overlapping structures can be changed quickly. This only works if they are in the same layer. Also for the often used *Erase Tool* a keyboard shortcut is very useful.

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