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Shadings in digital taxonomic drawings

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Abstract

This contribution describes how shadings can be applied to taxonomic line drawings created with vector graphics software. The line drawings created with the vector graphic software are saved in vector format and then also in bitmap graphics format. The bitmap version is opened in a bitmap graphics program and the areas for shading selected. A new layer is then created and clouds of pixels are 'sprayed' onto these areas. The pixel clouds are saved and later placed onto the outlines in the vector graphic software as a new layer. The results combine the advantages of vector graphics, perfectly smooth lines and the greyscales of bitmap graphics.

Key Words

Introduction

Photography is often used in taxonomic descriptions and works especially well for larger animals. When using a stack of pictures it is possible to combine them with software into one photo of excellent depth of field (for example with CombineZP: http://combinezp.software.informer.com). But for small, translucent animals stacking does not work as well and many details remain invisible in the photo. Here, drawings are still the best choice for a taxonomic description. The use of computers for taxonomic drawings helped to speed up the documentation and at the same time improve the quality of these line drawings. Compared to the traditional use of ink pens the digital drawing method has advantages: e.g. corrections are easy, it is possible to create complex structures like setae in an elegant and rapid way and the arrangement of plates is quickly achieved (Coleman 2003, 2006, 2009).

Montesanto (2015, 2016) used bitmap graphic solutions for taxonomic drawings, e.g. GIMP, but the quality of bitmap line drawings as proposed in these papers is inferior compared to vector graphics and the scaling of detailed drawings during the arrangement of plates leads to different line weights. However, bitmap graphics have a great potential when greyscale information is needed, for example for shading. Shading is especially helpful for showing cuticular structures such as carinae, teeth or grooves. However, vector graphics are superior to bitmap graphics in several respects for pure line drawings. The idea of shading directly within vector graphic software was proposed by Bober and Riehl (2014), but was adopted in only a few papers.

In the present paper it is shown how to combine the best of these two technologies in the same drawing: the high-quality smooth lines created by vector graphics like Illustrator, and greyscale bitmap shading with Photoshop.

Material and methods

Pencil drawings, made with a Leica DMLB microscope equipped with a camera lucida, were scanned with a DINA3 scanner (Plustek Optibook A300) as a template. Several scans of a large pencil drawing can be combined into one template within the vector graphics software program Adobe Illustrator CS2, which was used for this paper, subsequently using the "Place" command for combining parts of the scans. Alternatively photos can be used as a master (Coleman 2006). The bitmap program Adobe Photoshop CS2 was used to generate the pixel shadings. The method should work in an analogous way with other similar software products.

A Wacom Bamboo graphics tablet was used for creating line drawings in Illustrator as well as for shading in Photoshop.

Step-by-step instructions

- The starting point for shading is ideally a plate with a habitus drawing on it, opened in Illustrator. On the ar-ranged plate the habitus drawing is already at the right size and the density of pixels in the shadings can be best controlled in the final format.
- From within Illustrator, export the plate into Photoshop format (.psd). Select "Flat Image" in the Photoshop Export Options (Figure 1A–B). Minimize Illustrator and then continue to work in Photoshop.
- Open the file with the line drawings in Photoshop (File-Open or double click on the file name with a psd-extension).
- Limit the areas which should be shaded using the "magic wand" tool (Figure 2A). If needed, select several areas at the same time by holding the "shift" key while clicking inside the designated areas. If everything works correctly, the inner margins of the outlines then appear fuzzy. If the box margin of the picture becomes fuzzy instead, then the areas are not completely closed by a continuous line.
- The selection of areas has to be done on the layer that contains the outlines of the habitus (the first layer) (Figure 2B).
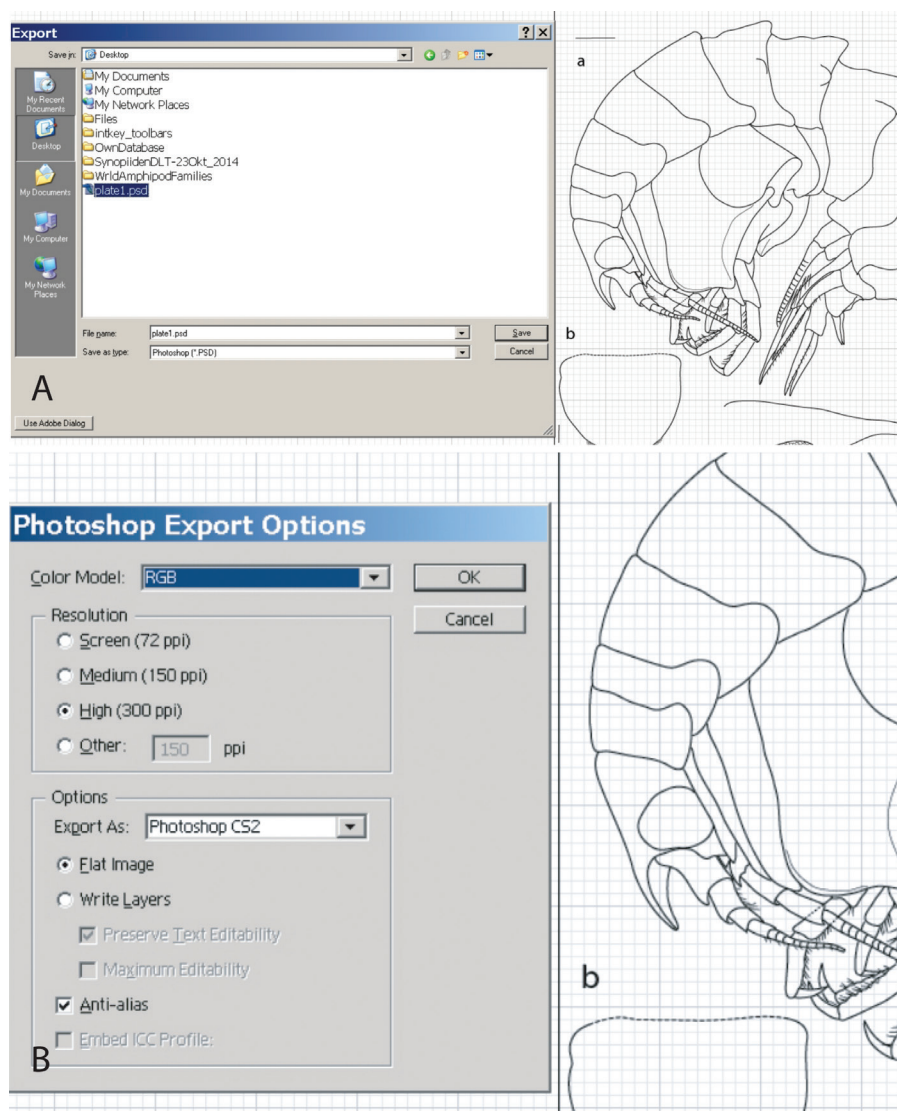
**Figure 1. A)** Export plate from Illustrator into Photoshop format (.psd). **B)** Use "Flat Image" option.
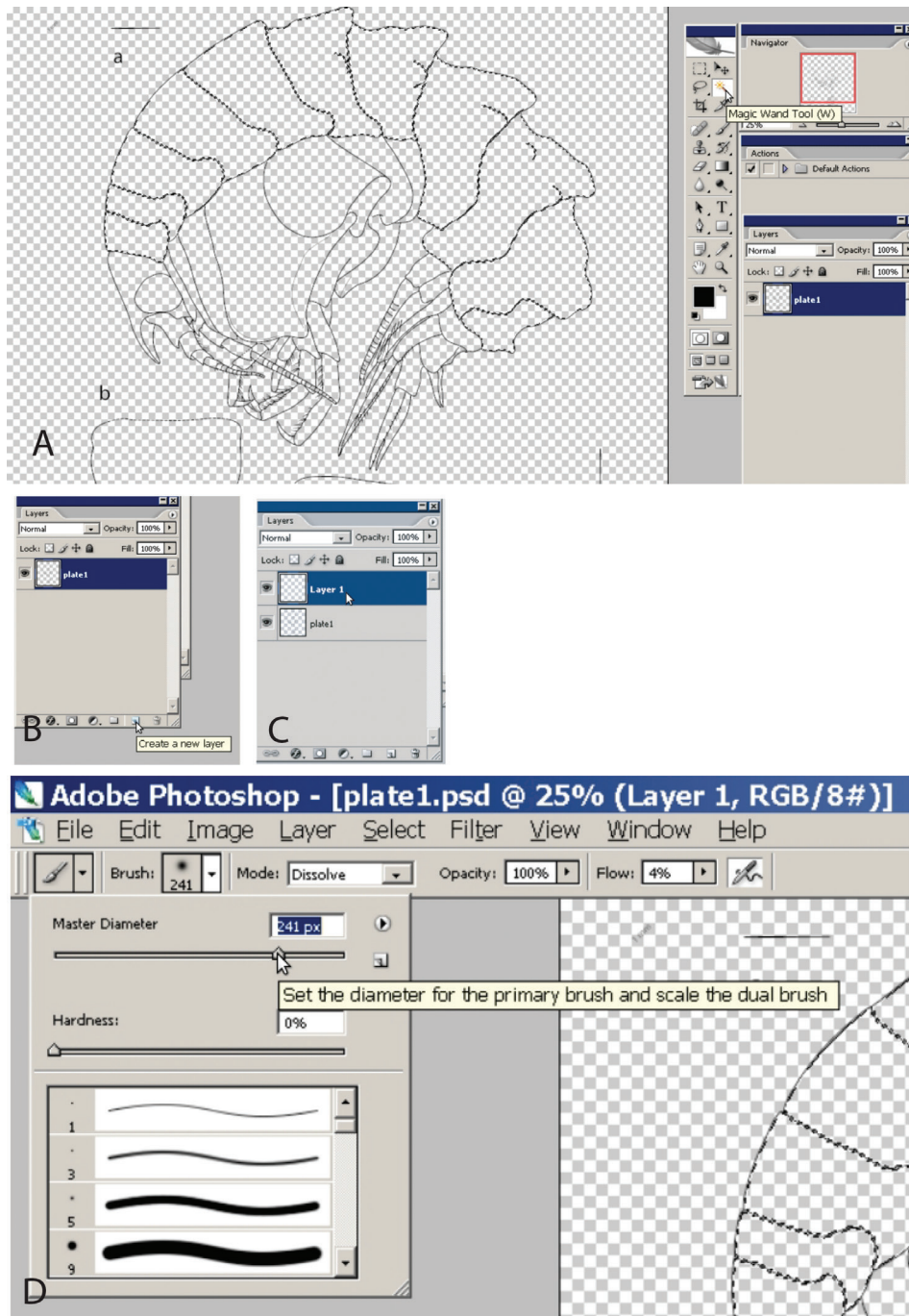
Figure 2. A) In Photoshop use "Magic Wand Tool" and the "shift" key to mark areas in the drawing for shading. **B)** Create a new layer, by clicking on second icon from the right in the icon bar at the lower end of the window. **C)** Select the newly created layer before applying the shading. **D)** Select "Brush", modify "Master Diameter" and set "Flow" at about 3–4%.

- Create a new layer (by clicking on the second icon from the right in the icon bar, marked as "Create new layer", below in the "Layers" window, see Figure 2B). It is essential to apply the shadings only to this newly created layer (Figure 2C)!
- Select the "Brush" (B) tool, and then in the Brush dialog (settings bar, upper left corner, below File and Edit pulldown menu) "Airbrush Soft Round".
- Adapt the Brush size by moving the "Master Diameter" lever (Figure 2D).

- There are two options: 1) "Mode: Normal" for greyscale or 2) "Mode: Dissolve" for stippling (creating a pixel cloud).
- Keep "Opacity" at 100%, the setting for "Flow" should only be at 3–4% (Figure 2D), in order to prevent too many pixels being sprayed.
- Foreground colour must be black.
- Spray pixel clouds with the mouse or the Wacom board. If everything was set up correctly the pixels will only appear inside the selected areas (Figure 3A).
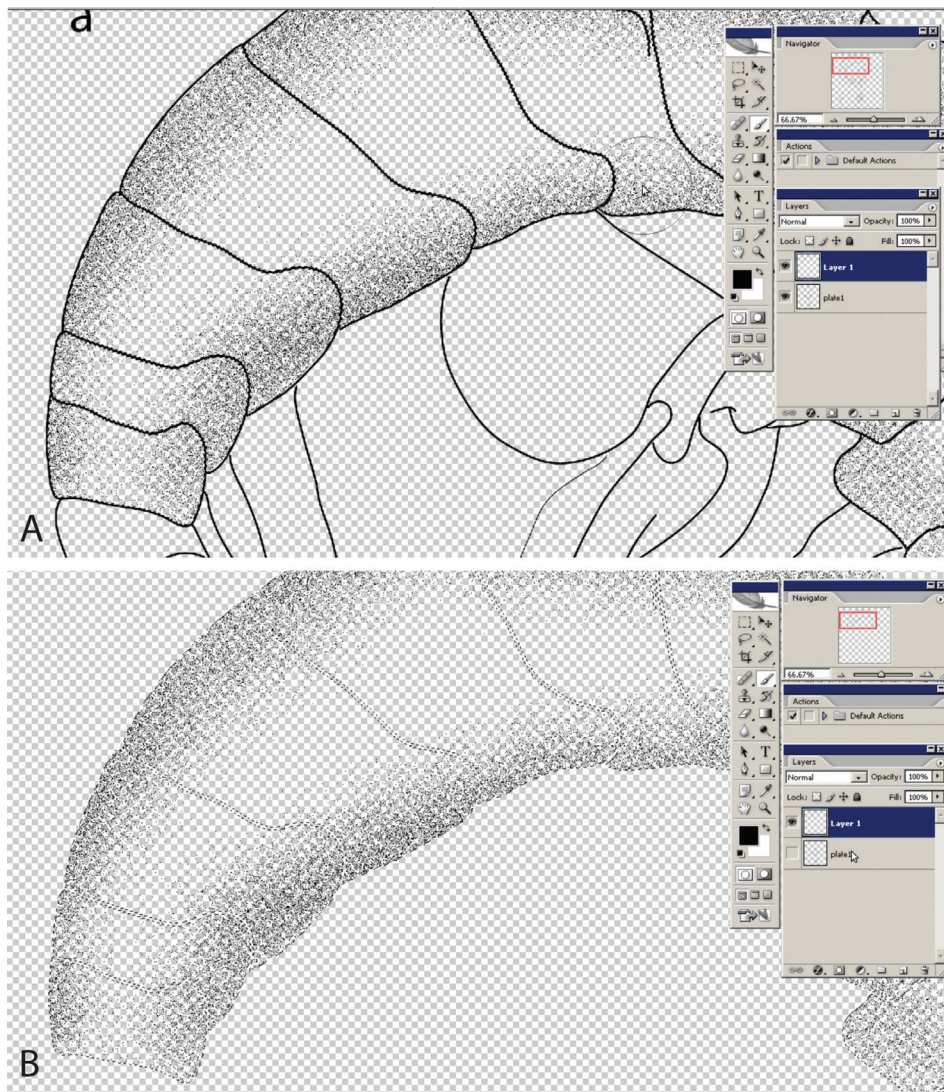
Figure 3. A) In Photoshop select newly created layer and apply shading by spraying pixels onto selected areas. **B)** After airbrushing, make first layer, containing the outlines, invisible by clicking on eye icon in "Layers". By this only the pixel clouds are retained.

- If some areas appear too dark, change "Set foreground colour" to white by clicking on the double arrow close to the white and black squares in the Tools. Then spray white pixels on top of the black pixels.
- In order to get an idea about the right density of the shadings, print out the file from time to time. The density of the pixel clouds in the printout may differ from what you see on the screen.
- When you are content with the result, make the layer that contains the outlines (the first layer) invisible by clicking on the eye symbol beside the first layer unselecting it (Figure 3B).
- Then save the Photoshop file, which now only contains the shadings, but not the outlines (Figure 3B).
- Expand the minimized Illustrator drawing, create a new layer and place the Photoshop file with the pixel shadings onto the habitus using the File-Place dialog. Carry out fine adjustments with the cursor keys (or simultaneously hold "shift" and use the cursor keys, for faster movements) (Figure 4A–B).

Discussion

Coleman described in a series of papers (2003, 2006, 2009) how to use Illustrator for taxonomic drawings. These three papers show how to produce high quality vector drawings both quickly and accurately. The only part that was missing in this series of publications is shading. Shadings in vector graphics work theoretically (Bober and Riehl 2014), but the results are not very convincing. During initial trials with Photoshop (Coleman 2003) a whole plate was exported into bitmap format prior to shading, leading to the loss of the vector information and thus rough lines. In the method proposed here, however, the vector graphics are unchanged and only the bitmap shadings are placed as an overlay on top of the vector graphics. In this way the advantages of vector graphics (perfect, smooth lines) and the greyscale and stippling capabilities of bitmap graphics are combined, leading to a final image of superior quality.
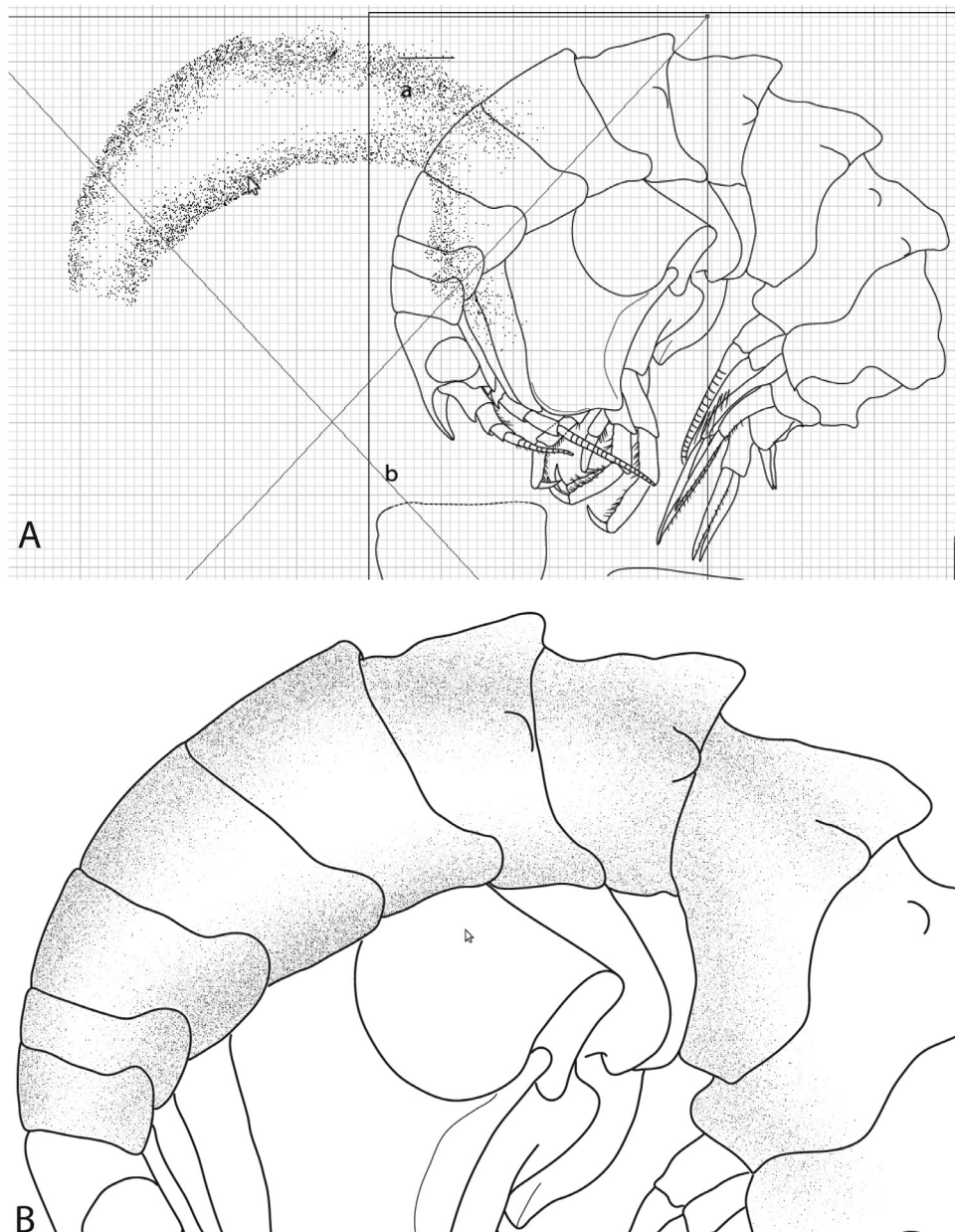
Figure 4. A) Place pixel cloud, saved without outlines from Photoshop into Illustrator using the File-Place command. **B)** Move the pixel cloud in the corresponding areas of the vector graphics in Illustrator.

Acknowledgements

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