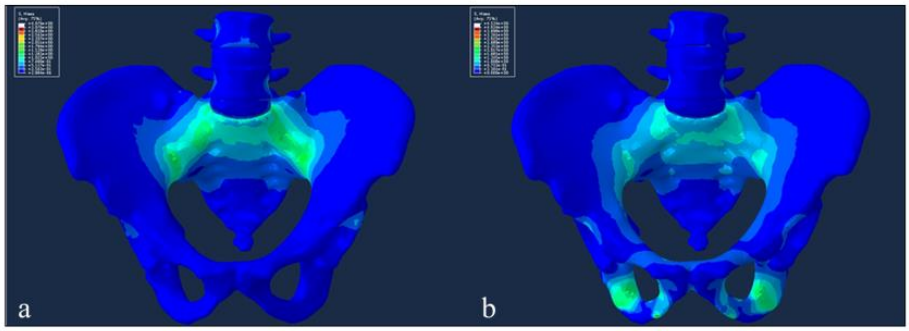
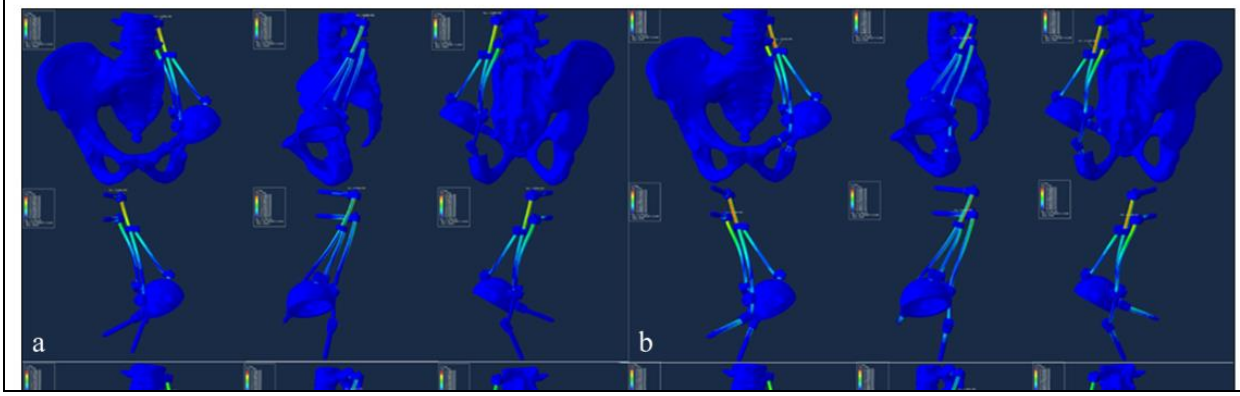
Rice University
Mech 403 Computer Assisted Design
Real "blue blob" examples (what not to do)

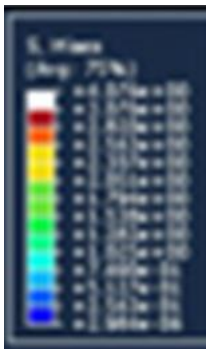
Here is a page segment from a journal where the results of an engineering study are communicated in a useless and failed manner. These are real examples of "blub blobs" that I insist should never appear in your final group design reports. The page illustrates what not to do when trying to convey technical information. The focus of the published study is the stress distribution in the human pelvic bone before and after a segment is removed and replaced with a titanium prosthesis. That is an important topic.

Below is part of an image from the article. The top portion (Fig. 3) claims to show the stress distribution before implantation. But, which of the six stress components or the six or seven common equivalent failure stress criteria is it presenting? The caption tells what the peak (unknown) stress values were, but which stress is it and where are their peak value locations on the pelvic bone? The color bar should provide that location information. But does it?

Fig. 3 Stress distribution of the normal pelvis. Patient standing on two feet, maximum stress= 1.52 MPa (**a**) and sitting, maximum stress=4.53 MPa (**b**)







No! The color bar numbers and text are too small to read. That color bar should have been captured at a larger scale and attached beside the other two displays. In this case, the authors did one correct thing and forced the (unreadable) color bars to have the same range. That is the proper way to graphically compare two different conditions of the same part.

Unfortunately, the authors accepted the default ranges for the color bar which makes the locations of the five lowest (unknown) stress regions quite clear; but it renders the five highest (unknown) stress regions (white, red, yellow …) so small you cannot tell where they are located. You should always adjust the color bar, for your final report, to assure that any regions of importance to the study or design are displayed. By cropping the color bar and placing it beside the contour plots there probably would still be enough space to keep the two contour plots the same size as originally displayed. Also, the color bar heading usually gives the name of the item displayed.

Furthermore, the display background should have been set to white before the report images were displayed for capture.

The lower portion is a segment of Fig. 4 from the article that is purported to communicate the same (unknown) stress information after implantation of the prosthesis. It is entitled "Fig. 4 Stress distribution of the post-operative pelvis. …" However, it provides absolutely no information about the (unknown) stress regions in the pelvic bone. The pelvic bone appears just as a solid blue blob and communicates no useful information.

That is a common situation when an assembly of more than one material is contoured. When a very stiff part (the implant) is connected to a less stiff part (the bone) in an assembly the higher stresses almost always occur in the stiffer material. The default contour levels in the color bar are set by the highest (unknown) stress anywhere in the assembly. The figure simply shows the obvious: the thin cantilevered metal rods extending from the new hip joint to the pelvic bone are the most highly stressed. But that does not mean that they are the parts of the assembly that are most likely to fail! To decide which part in an assembly is most likely to fail the analyst must display a separate contour plot for each part where the color bar range is set by the failure criteria value for the material from which the part of interest is made.

Had that been done here, Fig. 4 would show the important regions of (unknown) stress across the pelvic bone. The peak value contours on the pelvis probably would occur around the fixation areas for each implant rod. In a proper plot of the pelvic bone part of the assembly the rods would appear as an informative red blobs next to the contoured bone *because the rod stresses are far above the failure level of the bone for any failure criteria*.

The authors conducted an important and detailed study. Unfortunately, they failed significantly in communicating to the medical and engineering community. Be sure that your final report contains good images and graphs. A good picture is worth a thousand words!