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Reply to comments by J. H. Chandler and others

We cannot comment on the content or accuracy of press-releases generated by our paper. We can suggest, however, that the reader of any mass-media should be discerning enough to understand that such material is meant as a summary, and not a thorough analysis, of a body of work. With respect to our paper, we suggest a careful reading of the introduction and discussion sections, where we place our methodology within the context of previously existing photogrammetric techniques.

We will comment here on the technical points raised by Chandler and other's comment.

We do not propose that our technique will supplant existing techniques for estimating digital elevation models (DEMs). Our technique, like any other, has benefits and drawbacks, all of which are clearly described in our paper. One benefit, for example, of our technique is that we are able to estimate a DEM from three (or more) photographs taken with a hand-held camera with no constraints imposed on the camera positions or field survey. One drawback, at this point, is that our technique might not produce as accurate DEMs as might be extracted from careful aerial photogrammetry or laser altimetry. We are working currently on formalizing a comparison between our techniques and other methodologies for generating DEMs.

With respect to the issue of lens distortion, we stated clearly that a simplified pinhole camera is assumed (first sentence of the Imaging Model section). The effects of lens distortion from even a mid-range quality camera are generally minimal and have little impact on the reconstructed DEMs (see, for example, Farid, H., and Popescu, A. C., 2001, Blind removal of lens distortions: J. Opt. Soc. Am., v. 18, no. 9, p. 2072–2078).

With respect to the paraperspective projection, we wrote (p. 946, Paragraph 1),

> Computationally, this technique begins with a paraperspective approximation to the geometry of image formation. This approximation affords a closed-form analytic solution for surface topography, and is further refined through successive non-linear minimizations that assume a more realistic [perspective] imaging model, and imposes an overall smoothness constraint on the recovered structure.

Their suggestion that we only employ a paraperspective imaging model is simply incorrect.

With respect to the "subduing" effect, we wrote (p. 945, Paragraph 2):

> As can be seen in Figures 5–8, there is a consistent flattening of the estimated structure. This is due-most likely to the initial paraperspective approximation . . . .

Chandler and others' suggestion for the cause of the subduing in the estimated DEM is a puzzling reiteration of a point we already made. The flattening effect on the crests of the noses may also be partially due to low point selection densities in these areas. We are currently investigating this further.

With respect to the use of our methodology versus standard photogrammetric techniques, we trust that researchers are sufficiently discerning to determine when and if a technique will suit their needs.

Finally, we did, in fact, write the paper with freely available software packages, LaTeX (www.latex-project.org) and GNU Emacs (www.gnu.org/software/emacs). We are also making freely available the source code for generating DEMs using our method (www.cs.dartmouth.edu/farid/research/phototop). This code runs under MatLab® or the freely available GNU Octave (www.octave.org). We strongly believe in and support the concept of open source code, where a community of like-minded users benefit from and contribute to the advancement of a common computational or scientific goal.

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