Notes and Comment

Priming effects and the Deutsch scale illusion: Comments on "The effects of familiarity and previous training on perception of an ambiguous musical figure," by Davidson, Power, and Michie

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In a recent article, Davidson, Power, and Michie (1987) described two experiments in which they attempted to study the effects of priming on the Deutsch scale illusion (Deutsch, 1975). Although the authors addressed an interesting issue, they employed an inappropriate methodology, so that the effects of priming on the illusion remain undetermined.

In the original experiment by Deutsch (1975), subjects were presented with a dichotic pattern consisting of a major scale with successive tones alternating from ear to ear. The scale was presented simultaneously in both ascending and descending form, such that when a tone from the ascending scale was in one ear a tone from the descending scale was in the other ear. The percept most commonly obtained was of two separate melodies, a higher one and a lower one, which moved in contrary motion. Furthermore, the higher tones were all perceived as being in one ear and the lower tones as being in the other. (This was categorized as a "both streams" percept.) The next most probable percept was of the higher tones alone, which were heard correctly as switching from ear to ear. (This was categorized as a "single stream" percept.)

Davidson et al. (1987) hypothesized that if subjects were presented with different components of the illusion separately, this would enable them to search for these components within the full pattern, thus influencing how it was perceived. As a test of this hypothesis, they presented subjects with a number of "priming" patterns to the two ears separately, corresponding to pitch sequences embedded in the full pattern. On each trial, two such priming patterns were presented, followed by the full pattern, and the subjects were asked to choose which of six musical scores fit the right-ear component of the full pattern, and which fit the left-ear component. Although most of the musically trained or experienced subjects were unaffected by this manipulation, subjects without such training or experience tended to choose the scores corresponding to the priming patterns.

However, it is problematical to conclude that subjects who made the latter choice had indeed altered their percepts of the scale illusion as a result of such priming. As Davidson et al. themselves pointed out, one would expect that the musically experienced subjects would be better able to take advantage of the priming patterns, yet they did not do so. A more realistic explanation lies in the nature of the forced-choice task that was employed. Even for experienced listeners, it is not trivial to choose which of six musical scores in such a complex pattern is appropriate to the right-ear component, and which is appropriate to the left-ear component. For listeners who are unfamiliar with musical notation, such a task cannot be expected to produce meaningful results. Davidson et al. themselves acknowledged this difficulty. In an earlier study using this methodology, Smith, Hausefeld, Power, and Gorta (1982) wrote, "We decided to give subjects binaural practice in recognizing the six notated alternatives. If they could not accurately recognize these alternatives, then little sense could be made of subjects' forced-choice responses in the critical dichotic conditions" (p. 456). However, even this relatively simple practice task proved unsuccessful, so that Davidson et al. (1987) wrote, "No attempt was made to make the subjects familiar with the possible alternatives, since Smith et al. (1982) found that this simply confused nonmusicians" (p. 604).

Given that nonmusicians experienced difficulty with even the separately presented components, we cannot reasonably assume that they would have attempted the far more difficult task of making two choices appropriate to their percepts of the right- and left-ear components of the full pattern. Rather, they would have been likely to opt for the more viable (although still difficult) task of choosing the scores appropriate to the two components as presented separately. Their choices of the priming patterns would then be a simple reflection of this strategy. Unfortunately, Davidson et al. provided no controls for this interpretation.

A second problem with the forced-choice procedure employed by Davidson et al. concerns the choices made by a group of "contemporary composers." These subjects tended to make choices appropriate to the pattern that was presented to each ear, and the authors argued that this reflected veridical perception. However, such a conclusion is also problematical. As described above, the second most probable percept of the scale illusion obtained by Deutsch (1975) was of a single stream consisting of the higher tones alone, heard correctly as switching from ear to ear. In other words, this percept consisted of four tones interspersed with silence in one ear, interleaved with four tones interspersed with silence in the other ear. Yet such a description was not included in the set of notated

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choices given to the subjects. All six scores presented as choices for the right- and the left-ear percepts consisted of eight tones. Furthermore, a serious source of bias was introduced by the instructions to the subjects, who were told that the full pattern contained "8 notes presented to both ears at once" (Davidson et al., 1987, p. 604).

Given the lack of opportunity to choose scores appropriate to the single stream percept, and the bias in the instructions against such a description, one would expect subjects obtaining such a percept to have opted for the closest available alternative. Yet the only available option that included the single stream percept with the individual tones localized correctly was to choose the patterns that were presented to each ear. Unfortunately, Davidson et al. provided no controls for this interpretation either. The authors' assertions, then, that the "contemporary composers perceived veridically," and had "superior perceptual abilities" are not warranted by the evidence.

A final point concerns the type of signal employed to generate the patterns. Deutsch (1975) used constant-amplitude sinusoids, with no gaps or amplitude drops between tones; however, Davidson et al. used synthesized piano-like tones. These signals were substantially different from those employed by Deutsch, involving a complex and time-varying harmonic structure and substantial amplitude variations. Yet this difference is not even mentioned in the article. It is, however, inappropriate to draw inferences concerning the scale illusion as originally

demonstrated by Deutsch (1975) on the basis of work involving radically different signals.^{1,2}

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NOTES

1. This point applies equally well to the work of Smith et al. (1982), who also used synthesized piano-like tones as signals. The problems with the forced-choice method employed by Davidson et al. also apply to this earlier study.

2. Butler (1979) performed an experiment on the scale illusion employing both piano tones and sinusoids as signals, and he required musically trained subjects to notate what they heard. For both types of signal, judgments overwhelmingly reflected the illusory percept found to occur most frequently by Deutsch (1975). However, given the very clear ceiling effect present in Butler's data, we cannot assume that no differences depending on signal type would emerge under different conditions. (Indeed, in a short additional experiment employing a forced-choice procedure, Butler obtained more judgments reflecting the typical illusory percept with sinusoids than with piano tones. However, minimal data were collected in this condition.)