be clarified. Nevertheless, from this study it is submitted that prolonged hyperammonemia produces an altered behavioral state analogous to the early stages of hepatic coma.

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6. With the repetitive psychometric measures, in order to control for individual differences in innate ability, the values used were derived by subtracting the raw score on the psychometric measures test from the subject's median practice score. A parametric *t*-test was then done on the mean of the differences between placebo and ammonia performance. This follows the concept of ipsatization of behavioral performance data. D. M. Broverman, *Psychol. Rev.* **69**, 295 (1962).
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Induction of a Stereoscopic Depth Effect

Abstract. *Two pairs of horizontal lines of equal length, with different configurations of dots above and below, are presented stereoscopically. Upon fusion, the two lines are perceived as tilting in space in directions opposite to the depth effects of the dots.*

It is generally assumed that an object will look flat if its image on one retina is an exact copy of the image on the other retina. If a pair of horizontal lines of equal length is presented stereoscopically, one line to each eye, the fused lines should not have any depth. And this is what happens if the lines are presented in isolation. I considered the possibility that the context in which the lines are perceived may induce a depth effect in the stereoscopically combined lines.

In my experiment I assumed that a depth effect in the context induces an opposite depth effect of points in its immediate neighborhood. Figure 1 may be considered to be a test of this assumption. The dots above and below the lines form the context. The horizontal distances between pairs of dots on the left side of the figure are unequal to those of the corresponding pairs of dots on the right side of the figure. Of course, the image of the dots on one retina is not an exact copy of the image on the other retina. All horizontal lines are equal in length. Upon stereoscopic fusion the dots either recede or move forward. For example, with respect to the upper half of the figure, the right-hand dots recede and the left-hand dots move forward. In accordance with the assumption, the right-hand end of the fused line should move forward and the left-hand end should recede. Thus, the line should appear slanted in space. The lower line, on the other hand, should appear slanted in the opposite direction (*1*). A preliminary experiment confirmed this particular test of the assumption.

There was the possibility that in setting the type for Fig. 1 slight differences in the lengths of a pair of corresponding lines emerged that might have been responsible for the depth effects. This would mean that the left

Fig. 1. The figure is viewed stereoscopically. The length of a line, 13 mm, provides the scale for all other measurements. Reduction 22 : 13½.

upper line and the right lower line should be slightly longer than their paired lines. As a control for this possibility a new figure, in which only the positions of the dots were shifted, was composed from the same type as that used for Fig. 1. Essentially, the upper and lower halves of Fig. 1 were reversed for the new figure.

Twenty subjects viewed the two figures, first one then the other, through a Keystone No. 46 Telebinocular stereoscope. Each subject was informed that a given line could appear in one of three ways with respect to his line of sight: the right end could appear closer than the left end, the left end closer than the right end, or both ends could appear equidistant. In giving his report, a subject oriented a pencil in space in order to illustrate what he saw. Sixteen of the 20 subjects perceived the predicted slantings of the lines in each of the two figures. Moreover, upon questioning, the subjects reported that they perceived a particular line as a unit slanting in space. Apparently, they did not judge either end of a given line in relation to its surrounding dots and then infer a depth effect (*2*). The remaining four subjects perceived slants only in some of the lines. Finally, possible printing errors are not responsible for the depth effects of the lines.

It may be concluded that the depth effects of the fused dots induce opposite depth effects in the horizontal lines. Further experiments, testing the generality of this effect, are in progress.

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References and Notes

1. H. Werner, *Am. J. Psychol.* **51**, 489 (1938), has reported a similar effect with a different figure and interpreted it as a "binocular contrast effect." However, K. N. Ogle, *ibid.* **59**, 111 (1946), has questioned Werner's interpretation.
2. Crossing the eyes as a substitute for presentation of figures with a stereoscope leads to similar results; of course, reverse depth effects are obtained. Subjects find it difficult to cross their eyes or they are reluctant to do so. Consequently, this observation is based on myself and another person.

2 March 1964