

I. 次の英文を読み、設問 (1) と (2) に答えなさい。

A Bach Vortex Where All Levels Cross

One cannot help being reminded, when one looks at the diagrams of Strange Loops, of the Endlessly Rising Canon from the *Musical Offering*. A diagram of it would consist of six steps, as is shown in Figure 1. It is too bad that when it returns to C, it is an octave higher rather than at the exact original pitch. Astonishingly enough, it is possible to arrange for it to return exactly to the starting pitch, by using what are called Shepard tones, after the psychologist Roger Shepard, who discovered the idea. The principle of a Shepard-tone scale is shown in Figure 2. In words, it is this: you play parallel scales in several different octave ranges. Each note is weighted independently, and as the notes rise, the weights shift. You make the top octave gradually fade out, while at the same time you are gradually bringing in the bottom octave. Just at the moment you would ordinarily be one octave higher, the weights have shifted precisely so as to reproduce the starting pitch. . . . Thus you can go "up and up forever", never getting any higher! You can try it at your piano. It works even better if the pitches can be synthesized accurately under computer control. Then the illusion

is bewilderingly strong.

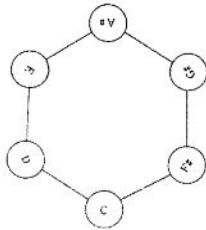


FIGURE 1. The hexagonal modulation scheme of Bach's Endlessly Rising Canon forms a true closed loop when Shepard tones are used.



FIGURE 2. Two complete cycles of a Shepard tone scale, notated for piano. The loudness of each note is proportional to its area; thus, just as the top voice fades out, a new bottom voice feebly enters. (printed by Donald Byrd's program "SMUT".)

This wonderful musical discovery allows the Endlessly Rising Canon to be played in such a way that it joins back onto itself after going "up" an octave. This idea, which Scott Kim and I conceived jointly, has been realized on tape, using a computer music system. The effect is very subtle—but very real. It is quite interesting that Bach himself was apparently aware, in some sense, of such scales, for in his music one can occasionally find passages which roughly exploit the general principle of Shepard tones—for instance, about halfway through the Fantasia from the Fantasia and Fugue in G Minor, for organ.

In his book *J.S. Bach's Musical Offering*, Hans Theodore David writes: Throughout the *Musical Offering*, the reader, performer, or listener is to search for the Royal theme in all its forms. The entire work, therefore, is a *ricercar* in the original, literal sense of the word.

I think this is true; one cannot look deeply enough into the *Musical Offering*. There is always more after one thinks one knows everything. For instance, towards the very end of the *Six-Part Ricercar*, the one he declined to improvise, Bach slyly hid his own name, split between two of the upper voices. Things are going on on many levels in the *Musical Offering*. There are tricks with notes and letter; there are ingenious variations on the King's Theme; there are original kinds of canons; there are extraordinarily complex fugues; there is beauty and extreme depth of emotion; even an exultation in the many-leveledness of the work comes through. The *Musical Offering* is a fugue of fugues, a Tangled Hierarchy like those of Escher and Gödel, an intellectual construction which reminds me, in ways I cannot express, of the beautiful many-voiced fugue of the human mind. And that is why in my book the three strands of Gödel, Escher, and Bach are woven into an Eternal Golden Braid.

D.R. Hofstadter: Goedel, Escher, Bach, Penguin 1984, pp. 717~719

vortex = 渦, 渦巻き	loop = 輪, 環
Musical Offering = 「音楽の捧げ物」	canon = カノン
hexagonal = 六角形の	modulation = 転調
pitch = 音高	range = 音域
synthesize = (音を) 合成する	exploit = 利用する

- (1) 文中で説明されている "Shepard-tone scale" の特徴について簡単に説明し、今日の電子音響技術と音楽文化の関係について自由に論じなさい。(解答用紙 1 枚分, 字数制限なし)
- (2) このような聴覚的錯覚を音楽に用いた例を挙げ、音楽の認知構造について自由に論じなさい。(解答用紙 1 枚分, 字数制限なし)