yet sound so natural that it is invariably confused with ordinary recorded speech. The instrument accomplishing this is the Parametric Artificial Talking Device of the Ministry of Supply Signals Research and Development Establishment. The sounds of most utterances can be specified in terms of six variables. Three of these are the formant frequencies: the other three are the intensity of the voicing; the intensity of the fricative noise which is present in some sounds such as *s*; and the fundamental frequency, which determines the pitch of the utterance. In the Parametric Artificial Talking Device, complex sounds are synthesized in accordance with the variations of these six parameters as functions of time.

In the current experiment, two versions of the phrase *Please say what this word is* were synthesized. The two versions were the same except in the range of their first formants, which were as shown in Table 1. Each version was followed by an identical test sound, which was a word of the form *b*-(vowel)-*t*. Recordings of these sentences followed by the test word were played to fifteen subjects, the playings being separated by at least five minutes. The subjects were asked to indicate whether the last word was *bit*, *bet*, *bat* or *but*. Fourteen of them reported hearing different words in the two cases, despite the identical physical stimulus. The experiment was repeated on fifteen different subjects, but with a ten-second silent interval between the introductory sentence and the test word. In this case only seven subjects described the words as different; the difference between the two groups is significant, $p < 0.01$ by the exact treatment of a 2×2 table.

Table 1. DISTRIBUTION OF RESPONSES FROM THIRTY SUBJECTS

Preceding words with	Test word heard as		
	<i>Bit</i>	<i>Bet</i>	<i>Bat</i>
First formant, 300-675 c.p.s.	20	10	0
First formant, 150-400 c.p.s.	0	19	11

This establishes that there is an auditory parallel to the visual constancy effects cited earlier. Furthermore, the slight differences present in the auditory case may allow fresh experiments to reveal the mechanism of these constancy phenomena. Unlike the visual case, the auditory one allows interpolation of other voices, skewing of the distribution of preliminary stimuli, and similar experiments directed at comparing constancy phenomena with data on level of adaptation in psychophysics².

Finally, the experiment also demonstrates the value of a speech synthesizer, since comparable control of the stimulus could not be achieved using a live voice. The psychological and phonetic implications of these results are now being followed up in further experiments using synthetic speech.

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¹ Joos, M., "Acoustic Phonetics" (*Language Monograph No. 23*; 1948).

² Vernon, M. D., "A Further Study of Visual Perception" (Cambridge, 1952).

³ Helson, H., *Amer. J. Psychol.*, **60**, 1 (1947).

"Automation Economics"

IN his review of my book "The Economic Consequences of Automation" (September 1, p. 444), Mr. Austen Albu, while giving me credit for the originality of my argument on the inflationary effect of the pipeline-lag between input and output during periods of increasing production, accuses me of having contradicted my own theory. He states that the argument conflicts with my view that automation reduces the extent of inflation by raising the output of goods and reducing the need for labour.

Mr. Albu should have noticed, in my chapter entitled "Deflation or Inflation?", the following sentence: "It is our contention that, provided that there is an increase in the aggregate cost of production, the increase in the output is likely to be preceded by an increase in prices, even if there is a decline in the cost per unit" (p. 77).

The word 'aggregate' was italicized in the book. Had he noticed it, he could not possibly have attributed to me the categorical view that automation reduces the extent of inflation. It depends on how automation affects the aggregate cost of production as distinct from cost per unit of output. My attitude is defined even more clearly in the following passage: "In so far as the grand total paid out for raw materials, transport, wages, etc., is reduced [by automation] it results in a reduction in total income and consumers purchasing power, and should therefore tend to produce a deflationary effect. If, however, the total is increased, then the effect of automation will be inflationary even if the cost of production is reduced. . . . For during the 'pipeline-lag' described above, the volume of consumer purchasing power will increase without being accompanied by a corresponding increase in the volume of goods available to consumers" (p. 80).

Throughout the book I endeavoured to avoid answering with a dogmatic 'yes' or 'no' the large number of questions raised by automation in the economic sphere. I gave a list of influences working in favour or against inflation, deflation, unemployment, capital requirements, etc. A reviewer could easily single out apparently conflicting statements and accuse me of having contradicted myself; the only way in which I could have avoided this would have been by presenting only one side of the arguments. Instead, I prefer to rely on the judgment of those who will read my book with sufficient care to form a well-balanced opinion on it.

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IF one accepts Dr. Einzig's view that all steps taken to increase production are inflationary, then the only distinguishable effect of automation is, as he says on p. 84, to reduce the extent of inflation. I think that the appearance of inconsistency arises out of the impression given by the title and some of the chapters that the book is about this mysterious concept 'automation'; whereas it is, in fact, a consideration of more general economic problems.

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