THE EFFECTS OF MEPROBAMATE ON TIME PERCEPTION

By

C. G. COSTELLO

Institute of Psychiatry (Maudsley Hospital), University of London

INTRODUCTION

THE change in time perception produced by the administration of drugs has received a fair amount of attention. Frankenhaeuser (6) has reviewed the work on the effects of hashish and mescaline intoxication on the estimation of time. She concludes that "there seems to be some agreement in that time seems longer than usual in passing but shorter when regarded in retrospect". But this work dealt with introspective reports regarding the passage of time rather than with quantitative changes and will not be discussed further here.

Sterzinger (12, 13) studied the effects of quinine, thyroxine, caffeine and alcohol on time estimation. His results were inconsistent and numerous methodological faults in his work have been pointed out by Frankenhaeuser (6). Clauser (1) reports evidence of the effect of quinine on time estimation but only one subject was used and there are no control data. Frankenhaeuser (6) found that neither quinine nor caffeine produced significant changes in time estimation.

Steinberg (11) studied the effect of 30% nitrous oxide in oxygen on time perception. The subject was required to estimate the duration of 30 seconds by counting aloud at an estimated speed of one count per second. No significant difference was found between the objective time taken to complete the count of thirty under drug and control conditions. Frankenhaeuser (6) refers to a personal communication from Burns (1958) in which he reports that productions of 15-second intervals were markedly longer under the influence of nitrous oxide (20–30 per cent. in oxygen) compared with productions under oxygen. Frankenhaeuser herself found that a mixture of 30 per cent. nitrous oxide and 70 per cent. oxygen did not have a significant effect on present time estimates but did produce significantly smaller past time estimates.

In the study to be reported here we were concerned with the predictions from the drug postulate of Eysenck's theory of cortical excitation-inhibition (3) as to the effects of a depressant drug—meprobamate—on time estimation. Frankenhaeuser has presented evidence showing that increasing the amount of mental content by increasing the amount of external stimulation made the objective second seem subjectively longer whereas a decrease in the amount of mental content had the reverse effect. In so far as an increase in inhibitory potential can be assumed to reduce the amount of mental content one would predict that depressants would make the objective second seem subjectively shorter, whereas stimulants would make the objective second seem subjectively longer. Frankenhaeuser reports that 200 mg. pentobarbital and 10 mg. metamphetamine produced significant changes in present time estimates in line with the above prediction. Goldstone, Boardman and Lhamon (7) have also reported evidence on the effects of 0·2 g. secobarbital (quinalbarbitone) and 15 mg. dextro-amphetamine which are in line with the above prediction. The longer

https://doi.org/10.1192/bjp.107.446.67 Published online by Cambridge University Press

productions of 10 and 20 second intervals after intravenous injections of isomyl (amylobarbitone) reported by Hormia (8) are also in line with the prediction since a decrease in the subjective length of the objective second would be expected to lead to longer productions.

Frankenhaeuser also presented evidence indicating that more was retained of the time units within a given interval under conditions which favoured retention of the events which occupy the time period than under conditions which impede retention. Since an increase in inhibitory potential would be expected to impede retention it can be predicted that stimulant drugs would increase the time retained and depressant drugs would decrease the time retained. Frankenhaeuser's results with secobarbital and dextro-amphetamine are in line with the prediction.

The prediction tested in this study was that meprobamate as a depressant drug would produce a decrease in the reproduction of time intervals.

METHOD

Llewellyn-Thomas (9) describes a technique which amplifies a subject's error in the reproduction of time intervals by using positive feed-back. The technique used in this study was based on that of Llewellyn-Thomas.

A buzzer was used as the Standard. The subject sat blindfolded at a table, the fingers of his right hand on a telegraph key. The buzzer was sounded initially for 5 sec. or 10 sec.; these periods were the initial standards and the order of presentation of the two periods was counterbalanced for the subjects used. The subject was instructed to press the key as soon as the buzzer stopped, thus sounding the buzzer again, and to keep the buzzer sounding by holding the key down for a period which he estimated to be the same as the standard. He was told not to count. He was to release the key and thus stop the buzzer at the end of his judgment.

Five seconds after his judgment, the subject was presented with a further stimulus period which was his own reproduction of the last stimulus. The subject was told that the Standards might not all be the same but was not told that feed-back was being used.

The cycle was repeated ten times. The successive Standards and Judgments were recorded with a stop watch.

Each subject was given two treatments (1) placebo (ii) 800 mg. meprobamate on two different days, the order of treatment being counterbalanced. Both the placebo and meprobamate were in identically appearing tablet form and taken orally. On each day the subject was tested 1½ hours after administration of the treatment.

Subjects

The total N in this experiment was twenty. There were 12 male and 8 female subjects. The ages of the sample ranged between 17 and 47 years with a mean of 29·95 years. All were paid volunteers and were of average or above average intelligence.

RESULTS

Figures 1 and 2 show the results in diagrammatic form. The mean judgment for the twenty subjects is plotted against the number of the cycle. The graph given for the initial 10 sec. Standard demonstrates consistent underestimations on both the placebo day and the drug day.

https://doi.org/10.1192/bjp.107.446.67 Published online by Cambridge University Press

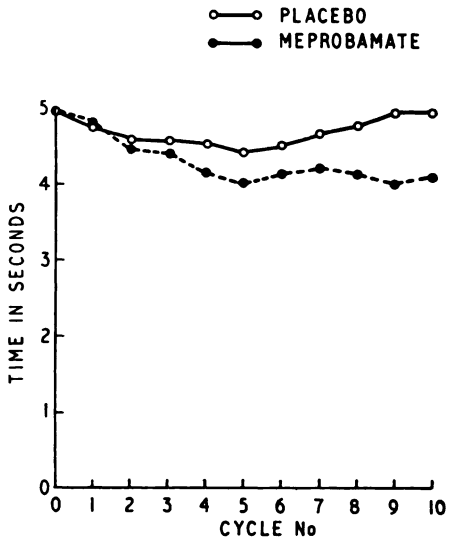


FIG. 1.—The reproductions of the time period (initial Standard 5 sec.) is plotted against the number of the cycle. Each point is the mean of 20 subjects.

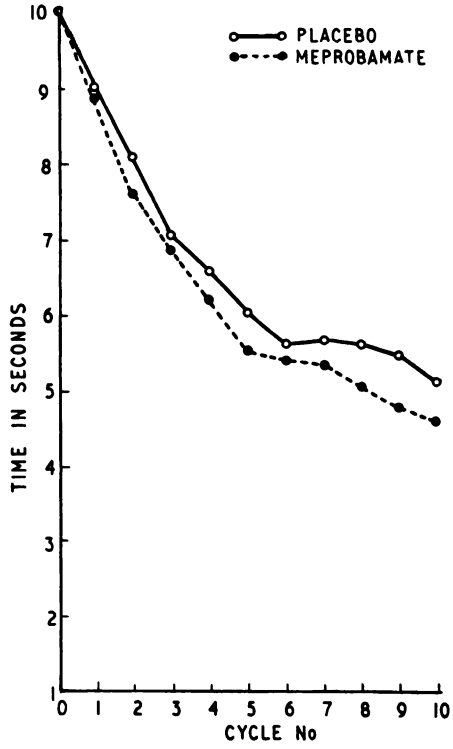


FIG. 2.—The reproduction of the time period (initial Standard 10 sec.) is plotted against the number of the cycle. Each point is the mean of 20 subjects.

https://doi.org/10.1192/bjp.107.446.67 Published online by Cambridge University Press

The graph given for the initial 5 sec. Standard demonstrates no consistent trend on either the placebo or drug day. But in actuality the graph based on the means hides large individual differences. Twelve of the subjects showed consistent underestimations, four showed consistent overestimations and only four showed no consistent trend. Despite these individual differences we have given the graphs based on the means. We are concerned here with the differences between the placebo and drug day readings and the feed-back method has simply been used in an attempt to amplify this difference. Llewellyn-Thomas (9) has presented individual curves in his paper and has discussed their significance.

It can be seen that meprobamate as predicted tends to produce a decrease in the reproduction of the time intervals. The difference between the placebo and drug day reproductions is greater the later the cycle in the series.

Despite the consistency of the treatment effect over the ten cycles so far as the mean scores were concerned, there were large individual differences in the treatment effect. The difference between the means at the tenth cycle for both the initial 5 sec. and 10 sec. Standards were not statistically significant when tested with a t test.

Analyses of variance were carried out for the initial 5 sec. and 10 sec. Standard. It can be seen in Tables I and II that the main "Treatment" effect was

TABLE I

Analyses of variance of the results for the 5 sec. initial Standard

Source	Degree of Freedom	Sums of Squares	Mean Squares	F	P
Subjects	19	1933·80	101·78	6·790	<·001
Treatments	1	17·98	17·98	1·199	N.S.
Days	1	5·11	5·11	—	N.S.
Residual (1)	18	269·87	14·99	19·854	<·001
Total	39	2226·76			
Cycles	9	7·28	·809	1·071	N.S.
Cycles/Subject	171	502·87	2·94	3·894	<·001
Cycles/Treatment ..	9	9·41	1·04	1·384	N.S.
Cycles/Day	9	1·92	·21	—	N.S.
Residual (2)	162	122·35	·75		
Total	399	2870·59			

TABLE II

Analysis of variance of the results for the 10 sec. initial Standard

Source	Degree of Freedom	Sums of Squares	Mean Squares	F	P
Subjects	19	3468·63	182·56	5·596	<·001
Treatments	1	86·31	86·31	2·646	N.S.
Days	1	18·41	18·41	—	N.S.
Residual (1)	18	587·20	32·62	21·517	<·001
Total	39	4160·55			
Cycles	9	640·17	71·13	46·919	<·001
Cycles/Subject ..	171	499·00	2·92	1·926	<·001
Cycles/Treatment ..	9	8·73	·97	·640	N.S.
Cycles/Day	9	9·48	1·05	·695	N.S.
Residual (2)	162	245·67	1·52		
Total	399	5563·60			

https://doi.org/10.1192/bjp.107.446.67 Published online by Cambridge University Press

not significant for either initial Standard. This is due to the highly significant "Subject/Treatment" interaction in the case of both Standards. It can be seen also that the main "Subject" effect is significant for both standards and the main "Cycle" effect is significant for the 10 sec. Standard. The "Subject/Cycle" interaction is significant for both Standards.

The Wilcox Matched-Pairs Signed-Ranks Test (10) was also applied to the differences between the placebo and drug readings at the tenth cycle for both the 5 sec. and 10 sec. initial Standard. But on this test as on the parametric ones above, the differences were not significant.

Extraversion scores from the M.P.I. (4) were available for all the subjects. In view of the large individual differences it was decided to correlate these scores with the scores on the time estimation test.

Eysenck (5) investigated the relationship between personality and the reproduction of four time periods 5 sec., 10 sec., 20 sec., and 30 sec. His subjects were 30 extraverted neurotics and 30 introverted neurotics chosen from 160 patients on the basis of their scores on the M.P.I. He found that extraverts gave significantly shorter reproductions than introverts, the difference between the means being significant for the 5 sec. and 10 sec. periods.

Eysenck's results are what one would predict from his theory of cortical excitation-inhibition and Frankenhaeuser's analysis of the processes involved in the retention of time. It will be remembered that Eysenck postulates that inhibitory potential builds up more readily in extraverts than in introverts.

It is clear that one would expect a negative correlation between extraversion scores and the scores representing the reproductions of the time intervals. Product moment correlations were calculated between the E scores and the subjects' reproductions of the 5 sec. and 10 sec. period at the 1st and 10th cycle on the placebo day. All the correlations were negative but insignificant (r ranged from —·11 to —·18).

In so far as inhibition is postulated by Eysenck to build up more quickly in extraverts one would predict a positive correlation between E and the decrease in the reproductions produced by meprobamate. Product moment correlations were calculated between E scores and the percentage decrease in the reproductions produced by the drug at the 1st and 10th cycle for both the 5 sec. and 10 sec. initial Standard. All the correlations were negative contrary to prediction but were insignificant, the r for the 10 sec. initial Standard was —·19 at the 1st cycle and —·32 at the 10th cycle. The correlation for the 5 sec. initial standard was —·12 at the 1st cycle and —·03 at the 10th cycle.

Discussion

Despite the demonstrated tendency of meprobamate to produce a decrease in the reproductions of time periods further work would need to be done before it could be established definitely whether or not meprobamate had the same effects as other depressants on time estimation.

Further work also needs to be done to establish the relationships between personality and time estimation. Here again only tendencies have been revealed by the signs of the correlations.

A number of reasons may be suggested for the failure in this study to obtain a significant drug effect:

(*i*) The subjects used were also given an after-image and spiral after-effect test and the experiment was designed primarily to investigate individual differences in drug effects. Individual differences in the effect of the drug on the after-image and the spiral after-effect were shown to be significantly correlated with

https://doi.org/10.1192/bjp.107.446.67 Published online by Cambridge University Press

extraversion scores in an earlier study (2). These significant correlations occurred when measures of the drug effect 1½ hours after administration of meprobamate were used. It was for this reason that the time since administration of treatment was set at 1½ hours in the present study. It may be that the drug effects on time estimation would show up more clearly if a longer time was allowed to elapse between the administration of the drug and testing. It was found in the earlier study mentioned above that the effect of meprobamate on the after image increased up to 3½ hours after administration of the drug.

(*ii*) We have noted in the introduction that Steinberg found no significant difference between the objective time taken to complete the count of thirty under drug and control conditions. She did find, however, that both the placebo and the nitrous oxide produced a significant increase in the objective time taken when the results were compared with pre-placebo and pre-drug conditions. No pre-drug readings were taken in the present study. It may be that the placebo also produced a decrease in the reproduction of the time intervals thus masking the effect of the meprobamate.

(*iii*) Perhaps more important than the above two reasons is the following. Frankenhaeuser has criticized the method of reproduction in the study of time estimation on the grounds of its being a highly complex measure of time perception involving estimates of present and past time. She did not find any significant effects produced by pentobarbital or metamphetamine on the reproduction of a 10 sec. period.

The complexity of the method of reproduction is worth examining a little further. In so far as the method involves estimates of past time one would predict that meprobamate would produce a decrease in the reproduction. The argument for this has been outlined above. But in so far as it involves estimates of present time during the actual reproduction one would predict an increase in the objective duration of the reproduction. Thus, the effect of meprobamate on the estimation of past time might be masked partly by its effect on the estimation of present time.

It may be that the complexity of this method of time estimation also accounts for the lack in this study of significant correlations between personality and the time estimates.

It would seem then that more refined methods of studying time estimation will have to be used in future. Some combinations of Llewellyn-Thomas's feed-back technique and Frankenhaeuser's techniques may prove more sensitive to drug effects and personality differences.

Summary

(1) The effects of meprobamate on the reproduction of a 5 sec. period and a 10 sec. period was investigated. A feed-back technique was used to amplify the drug effect.

(2) Twenty subjects were tested under two conditions each on two separate occasions. The two conditions were (i) administration of placebo; (ii) administration of 800 mg. meprobamate. Testing was done on each day 1½ hours after administration of treatment.

(3) The drug tended to produce a decrease in the reproduction of the time periods as predicted, but the effects were not significant.

(4) Negative correlations were found as predicted between extraversion and the reproduction of the time periods under placebo conditions, but none of the

https://doi.org/10.1192/bjp.107.446.67 Published online by Cambridge University Press

correlations were significant. Negative correlations were also found between extraversion and the effects of the drug on the reproduction of time, but none of the correlations were significant.

(5) A number of possible reasons for the lack of significant results have been presented.

References

1. Clauser, G., *Die Kopfuhr. Das automatisches Erwachen.* Stuttgart: Enke, 1954.
2. Costello, C. G. The effects of a depressant drug on certain perceptual tests. Ph.D. Thesis, University of London, 1960.
3. Eysenck, H. J., "Cortical inhibition, figural after-effect and theory of personality", *J. abnorm. soc. Psychol.*, 1955, **51**, 94–106.
4. Eysenck, H. J., The Maudsley Personality Inventory. University of London Press, 1959.
5. Eysenck, H. J., "Personality and the estimation of time", *Percept. Mot. Skills*, 1959, **9**, 405–406.
6. Frankenhaeuser, M., *Estimation of Time.* Stockholm: Almquist & Wiksell, 1959.
7. Goldstone, S., Boardman, W. K., and Lhamon, W. T., "Effect of quinalbarbitone, dextro-amphetamine, and placebo on apparent time", *Brit. J. Psychol.*, 1958, **49**, 324–328.
8. Hormia, A., "On the sensation of duration, especially regarding the relations between the intensity and duration of sensation", *Annal. Acad. Sci., Fennicae V. Medica-Anthropol*, 1956, 58.
9. Llewellyn-Thomas, E., "Successive time estimation during automatic positive feed-back", *Percept. Mot. Skills*, 1959, **9**, 219–224.
10. Siegel, S., *Nonparametric statistics for the behavioural sciences.* New York: McGraw-Hill, 1956.
11. Steinberg, H., "Changes in time perception induced by an anaesthetic drug", *Brit. J. Psychol.*, 1955, **46**, 273–279.
12. Sterzinger, O., "Chemopsychologische Untersuchungen über den Zeitsinn", *Z. Psychol. Physiol. Sinnesorg.*, 1935, **134**, 100–131.
13. Sterzinger, O., "Neue chemopsychologische Untersuchungen über den menschlichen Zeitsinn", *Z. Psychol. Physiol. Sinnesorg.*, 1938, **143**, 391–406.

https://doi.org/10.1192/bjp.107.446.67 Published online by Cambridge University Press