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SUBJECTIVE DURATION OF EVERY THREE-YEAR PERIOD FOR 3 TO 18 YEARS OF AGE, ESTIMATED BY STUDENTS

YOICHI ANDO, HIROKO TSURUTA*, AKIO MOTOKAWA**, TAKAJI MATSUSHIMA, AND KAZI SAIFUDDIN

Graduate School of Science and Technology, Kobe University, Rokkodai, Nada, Kobe 657-8501, Japan.
**Joined for this project, ** Now at Obayasi-Gumi Co., Osaka*

Results indicated that both subjective time durations, one day and three years, are well described by the normal distribution if the time scale is logarithmic rather than linear. A remarkable finding obtained here is that in reference to the mean subjective time duration of the junior high school (three years), the mean subjective time durations for each of the three-year periods before elementary school were significantly longer than unity (about 1.2), and the subjective duration of the three year period of the senior high school is significantly shorter (about 0.8). When subjects transferred to other elementary schools at 6 to 11 years of age, the mean subjective time duration of the periods below 11 years of age was much longer, more than 1.3.

INTRODUCTION

Little is known about the relation between duration experience and age. We surveyed a group of university students and evaluated their subjective impressions of the one-day and three-year periods. More than 500 university students set out on an ocean voyage aboard a 22,000-ton charter vessel for 30 days between Kobe, Japan, and Perth, Australia, as a summer session. At almost the end of the journey, 285 students participated in an investigation of subjective duration. First, it was examined whether the impression was described on a logarithmic scale. Second, in reference to the subjective duration for three years during junior high school, the subjective durations of the three years before elementary school, of the lower and upper classes of elementary school, and of senior high school were examined. The effects of transferring to other elementary schools are also discussed.

PROCEDURE

To obtain the subjective impression of every three-year period for 15 years from 3 through 18 years of age, minimizing the effects of individual conditions of life, students on the 30-day ocean voyage between Kobe and Perth in a summer session were selected as subjects. The total number of subjects participating in this investigation, performed in a large lecture room of the chartered boat, was 285 (81% female and 19% male). Most were juniors and sophomores (Table1).

Questionnaires were distributed, and the subjects were asked to carefully respond with their subjective impressions of the following time durations:

Q1: One day in the voyage relative to that of the usual university day before the voyage;
Q2: The three years before elementary school, relative to that of the three-year junior high school period (JHSP);
Q3: The three years of the lower class of elementary school, relative to that of the JHSP;
Q4: The three years of the upper class of elementary school, relative to that of the JHSP;
Q5: The three years of the senior high school, relative to that of the JHSP;

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Table 1. Age of subjects participated.

Age	Number	%
18	13	4.6
19	117	41.0
20	127	44.6
21	26	9.1
22	2	0.7
Total	285	100.0

Thus this method is similar to the magnitude estimation.

Subjective durations were given as numbers from 0.1 through 3.0 in steps 0.1. Furthermore, a question was included asking which of the three-year periods was the most delightful and splendid.

RESULTS

Subjective duration of one day during voyage

The percentage cumulative frequencies of varied 282 data are shown in Figure 1 as a function of the time ratio on linear and on logarithmic scales. If the distribution is normal, it should be possible to draw a straight line through the plotted points. Comparing (a) and (b) in Figure 1, we can see that straight lines can be fitted when the percentages are plotted with the time ratio on a logarithmic scale.

It is interesting that 67% of the subjects rated the subjective duration of one day during the voyage shorter than that of the usual college day, but this percentage is not significantly different from the null hypothesis (50%).

Subjective duration for three-year periods

The percentage of cumulative frequencies of the data as a function of the time ratio on linear and on the logarithmic scales is shown in Figure 2. Rather straight lines are clearly obtained with the logarithmic time scales, but not with the linear ones. The results of the test of normal distribution are indicated in Table 2. It is remarkable that the three lines (Q2, Q4, and Q5) are well described as the normal distribution ($p > 0.05$, $p > 0.05$, and $p > 0.05$) on the logarithmic time scale, but not on the

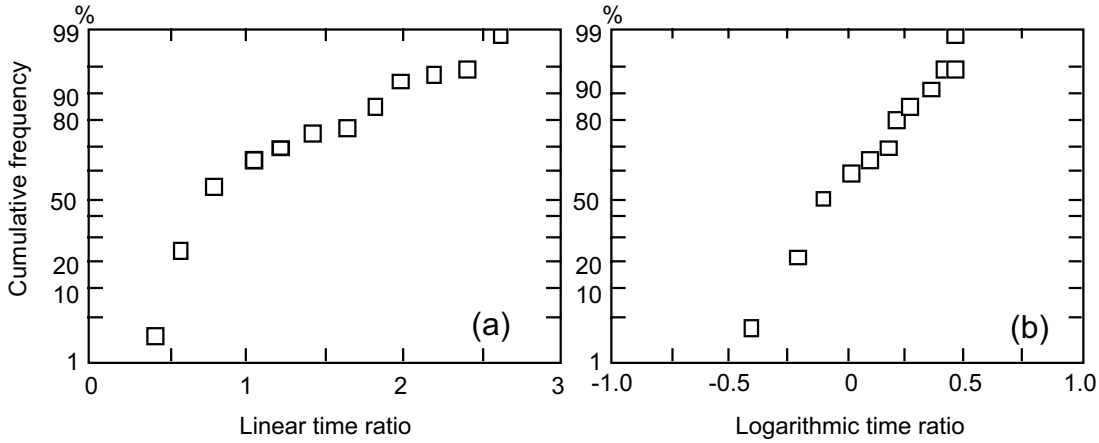

Fig. 1. The percentage cumulative frequency of subjects as a function of the ratio of the perceived duration of one day during the voyage to that of one day before the voyage. (a) As a function of the linear time ratio; (b) as a function of the logarithmic time ratio.

Table 2. Test of normal distribution on the logarithmic and linear time scale.

Scale	Questions	Degree of freedom	Chi-square	Probability (p)	Lebel of significance
Linear scale	Q2	3	41.98	4.044×10^{-9}	$p < 0.001$
	Q4	3	24.24	2.220×10^{-5}	$p < 0.001$
	Q5	3	84.49	3.330×10^{-18}	$p < 0.001$
Logarithmic scale	Q2	3	3.00	0.391	$p > 0.05$
	Q4	3	7.77	0.051	$p > 0.05$
	Q5	3	6.93	0.074	$p > 0.05$

Table 3. Analysis of variance with three variables.

Variable	Sum of squares	Degree of freedom	Mean square	F	Significance
Sex	0.34	1	0.34	0.85	p=0.356
Experience transferring schools	1.58	1	1.58	3.98	p=0.046
Periods of three years	20.45	3	6.82	17.17	p<0.001
Two-way interactions	1.43	7	0.20	0.51	p=0.825

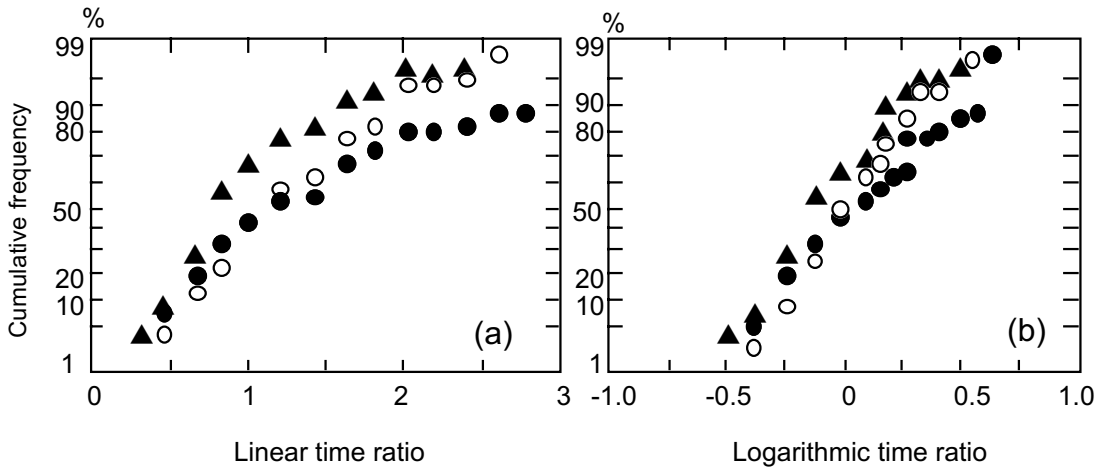

Fig. 2. The percentage cumulative frequency of subjects. ●: The three years before elementary school (3 to 5 years old); ○: the three years during the upper classes of elementary school (9 to 11 years old); ▲: the three years during senior high school (15 to 17 years old). (a) As a function of the linear time ratio; (b) as a function of the logarithmic time ratio.

linear ones ($p < 0.001$, $p < 0.001$, and $p < 0.001$). For the sake of simplification, the results from Q3 are not plotted in this figure. Significant differences from the null hypothesis of unity are indicated for all these results by one-tailed t-testing ($p < 0.01$).

The analysis of variance on the subjective duration was performed with (1) sex of subject, (2) experience of transferring elemental schools because of a change of family's residence, and (3) periods of three years as factors. The results are listed in Table 3. Significant differences can be seen in (3) periods of three years and (2) experience of the transfer of elemental schools, but not in sex of the

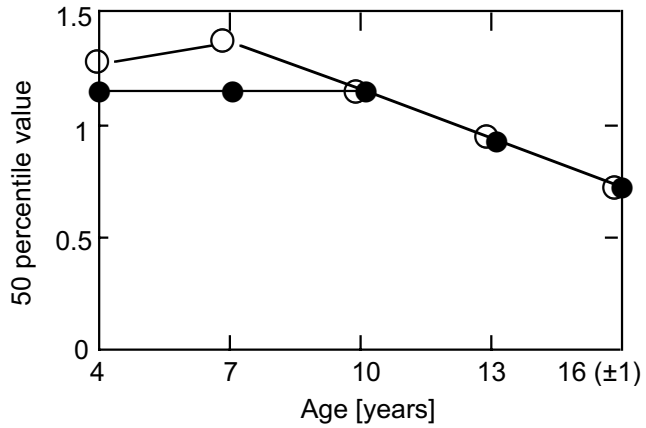

Fig. 3. The 50th percentile values of the time ratio. ○ : Subjects who transferred to other elementary schools from the ages of 6 to 8 (47 subjects) and from the ages of 9 to 11 (23 subjects). ● : Subjects who did not transfer to other elementary schools.

subject.

Figure 3 indicates the 50th percentile values as a function of the age of a three-year range both for subjects who moved and transferred to another elementary school and for subjects who did not.

For subjects who did not change elementary schools, results from Q2 (3 to 5 years of age) through Q4 (9 to 11 years of age) reveal that these subjective durations are relative to that of the JHSP, longer than unity, 1.2; and results from Q5 (15 to 17 years of age) indicate that this subjective duration is significantly shorter than unity, 0.8 ($p < 0.01$). For subjects who transferred to other elementary schools, the subjective durations for 3 to 5 and 6 to 8 years of age were significantly longer, 1.3 or more, than those for subjects who did not transfer ($p < 0.05$).

DISCUSSION

Results indicate that as far as normal distribution is concerned, the subjective durations of the one-day and the three-year periods are well described on the logarithmic time scale. This is consistent with the results of previous studies of the subjective duration of intervals (Eisler, 1975; Ando, 1977; Ando and Ando, unpublished).

The remarkable finding of this investigation is that the 50th percentile mean values for the three-year periods below the age of 11 years are about 20% longer than that of the three-year JHSP, but that the mean values subjective duration of the period from 15 to 17 years of age is 20% shorter. This tendency is correlated with the percentage of subjects who answered that this period was the most

Table 4. The most splendid periods below 18 years of age.

Period (age)	Number	Percent
6-8 years old	11	3.9
9-11 years old	29	10.2
12-14 years old	69	24.3
15-17 years old	175	61.6
Total	284	100.0

splendid and delightful period among the periods, as indicated in Table 4. On the average, if the period is more splendid and delightful, its subjective duration is shorter. In contrast, if a subject transferred from one elementary school to another, the stress may have led to a longer subjective duration for the corresponding period (6 to 8 years old) and the former period (3 to 5 years old).

We consider the duration experience or the perception of time duration in the brain: if no activities of the brain $\alpha(t)=0$, it is then considered that time perception is zero, such that T=0. If our brain is developed after birth, then time perception will emerge. The duration experience is prolonged because of the degree of the brain activities associated with development, which may be related to some extent to movements in the environment. This duration experience may depend on a degree of brain development resulting from new experiences and new information from the environment. When brain has become accustomed to daily environments and life, the duration experience may be shortened. If we assure that $\alpha(t)=0$ is overall activity associative development of the brain by means of learning, cognition, and creation, the maximum duration experience may be obtained at $d\alpha(t)/dt=0$. Thus, if a pupil moved from an accustomed school life to an unknown school environment with different pupils, the duration experience of the pupil may be prolonged in this manner.

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