Differences between Kuwaiti and British College Students on Receiver Operating Characteristics of Time Judgment: A Comparative Study*

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Abstract: The present study investigated the cross-cultural differences between Kuwaiti and British subjects in terms of receiver operating characteristics (ROC) on the judgment of short time intervals at different times of the day. The subjects were 232 students from two universities: Kuwait University and Sussex University (116 Kuwaiti students, with a mean age of 19.68., SD of 1.65 yr, and 116 British students with a mean age of 18.71, SD of 1.07 yr). The total sample consisted of 99 males and 133 females, with a mean age of 19.30 yr and SD of 1.65 yr. They were asked to judge the duration of two tones of sound of 60 db each, for 850 msec and 1000 msec presented one at a time, and to determine whether it was the short or the long interval at three different times of the day (0800, 1200, and 1700 h). A signal detection paradigm was used to obtain the (d) Prime ROC curves of their judgments. The results indicated that the British participants had higher values of (d) and ROC curves than the Kuwaiti subjects at noon and in the evening (1200 and 1700 h); but, in the morning (0800 h), they were almost similar. The time perception and time estimation are influenced by the norms of the culture the people live in. An understanding of the nature of that influence may provide important clues about various psychological experiences.

Key words: Comparative study, Receivber operating characteristics (ROC), Time judgment, Cross-cultural.

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* This study was supported by Kuwait University under grant No. OP02/08.

Introduction

Time perception has become an important aspect of human efficiency. Human behavior has a temporal dimension, which means that human beings react to a stimulus, which in turn, has a time frame. This notion of time perception was introduced by Fraisse (1963). This objective and behavioral aspect of time perception has made it amenable to scientific experimentation and more vigorously in the last century. For example, evidence suggests that the perception of how quickly time passes plays a psychological role in many aspects of human life; it is also related to psychological disorders such as depression (Mezey and Cohen, 1961). Carstensen and Fredrickson (1998) and Carstensen and Turk-Charles (1994) indicated that perception of the amount of future time may have an impact on the goals that people pursue in their lives.

Bschor, Ising, Lewitzka, Muller-Orlinghausen, and Baethhge (2004) studied the time sense of depressed patients. They found that both depressed and manic patients overestimate time compared with healthy control groups. However, the depressed group, a statistically significant difference compared with healthy controls could only be found in the production of time, but not in the estimation of tasks.

Since the implication of the Signal Detection Theory (SDT) in perception (Tanner and Swets, 1954), there have been a number of attempts to apply this approach in a variety of contexts. The SDT in perceptual discrimination tasks involves two separate processes: efficiency of the sensory process (d) and decision-making criterion (B). Pastore and Scheimer (1974) have reviewed several studies using SDT in the field of animal learning, audiology, speech perception, memory, and attention.

Yonelinas (1994) indicated that increasing the length of the study list increased the intercept of d's, but it decreased the slope of the receiver operating characteristics (ROC) and increased the probability of recollection in recognition judgment. SDT and ROCs have been applied to explain perceptual differences between introverts and extroverts. It has been found that introverts have higher (d) and (B) than extroverts in the morning (0800 h), but these results would be reversed in the evening (1700 h). The extroverts have higher values of d and B in the evening (Baroun, Sen, and Anima, 1996; Baroun and Sen, 1997; Craig, 1979; Sen and Goel, 1981; and Sen and Ranjan, 1990).

Heagerty and Zhen (2005) introduced a new version of time-dependent sensitivity, specificity, and associated ROC curves that are useful for characterizing the predictive accuracy of a scalar marker, such as a derived model score, when the outcome is a censored survival time. They showed that the area under the time-specific ROC can be plotted as a function of time to characterize temporal changes in accuracy and can be integrated using the marginal distribution of failure time to prove a global concordance summary. Incident sensitivity and dynamic specificity are shown to be easily estimated using a fitted hazard model and the empirical-distribution of the marker data within risk sets.

Craig (1979) investigated the variation in a binary discrimination task at two different times of the day, morning (0800 h) and evening (2000 h), depending on body temperature. The subject's task was to report not only the presence of two signals (A and B) but also the confidence of their judgment. The results indicated that there was no significant difference in the efficiency (d) of the discrimination of signal between the two times of day (morning and evening). However, there was a significant difference in response bias (B) and they reported greater confidence in the morning than in the evening.

Several comparative studies on time estimation and time recall have been carried out, and it was found that people of different cultures estimate and judge time intervals differently. Engle and Lumpkin (1992) examined the effect of cognitive enhancement and cultural differences on recall accuracy. The cognitive enhancement strategy involved improving cues to the subjects to increase the number of activities recalled. The results revealed that recall accuracy could be increased by improving strategies and there was a considerable cross-cultural similarity in recall accuracy under the high-enhancement condition. They indicated no significant differences in time judgment between two cultures (i.e., Californians and Guatemalans).

Baroun and Sen (1997a) investigated whether or not Kuwaiti and Indian subjects cross-culturally would differ in the ROC on time judgment at different times of day. The subjects were 132 university students (66 Kuwaiti students and 66 Indian students). The results revealed that, although there were no differences in the d's and ROC's between them in the morning and at noon, there were significant differences in the evening -i.e., the Kuwaitis were more sensitive to time judgment than Indians.

In fact, time perception may have important implications in many areas of psychology, including social, personality, development, cultural, and cognitive psychology (McGrath and Kelly, 1986; Carstensen, Isscowitz, and Charles, 1999;). Conway III (2004) suggested that individual experiences of time and of mood tend to become more like those of other group members in an interactive context. Ji, Guo, and Zhag (2009) have shown evidence that culture shapes the way people think and reason, they found that European North Americans (including Americans and Canadians) are analytic in their thinking, in contrast, East Asians (including Chinese, Japanese, and Koreans) are holistic in their thinking. As an example, the Chinese perceived past events (past time) as being closer to the present than did Canadians, this suggest that Chinese had a greater awareness of the past.

In the same line of study Fung, Lai, and Ng (2001) examined the Socioemotional theory, which holds that as people recognize the inevitable constraint of time imposed by mortality, their goals change, motivating them to limit social contact with those with whom they are emotionally close. This theory was tested among Taiwanese and Mainland Chinese. Their results revealed that adults (aged 60-90 years) in both cultures were more likely than younger adults (aged 18-30 years) to prefer familiar social partners who were most likely to provide emotionally close social interactions. These age and cultural differences were eliminated when differences in perceived time were statistically controlled.

Gil, Niedenthal, and Droit-Volet (2007) examined age-related variations in judgments of time duration. The results showed that 3-year-old children were able to estimate time, although sensitivity to time increased with age, this idea is supported with the internal clock, which is functional at an early age. Wearden, Norton, Martin, and Montford-Bebb (2007) in their experiment found that filled intervals are perceived as, on an average, longer in duration than unfilled ones. They found also, that there were no differences in absolute variability between verbal estimates of filled and unfilled intervals. Noulhiane, Mella, Samson, and Pouthas (2007) found that emotions are only affected in the processing of a short duration (up to around 3-4 seconds). This finding was consistent with that of Angrilli et al., (1997), who observed a significant arousal effect for 2 seconds.

The present study was designed to investigate whether Kuwaiti and British subjects would cross-culturally differ in ROC on time judgment at

different times of the day: morning (0800 h), noon (1200 h), and evening (1700 h). It was hypothesized that there would be no significant differences between the nationality viz., Kuwaiti and British samples in terms of time judgment at different times of day. The Variables of the study were two nationalities, three different times of day, and two tones of sound (60 db) as independent variables, whereas the dependent variables were time judgment, the efficiency of sensory process (d prime), and Receiver Operating Characteristics (ROC curves).

It is important to understand how time perception and time estimation are influenced by the norms of the culture the people live in. An understanding of the nature of that influence may provide important clues about various psychological experiences.

Method

Subjects:

Participants were 232 undergraduate students of two nationalities (Kuwaiti and British) from Kuwait University and Sussex University. The sample consisted of 116 Kuwaiti students (45 males and 71 females with a mean age of 19.68., SD of 1.65 yr), and 116 British students (54 males and 62 females with a mean age of 18.71, SD 1.07 yrs), enrolled in undergraduate courses in both Kuwait and Sussex universities. The mean age of the total sample was 19.30 yr and SD was 1.65 yr. The participants came to the laboratory in groups of 5-10. Each group was tested according to a time table. Three experimental sessions were carried out on three different days at three different times of day. The participants were given some gifts as incentive to participate in the experiment.

Materials used:

To achieve the objective of this study, the following variables were selected. A tape recorder was used to produce sound intervals of 850 msec (short interval) and 1000 msec (long interval); the intensity of the sound was 60 db (1000 spc). The tones were recorded from a sound generator, controlled by a computer into the tape recorder (recorded in Sussex University laboratory). These two time intervals were selected on the basis of the results of a pilot study conducted on 20 subjects, who judged tones of different time intervals to determine the short tone interval or the long tone interval. The particular pair of intervals was chosen on the basis of a

criterion such that the difference between these two intervals could be detected at least 50% of the time. Three randomly ordered sets of tapes were recorded. Each tape consisted of 30 practice trials and 120 test trials. The set of tapes called A was used for 0800 h, B for 1200 h, and C for 1700 h, so that no subject was tested with the same set of ordered tones at the same time of the day. These presentations aimed at eliminating participant expectation of receiving each tone 50% of the time.

Procedures:

The subjects were asked to judge the duration of two tones of either 850 msec. (short interval) or 1000 msec. (long interval), which were presented one at a time. They were instructed to determine whether it was the short or long interval at three times of the day. The test was done at three different times of the day: morning (0800 h), noon (1200 h), and evening (1700 h). The subjects were asked to write down their judgment on an answer sheet. Before the experiment started, there were demonstration trials during which the two tones were presented 10 times each, where the subjects were informed which of the tones represented the short interval and the long interval. Following the demonstration trials, there was a practice session (30 trials) where the subjects were given feedback about their responses. During the experiment, 120 trials were given to each subject, and the data were collected. The two time intervals were presented randomly, the long time interval being presented 70 times and the short time interval 50 times. This type of presentation was done to avoid subject expectation of each type 50% of the time.

The participants heard and judged each tone, and estimated whether it was (S) definitely sure it is a short tone, (S?) fairly sure it is a short tone, (L) definitely sure it is a long tone, and (L?) fairly sure it is a long tone. Participants responded by encircling either S, S?, L, and L?, as appropriate on the answer sheet.

The formulas for 'False Alarm' score and 'Hit' score are:

False alarm score = Hit A + / (Hit A / Miss A + Hit B) where Miss A means incorrect detection of signal (Miss of short intervals) and Hit B means correct detection of signal B (hit of long intervals).

Hit scores = Hit A / (Hit A + Miss B) where Hit A means correct detection of signal A (hit of short intervals) and Miss B means incorrect detection of signal B (miss of long intervals).

Results:

The means (M) and standard deviations (SD) of efficiency of sensory process (d) of Kuwaiti students and British students were computed with respect to short and long time intervals. The results are shown in Tables 1 and 2.

Table 1
Mean and standard deviation of the efficiency of sensory process (d) with respect to nationality.

Nationality	N (232)	M	SD	t	p
British	116	8.47	2.65	12.68	.001
Kuwaiti	116	7.13	3.08		

Table (1) shows the means and SDs for the derived measure of efficiency of sensory process (d), total (d), and t ratio of the short and long time intervals for each of the two nationalities. British students had a higher mean score than their Kuwaiti counterparts.

Table 2
Mean and standard deviation of the efficiency of sensory process (d) at different times of day with respect to nationality

Nationality	N (232)	08.00		12.00		17.00	
		M	SD	M	SD	M	SD
British	116	2.74	1.56	2.38	1.06	3.35	1.98
Kuwait	116	2.73	1.92	1.93	1.22	2.45	2.10
t		.001		8.63		11.14	
p		n1		.01		.001	

Table (2) shows the means and SDs of the derived measure of efficiency of sensory process (d) of the short and long time intervals for each nationality at three times of the day. At 0800 h, Kuwaiti students had almost the same mean as the British students. At noon time (1200 h), the British students had a higher mean of (d) than the Kuwaiti students. At 1700 h, the British students again had a higher mean of (d) than the Kuwaiti students.

The ROC diagrams were made by plotting the proportion of hits and proportion of false alarms. The vertical and horizontal axes

represent these proportions. A single point expresses the proportion of hits plotted against the proportion of false alarms. Individuals with stricter criteria have points to the left on the horizontal axis and toward the bottom of the vertical axis. Those with lenient criteria have points toward the upper right (Kimble, Garmezy, & Zigler, 1984).

The ROC diagrams were drawn separately for the three different times of day (0800 h, 1200 h,, and 1700 h) and are presented in Figures 1-3.

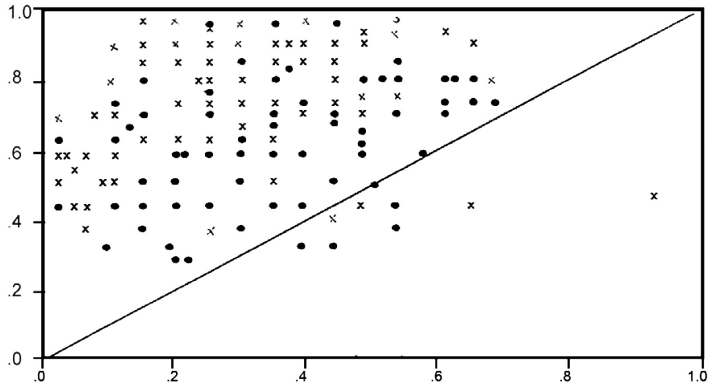

Figure 1: ROC curve of Kuwait and British in the morning (0800 hrs.)

Figure (1) shows the ROC curves of the Kuwaiti students and British students in the morning (0800 h). The Kuwaiti students and British students had almost the same cluster in the upper half of the graph.

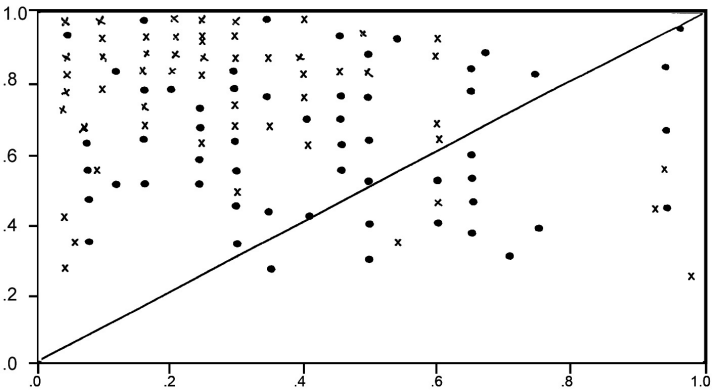

Figure 2: ROC curve of Kuwait and British in the noon (12:00 hrs.)

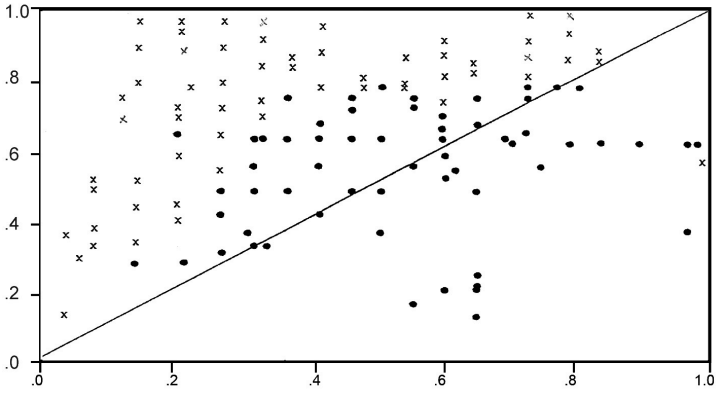

Figure 3: ROC curve of Kuwait and British in the evening (17:00 hrs.)

Figures (2) and (3) show the ROC curves of the British students and Kuwaiti students at noon and in the evening (1200 h and 1700 h). The British students had a cluster of ROCs in the upper portion of the graph, whereas the Kuwaiti students had the cluster in the lower portion.

Discussion:

The efficiency of the sensory process (d prime) in time judgment (Table 1) showed that there were significant differences between Kuwaiti and British students in terms of d-i.e. The British students had higher values of d than their Kuwaiti counterparts. This indicated that British students were more sensitive to time judgment than the Kuwaiti students in overall time estimations (tone intervals).

Looking at the efficiency of the sensory process (d) in time judgment at different times of the day, the results showed that both Kuwaiti and British students almost had similar values in the morning (0800 h), but at noon and evening (1200 and 1700 h), there were significantly different values of d's for the British and the Kuwaiti students. The British students had greater mean values of d's than the Kuwaiti students. This means that the performance of the British students at noon and in the evening was at a higher level, whereas, that of the Kuwaiti students dropped to a lower level. This could mean that British were more aware of time passage than Kuwaiti. It is well known that British people are more fanatical about time, through their life they become more aware that time is in some sense "running out." For the British lifestyle, time is

very important and it is essential to make the right choice, not to waste time on gradually diminishing future payoffs.

Conway III (2004) indicated that people's consensus on time perception can influence each other, which emerges in the context where participants are not directly engaged in a time perception task. Carstensen, Isaacowitz, and Charles (1999) argued that the perception of time is inevitably linked to the selection and pursuit of social goals. The perception of time plays a central role in prioritization of social goals and subsequent preferences for social partners. People are always aware of time -not only of clock and calendar time, but of lifetime.

The results of the ROC curves showed that the Kuwaiti and British students had similar clusters in the upper graph in the morning (0800 h). However, these results changed at noon and in the evening; the British students had the cluster of ROC in the upper half of the graph, while the Kuwaiti students had this in the lower half, near the chance level of performance. This finding is in line with that of Baroun and Sen (1997b), who found that although there were no differences in d's and ROC's between Kuwaiti and Indian subjects in the morning and at noon, there were significant differences between them in the evening.

The two distinct clusters of ROCs of Kuwaiti and British samples at noon and in the evening indicate a marked difference in the performance and sensitivity of the two samples. The British students were more sensitive to time judgment than the Kuwaiti students at noon and in the evening. This result corroborates other studies that have been carried out to examine the performance among different cultures (Engle & Lumpkin, 1992; FormyDuval, Williams, Patterson & Fogle, 1995; Ying, 1990).

In conclusion, the present results indicate significant differences between Kuwaiti and British samples in time judgment at different times of the day. The British subjects had higher values of (d) and ROC curves than the Kuwaiti subjects at noon and in the evening (1200 and 1700 h), but in the morning (0800 h), the values were almost similar. This information offers some insights and understanding into the adaptive styles of both cultures (Kuwaiti and British) and their effect on their daily functioning.

Thus, to a certain degree, time perception and time estimation are influenced by the norms of culture. Understanding the nature of this

influence may provide important clues to explain various psychological experiences. This may enable psychologists to understand how cultural beliefs affect time judgment.

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Submitted: July 2009
Approved: Jan. 2010

الفروق بين طلاب جامعة الكويت وطلاب إحدى الجامعات البريطانية في خصائص تتبع الإشارة لتقدير الوقت: دراسة مقارنة

خضر عباس بارون*

ملخص: هدف هذه الدراسة إلى فحص الفروق الثقافية بين طلاب جامعة الكويت وجامعة سكس (Sussex) في درجة الكفاءة العملية الحسية والفروق الإدراكية لمنحنيات تتبع الإشارة (ROC) لتقدير فترات زمنية قصيرة في أوقات مختلفة من اليوم، وقد اشترك في الدراسة 232 طالباً من الجامعتين (116 طالباً من جامعة الكويت، متوسط أعمارهم 19,68 سنة، وانحراف معياري 1,65 سنة، و116 طالباً من جامعة سكس، متوسط أعمارهم 18,71 سنة، وانحراف معياري 1,07 سنة، وكان المجموع الكلي للعينة 99 من الذكور و133 من الإناث، وقد طلب من كل منهم تقدير دوام نغمتين صوتيتين بقوة 60) (db لكل واحدة، واحدة بطول 850 ملي ثانية (.msec) والأخرى 1000 ملي ثانية (.msec) في أوقات مختلفة من اليوم (الساعة 08:00 صباحاً، و 12:00 ظهراً، و07:00 مساء)، واستخدم نموذج تتبع الإشارة للحصول على درجة كفاءة العملية الحسية (d Prime) ومنحنيات (ROC) لتقدير الأوقات. وقد أظهرت النتائج أن إدراك الوقت وتقديره في فترات مختلفة من اليوم كان أعلى لدى الطلاب البريطانيين من الطلاب الكويتيين في موعدي الظهر والمساء، مع تساويهما في وقت الصباح، واستنتج أن إدراك الزمن وتقديره يتأثران بالمعايير الثقافية السائدة في كل من الدولتين.

المصطلحات الأساسية: تقدير الوقت، نموذج تتبع الإشارة، دراسة مقارنة عبر الثقافتين الكويتية والبريطانية.

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