**Perceptions of waiting time in different service queues**
(unpublished, 2005)

Professor Peter Jones
ITCA Chair of Production and Operations Management
School of Management
University of Surrey
Guilford, Surrey, England, UK GU2 7XH
Tel: +44 (0) 1483 686377
Email: p.jones@surrey.ac.uk

And

Dr Li-Jen Jessica Hwang, BA (Hons) MSc. PhD
Lecturer in Service Operations Management,
School of Management
University of Surrey
Guildford, Surrey England, UK GU2 7XH
Tel: (01483) 686372

**Abstract**
This article investigates the extent to which there is a gap between customers' perception of waiting time compared with actual waiting times; and whether this gap varies according to service context. It also investigates a new proposition that customers' perception of time available for the service influences their perception of wait time. A field study collected 455 actual and perceived customer waiting times in a single queue single server system from a retail grocery store, cafeteria, post office, bus stop and vegetable market. Results showed that perceptions can be significantly greater than actual waiting time across the study; there was no correlation to the service context; and perception varied inversely to the time available.

**Keywords** - queuing psychology, service operations, waiting lines, capacity planning

## Introduction

Time-saving and convenience are commonly mentioned by consumers as among the most important motivations for purchasing a service. However, waiting to be served may neutralise potential benefits and negatively affect attitudes toward the quality of service (QoS), brand or the product (Ryan and Valverde, 2003). This places emphasis on the waiting experience as part of the overall service package. Many solutions focus on reducing actual waiting time, rather than focus on perceptions of waiting time, but perceptions can be more important to consumers' subjective evaluations of quality and customer satisfaction (Weinberg, 2000). Customers identify waiting in line as frustrating, stressful and expensive. After synthesising the existing research on the behavioural aspects of waiting, Durrande-Moreau (1999) and Nie (2000) concluded that the psychological and social perspectives of waiting are very

important and the study of the experience of waiting should not be dominated by mathematical models that lack the consideration of human factors.

Early studies of waiting time identified that most customers judged that they have waited longer than they really have (Katz, *et al.*, 1991; Graessel and Zeidler, 1993; Smidts and Pruyn, 1994; Jones and Peppiatt, 1996; Pruyn and Smidts, 1998). Industry practitioners were well aware that both the actual and perceived wait times were important links to customer satisfaction (Smidts and Pruyn, 1994; Hornik and Zakay, 1996; Davis and Heineke, 1998; Antonides *et al.*, 2002) and operational efficiency (Hall, 1991; Canel and Kadipasaoglu, 2002; Ittig, 2002; Mantel and Kellaris, 2003; Sheu *et al.*, 2003: Luo *et al*, 2004). Disney incorporated features designed to alleviate stress into their queues where they knew waiting was inevitable in the 1970s. Indeed, Maister (1985) developed this basic waiting theory into a series of propositions to explain the potential gaps between actual and perceived wait time.

### *Understanding the psychology of waiting lines*

The gap between customers' perception of waiting time and actual waiting time has been clearly conceptualised, but infrequently measured. Sasser, Wyckoff and Olsen (1978) documented the management of perceived waiting time, citing anecdotal evidence derived from installing mirrors in elevator wait areas. But it was not until Maister (1985) identified eight 'propositions' relating to what he called the psychology of waiting lines that these ideas were conceptualised. His eight propositions are:

1. Unoccupied time feels longer than occupied time
2. Pre-process waits feel longer than in-process waits
3. Anxiety makes waits feel longer
4. Uncertain waits seem longer than certain waits
5. Unexplained waits seem longer than explained waits
6. Unfair waits seem longer than equitable waits
7. More valuable the service, the longer people will wait
8. Solo waiting feels longer than group waiting.

These propositions have been further developed to suggest a number of other variables may also affect perceptions of wait time:

- Uncomfortable waits feel longer than comfortable waits (Davis and Heineke, 1998)
- New or infrequent users feel they wait longer than frequent users (Jones and Peppiatt, 1996).

Other factors that may influence perception of wait time may include:

- Length of queue (Nie 2000; Refaeli *et al.*, 2002)
- Number of people behind person in the queue (Zhou and Soman, 2003)
- Level of interest in the activity designed to occupy time (Nie 2000)]
- Rate of queue movement (Nie 2000)

- Attribution of cause of wait in terms of 'locus', 'stability', controllability, and 'legitimacy' (Nie 2000)

A number of studies have tested some of these propositions. Some of the findings support, while others refute these propositions (Katz, *et al.*, 1991; Graessel and Zeidler, 1993; Smidts and Pruyn, 1994; Jones and Peppiatt, 1996; Pruyn and Smidts, 1998; Groth and Gilliland, 1998; Luo, *et al.*, 2004). Overall, the findings suggest that as wait times become longer, the exaggeration of perceived time does not increase proportionally, as indicated in Table 1.

| **Study** | **Field** | **Actual wait Time (mins.)** | **Perceived wait Time (mins.)** | **% Difference** | **Actual Difference (secs)** |
|---|---|---|---|---|---|
| Katz *et al.* (1991) | Bank | 4.20 | 5.10 | **21%** | **54** |
| Smidts & Pruyn (1994) | Dutch Hospital clinics | 22.60 | 23.10 | **2.2%** | **30** |
| Jones & Peppiatt (1996) | England retail | 2.78 | 3.80 | **37%** | **61** |
| Pruyn & Midts (1998) | Dutch Hospital clinics | 15.00 | 16.10 | **7%** | **66** |
| Groth & Gilliland (1998) | Study 1:Fast food USA | 5.84 | 5.28 | **-10%** | **-33.5** |
| | Study 2: bookshop USA | 4.34 | 5.25 | **21%** | **54.7** |
| Luo *et al.* (2004) | USA, Pizza shop | 4.67 | 3.59 | **-23%** | **-64.8** |

Table 1: Examples of results between actual wait time and perceived wait time

Table 1 seems to suggest that, with the exception of fast food outlets, the proportional difference between actual and perceived wait time decreases as wait times become longer. In one study, the correlation between actual wait time and perceived wait time was 0.596 (Davis and Heineke, 1998). Another study suggested that the perceived waiting can be calculated to be 11.9 seconds plus 0.276, multiplied by the subject time (Graessel and Zeider, 1993). However, in all instances, these are average times – which did not take into account that for part of the sample, experiments were conducted to deliberately influence perceptions of wait time by occupying the respondents. Nonetheless, there is evidence that individuals exaggerate their wait time in a variety of queuing situations – banking, retail and medical.

The level of this exaggeration may (Groth and Gilliland's fast food study, 1998; Luo *et al.*'s pizza shop study, 2004) or may not (Katz *et al.*, 1991; Smidts and Pruyn, 1994; Jones and Peppiatt, 1996) be reduced if their time is occupied.

This time distortion has an impact on people's ability to estimate time and drew more attention to the wait itself and the waiting circumstances (Graessel and Zeidler, 1993; Van Dierdonck, 2003). The degree of exaggeration is not proportional to the wait time, but could possibly be absolute – implying that people exaggerate their wait time by say roughly one minute, whatever the situation. The studies to date each took place at a different time and in different countries. Further, none of them looked at actual and perceived wait time in several contexts, at the same time, with the same population. The research reported here is such a study.

**Hypotheses**

Hornik (1984) in his study measuring the duration of observed waits asked consumers after their check out about their own estimation of time. Hornik found significant estimation errors as people overestimated their waiting time by an average of 36 percent of the time spent queuing. Maister (1985) later suggested that the waiting experience is context specific. Clock time is an objective, external non-social referent for the unfolding of behaviour; whereas perceived time grows out of social relations behaviour and is influenced by feelings, beliefs, desires and the cultural context in which waiting takes place (Fraisse, 1984; Kostecki, 1996; Pruyn and Smidts, 1997). Durrande-Moreau (1999) examined 18 empirical studies on the subject of waiting and concluded that the top factor in the gap between the real waiting time and the perception of time was central stimulus.

The other main finding was that the longer the duration, the more negative the wait. Jones and Peppiatt (1996) suggested that the part of the difference between actual and perceived wait time was because respondents stated their perceived measures in minutes, while researchers recorded the actual wait in seconds. Pruyn and Smidts (1998) showed that if the actual waiting time is long, negative affects will prevail, whereas when the waiting time is shorter than expected, people will feel relief and acceptance. Antonides, *et al.* (2002) in their field experiments on toll-free service tele-queues found the longer the waits, the smaller the overestimations and the more negative the experience.

On the contrary, Luo, *et al.* (2004) in their experiments into the comparative operational measurement of waiting time before and after a process redesign, found perceived waiting time was less than the actual waiting time. Given these issues form the core of the waiting issues, we hypothesize the following:

***Hypothesis 1: The gap between actual and perceived wait time will not vary in direct proportion to the length of the wait.***

In addition to differences in perceived wait time, the situational factors in engaging different activities can have an effect on perceptions. As few empirical researches have investigated waiting perceptions, and each study focused on a particular wait situation, directly comparing their findings ranges from difficult to meaningless, as authors use unique terms (e.g. different measures on the expectation concept) and varied implementations (Durrande-Moreau, 1999). For example, field tests were carried out covering queuing in post offices (Pruyn and Smidts, 1993), shops (Tom and Lucey, 1995; Jones and Peppiatt, 1996), health sectors (Pruyn and Smidts, 1997), banks (Katz *et al.*, 1991; Sarel and

Marmorstein, 1998), and delayed flights (Taylor, 1994). The rationale on queuing for different type of services can depend on the value of the service to people.

Consequently, the subjective duration of certain activities may influence outcomes such as evaluation of service quality (Dubé- Rioux, *et al.*, 1989; Chebat, *et al.*, 1994; Hui and Tse, 1996; Durrande-Moreau, 1999; Antonides, *et al.*, 2002), (dis)satisfaction (Tom and Lucey, 1995; Davis and Heineke, 1998; Pruyn and Smidts, 1998), and consequent behaviours (Larson, 1987; Schmitt, *et al.*, 1992; Meyer, 1994; Rose and Neidermeyer, 1999; Groth and Gilliland, 2001).

***Hypothesis 2: The gap between actual and perceived wait time will be the same across a variety of service contexts.***

Another factor for investigation is repeat customers. Regular customers have previous experience of the queue and may be less anxious and uncertain about the waiting situation. Hornik (1984) proposed frequent shoppers make shorter estimations due to habit. Jones and Peppiatt (1996) found that new or infrequent customers of a small food takeaway shop feel that they wait longer than frequent users. Carryover effects explained by Dellaert and Kahn (1999) were found whereby consumers' evaluations of one event within an episode may affect their evaluation of another similar event.

This was also established by Zohar, *et al.* (2002) in their simulation testing abandonment time in tele-queues where they concluded that experienced callers exhibit remarkable adaptivity to system performance. Based on queue length modelling, Haxholdt, *et al.* (2003) suggest that arrival rates depends on customers' perception of past waiting times. On the contrary, Sarel and Marmorstein (1998) found that delays occurring in retail bank service encounters did not make the wait more acceptable, but made customers who had experienced frequent service delays in the past become more aggravated, not less.

***Hypothesis 3: New or infrequent users exaggerate their wait time more than frequent users.***

Up until now the linkage between demographic information and individual preference is not clear in a waiting situation. Some studies (Smidts and Pruyn, 1994; Jones and Peppiatt, 1996; Luo *et al.*, 2004) have collected their respondents' profiles as basic information, however the relationships among these variables was not properly explained. Arnesen, *et al.* (2002) in a study of their outpatient clinics survey in a Norway hospital found that gender and socioeconomic status could not explain variations in waiting time. Groth and Gilliland (2001) suggested tailoring the waiting line systems to specifically targeted groups of customers or geographic regions. Ironically, no result was shown to be significant with regards to differences in age, gender or ethnicity when comparing single-line and multiple-line service systems.

The effects of demographic profile on the time duration are not fully understood. In their study of the interactive effect of mood and gender on duration estimation, Kellaris and Mantel (1994) found males were more accurate in their time estimation as compared to females. Later on, Pruyn and Smidts (1998) suspected that a number of variables specifically related to impatience (such as Type A/B coronary personality), the need for control or orientation towards time, may play a role. Grewal, *et al.* (2003) found men reacted more negatively to the expectation of waiting and criticized the store more than women respondents. Therefore, the fourth hypothesis is proposed to establish a link with the respondents' profile.

***Hypothesis 4: The perceived wait time is influenced by the participants' demographic profile (such as gender, age).***

The review of previous studies along with the research team's personal and research experience leads to a fifth hypothesis. Meyer (1994) concluded that time already spent in the queue as well as the distance from the goal were significant predictors of self-assessed mood only when the goal was considered to be less attractive. Therefore, we proposed the final hypothesis to understand how the time available to wait for the activity affects wait time.

***Hypothesis 5: The level of exaggeration in perceived wait time is in inverse proportion to the respondents' perception of the time they have available for engaging in that activity.***

**Methodology**

Groth and Gilliland (2001) in their investigation on the role of procedural justice associated with waiting in the service delivery process found that the use of a single-line system reduced customer's perceived waiting time when compared with multiple-line systems. Pruyn and Smidts (1999) applied the social facilitation theory on waiting in the health sector. They found that waiting with others made the wait more, rather than less acceptable and interfered with the estimation of the waiting time duration when compared with waiting alone. To remove the extraneous variables, this study focused on individual customers in single waiting line queues from five different service environments: a small retail food/corner store, a cafeteria, a post office, a bus stop, and a weekly vegetable market, all on an English University campus.

While the majority of respondents were from Europe (72.5%), the others were from Asia, the Pacific Rim of Australia, Africa, and America. The sample had more variability than a typical student sample as these service environments are not only used by students but also by staff working for the university. The samples were taken during the summer of 2004. After cleaning the non-response data and coding the raw data into SPSS for an analysis, a total of 455 participants from five different service environments were included for analysis.

The purposive sampling procedure was used for this initial study based on two conditions:

(1) people both waiting by themselves and
(2) in a single-line service system.

Ethnographic observation was carried out on each field site to measure the actual objective waiting times (utilising a stopwatch, in seconds) between entering a queue situation and receiving the service. Those customers who were observed waiting in a line were subsequently approached and asked to fill out a short questionnaire regarding their queuing experience.

The procedure was originally piloted to test phraseology. The questionnaire started with brief statements introducing the purpose of the study. Then participants were ensured confidentiality and anonymity. Before proceeding with the principal questions, filter questions were asked to re-confirm their waiting activity on site. No repeat samples were collected. Filling out the questionnaire took approximately 5 minutes.

The questionnaire included questions on perceived waiting time, reaction to the wait and evaluation of the waiting experience. Consistent with previous research (Hui *et al.*, 1998; Antonides *et al.*, 2002) perceived waiting time was assessed by asking open-ended questions. This required the estimation of the length of the delay experienced, from the moment they entered the waiting line until they reached the counter. Waiting behaviour patterns were also assessed to discover how often they used the activity and the time they had previously planned for it.

## Findings

### *Actual vs. perceived waiting time*

Using paired samples t-test analysis, the results showed that overall there was significant statistical differences between the actual wait time and perceived waiting time (t = -9.628, df =454, p=0.000 (two-tailed). Table 2 shows the descriptive waiting time in seconds.

Initial analysis done by Pearson correlation showed the perceived waiting time was over-estimated compared with actual time ($r = 0.898$; $p < 0.001$(one-tailed)). Further, simple regression analysis found that the perceived waiting time can be predicted by the actual waiting time (through the equation β= 33.626 seconds + (1.088 clock waiting time in a queue $_i$), $F$=1877, $p$=0.000).

| | **Mean (seconds)** | **Std. D** | **Most frequent wait time (seconds)** | **Minimum** | **Maximum** |
|---|---|---|---|---|---|
| **Actual wait time**<br>**Perceived wait time** | 262.18<br>318.84 | 232<br>280 | 210<br>300 | 20<br>0 | 1804<br>2400 |
| **Gap** | 56.66 | 126 | 28 | -296 | 750 |

Table 2: Descriptive waiting time between actual and perceived


7

However, the dots in the scatterplot (Figure 1) seemed to funnel inwards indicating greater variance at lower levels of waiting time as heteroscedasticity in the data but having no obvious outliers on the plot; thus the stability of the model is unable to be confirmed. These results partially support Hypothesis 1.

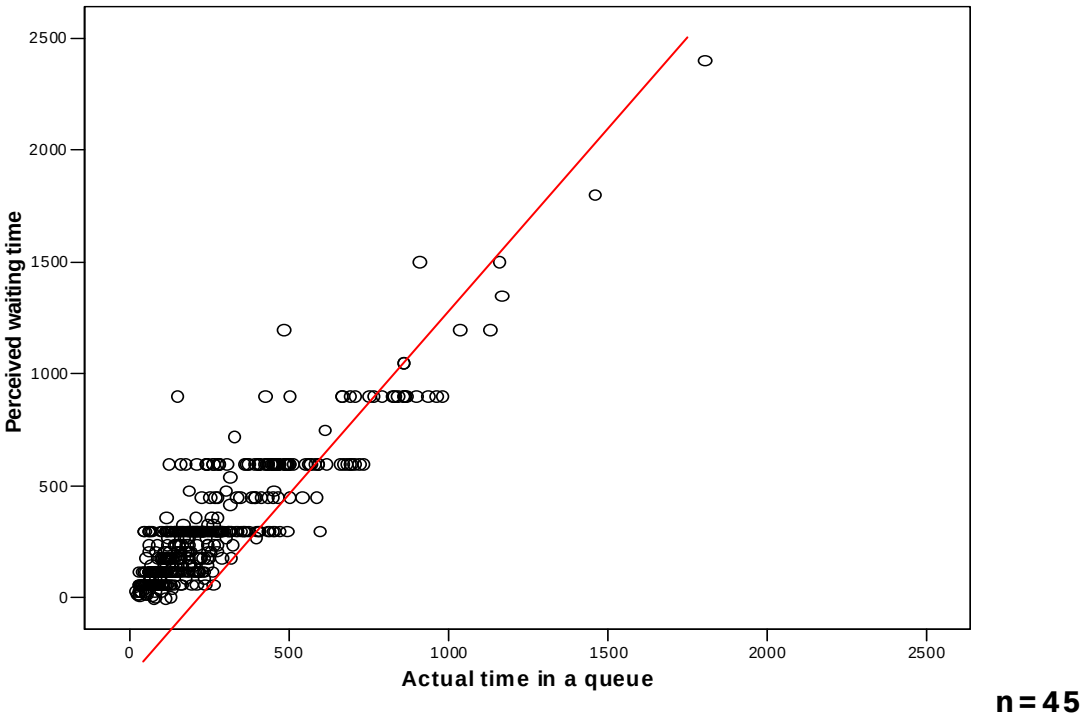


Figure 1: Scatterplot of perceived waiting time against actual time in a queue

***Service environments***

An analysis of variance of the homogeneity of the five different service environments using a one-way ANOVA test was determined to be significant. Thus, the Kruskal-Wallist test as a non-parametric type was applied. The results showed that the five different service environments influenced both the actual time (*chi*=232.269, df=4, $p<0.000$) and perceived waiting time (*chi*=229.961, df=4, $p<0.000$). The means for each environment are found in Figure 2. The differences in actual waiting time and perceived waiting time was also found to be significantly different (*chi*=32.579, $p=0.000$).

The post-hoc tests showed that there were significant differences between the waiting times for the bus service and the other four locations ($p<0.000$). The actual waiting time at the bus stop averaged just over 5 minutes longer than the next longest wait, the vegetable market; and up to more than 7 minutes longer than at the shop, the shortest waiting time.


8

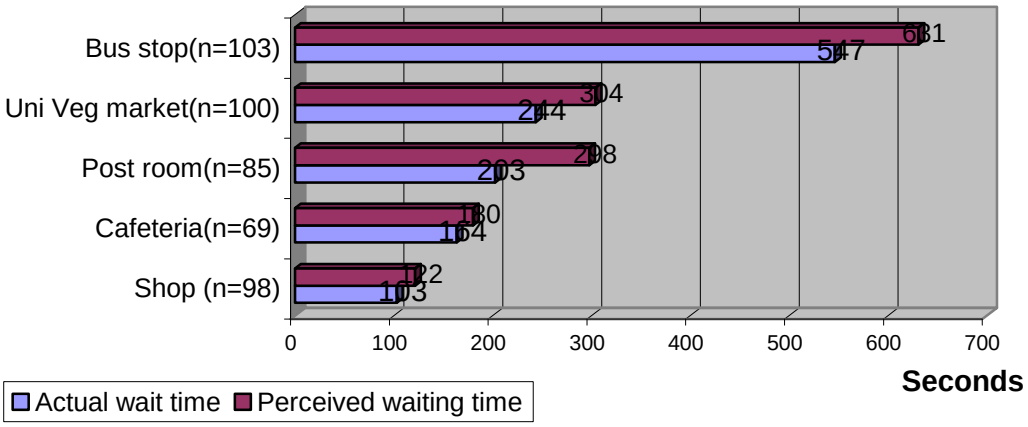


Figure 2: The mean of actual and perceived waiting time in five different service environments

Furthermore, the perceived waiting times were proportionally longer as well. The gap between actual and perceived waiting time were found over one minute for the post service (95 seconds), bus service (84 secs.) and vegetable market (60 secs.). There were shorter gaps for the shop (18 secs.) and the cafeteria services (17 secs.). Therefore, these results did not confirm Hypothesis 2.

***Usage levels***

Upon analysis, variance of the homogeneity of the three usage levels (daily users, weekly users and infrequent users) using a one-way ANOVA test was determined to be significant. Thus, the Kruskal-Wallist test as a non-parametric type was applied. The results showed that the three groups have different actual waiting times (*chi*=45.001, df=2, *p*<0.000) and different perceived waiting times (*chi*=33.827, df=2, *p*=0.13), but there were no significant differences in the gaps between the two (*chi*=1.025, *p*=0.599).

The means are shown in Figure 3. From the Post Hoc Turkey HSD tests, the daily user spent more time in line than the infrequent user and weekly user. Therefore, hypothesis 3 was not accepted.

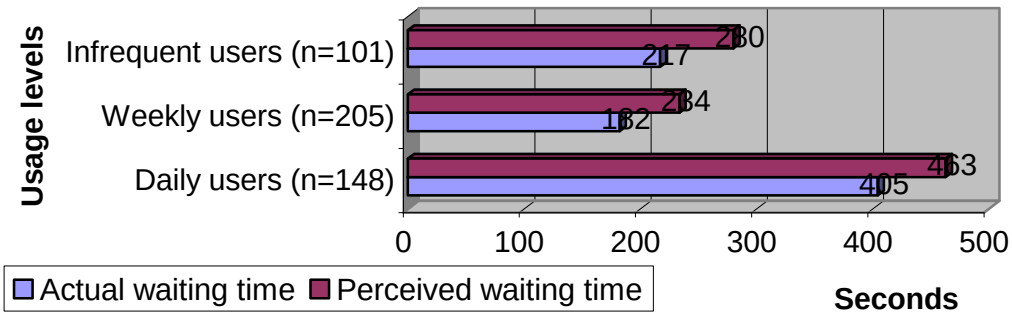


Figure 3: Usage levels


9

Somewhat surprisingly, daily users have much longer waits than less frequent users. This can be explained in that virtually all of those who waited for the bus (the location with the longest waiting time) were daily users.

***Demographic profile of participants***

The sample consisted of 207 male (45.5%) and 248 female (54.5%) respondents. This composition had no statistical difference with the actual waiting time ($t$ = -0.898, $df$ =453, $p$=369) and the perceived waiting time ($t$ =-0.090, $df$ = 453, $p$=928). There were gender differences in the attitudes towards waits ($chi$=4.835, df=1, $p$ =0.028). Men were more likely to dislike waits than women and be less accepting of their inevitability ($chi$=5.102, df=1, $p$ =0.024).

The age of respondents ranged from 10.3% teenagers, 40.2 % in their twenties, 21.8% in their thirties, and the rest over forty (12.7% forties, 8.6% fifties, 3.3% sixties). An analysis of variance of the homogeneity of the four age groups using a one-way ANOVA test was determined to be significant. Thus, the Kruskal-Wallist test as a non-parametric type was applied.

The results showed that age differences have influenced the actual time ($chi$=18.525, df=3, $p$<0.000) and perceived waiting time ($chi$=10.715, df=4, $p$=0.13), but no significant differences in the gap between the two ($chi$=1.217, $p$=0.749). The means are found in Figure 4. Therefore, Hypothesis 4 was only partially supported.

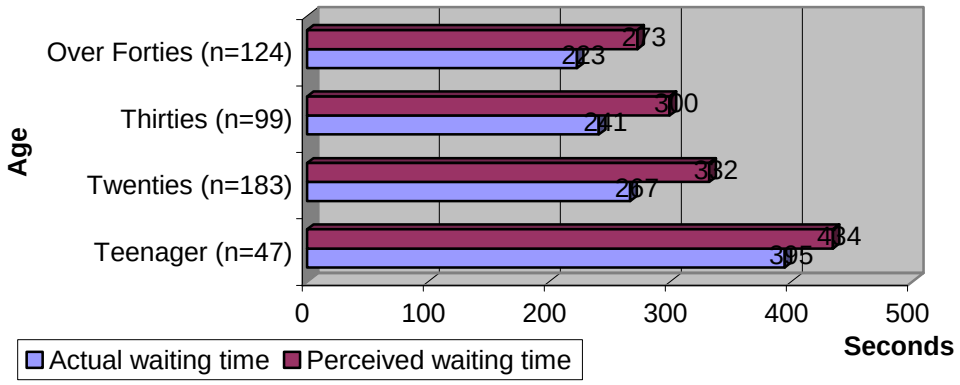


Figure 4: The actual waiting and perceived in different age groups

***Time available for the wait***

An analysis of variance of the homogeneity of the four time availability groups using a one-way ANOVA test was determined to be significant. Hence, the Kruskal-Wallist test as a non-parametric type was applied. The results showed that the four groups differed in the actual time ($chi$=30.184, df=3, $p$ =0.000) and perceived waiting time ($chi$=38.699, df=3, $p$=0.000). The means are found in Figure 5.

When respondents thought they were late, the gap between actual and perceived waiting time was the largest, at 77 seconds. These respondents


10

accepted that they had already missed a deadline, and therefore, felt little time pressure. When they felt they had only "just a couple of minutes", the gap was just 35 seconds. It was 52 seconds when they felt they had a fair amount of time; and 64 seconds if they felt they had plenty of time. This confirms Hypothesis 4.

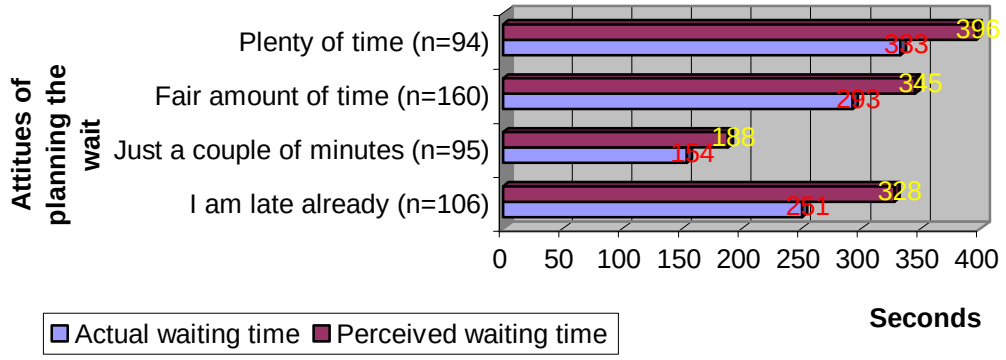


Figure 5: Attitudes on planning the wait

**Discussion**

The time distortion experienced in waiting lines can have interesting theoretical implications and important commercial consequences. From this study it is clear that time is measured objectively but its passage is experienced subjectively. This research confirmed similar results from previous researches that concluded that customers perceived longer waiting time than the actual clock time (Fraisse, 1984; Hornik, 1984; Graessel and Zeider, 1993; Jones and Peppiatt, 1996; Pruyn and Smidts, 1998; Durrande-Moreau, 1999; Antonides *et al.*, 2002). The simple regression equation presents a comparable outcome to Graessel and Zeider's (1993) relationship between real waiting time and perceived waiting time.

This supported Hypothesis 1, in that the gap between actual and perceived wait time will not vary in direct proportion to the length of the wait. Rather perceived wait time seems to differ from the actual length of the wait by a constant amount, with less regard to the service environment. The cause of overestimation of the elapsed time (Fraisse, 1984) might rely more on inferences based on the amount of information encountered/processed/stored/ retrieved from the time interval, and less on their cognitive timer. The estimation of duration may also involve memory when the time duration is over 5 seconds (Fraisse, 1984).

Although, the result of the simple regression displayed a linear relationship between actual and predicted waiting time, the disappointment is the funnel-shaped cloud of lower levels of actual waiting time data might indicate a violation of the assumption of homoscedasticity. More data for longer waiting time bands are required to verify the current model.


11

Different lengths of waits were found in different waiting environments. The environmental circumstance is seen to determine people's time allocation (Hornick and Zakay, 1996). Accordingly, differences were found in their perceptions of waiting time, especially in relation to the bus queue. It could be argued that taking a planned bus journey may be treated as a necessity compared with the other types of service activity.

As the gaps between actual and perceived waiting time varied somewhat among different service settings, the duration of waiting for certain activities may also indicate the distinctive perceived value of the services. This may therefore create different behaviours in preserving time. The cognitive process (Hornik and Zakay, 1996) in understanding various activities can also influence time perception. As such, the post office and bus service processes may be considered much more complicated than a shop service.

It was also found that people who have previous experience of the wait appear to understand the length of wait and do not exaggerate the waiting time. This has partially confirmed previous suggestions in regard to the carry over effect. That is, time projections can be related to the past or the future. It can also be linked to the preciseness and realism of either memories or the imagination of the future. However, the unexpected result of there being no differences in time exaggeration among the three service process usage levels, merits further investigation to determine the underlying rationale for the phenomenon.

The psychological literature suggested that gender differences might have an effect on perceived time (Kellaris and Mantel, 1994). In that regard males would produce more accurate time estimates; whereas, females tended to perceive shorter, less accurate time durations. Evidence such as was found in a video observation study of a retail service (Grewal, et al. 2003) suggested that men have less tolerance for waiting than do women. However, this research did not find that the respondents' demographics had any differences in time perception and therefore cannot confirm that the consumer profile has created different waiting perceptions. Hence, Hypotheses 4 is not supported.

Different coping strategies were found in dealing with the waiting. Some individuals were in a hurry and planned long in advance; whereas, others were more relaxed and showed little concern and commitment for deadlines. The attitude on planning their wait was found to correlate with the length of waiting time, if they think there was enough time to meet their plan. However, if they believed they were already late, the attitude became different. Anxiety, frustration and lack of control appeared to build up in excising the perceived waiting time and might have increased their sensitivity to wasted time. Perhaps, the time styles (Durrande-Moreau and Usunier, 1999) have supported some influences on the way people individually experience waiting.

## Conclusion

This paper has attempted to overcome some of the counter-productiveness of various independent propositions on the psychology of waiting by looking at five service encounters. The results found that the temporal perception of the waiting time was overestimated. It also indicated that waiting time was influenced by different service environments and value of the waits. However,

such perceptions may not be affected by waiting experiences and demographic profiles.

Understanding various propositions on the waiting time can assist operations managers to actively influence a customer's perception of the waiting time. In addition, predictions can be made about the length of time the customer has been waiting. As the waiting time is subjective in the way customers perceive the results of capacity management, it is important to address the queue issues from the lens of customer. The service strategy can then be planned according to the prior predicted wait, as well as the specific queue information at the various service encounters.

The findings of this study should be interpreted cautiously given the preliminary nature of the study. Although some of the results are consistent with previous research and some are not, the use of student subjects may have influenced responses in ways that are difficult to evaluate. Additional research with more data is needed to assess the perceptions of waiting issues.

## References


Antonides, G., Verhoef, P., and van Aalst, M. (2002), "Consumer perception and evaluation of waiting time: a field experiment", *Journal of Consumer Psychology*, vol. 12 no. 3, pp. 193-202.

Arnesen, K. E., Erikssen, J., and Stavem, K. (2002), "Gender and socioeconomic status as determinants of waiting time for inpatient surgery in a system with implicit queue management", *Health Policy*, vol. 62, no. 3, pp. 329-341.

Canel, C. and Kadipasaoglu, S. (2002), "An efficiency study for a student health center", *International Journal of Health Care Quality Assurance*, vol. 15, no. 4, pp. 159-167.

Chebat, J., Filiatrault, P., Gelinas-Chebat, C., and Vaninsky, A. (1994), "Why am I waiting? Effects of consumer's mood on the attribution of waiting time and perceived quality of services", *International Research Seminar in Service Management*, no. 3, pp. 138-176.

Davis, M. M. and Heineke, J. (1998), "How disconfirmation, perception and actual waiting times impact customer satisfaction", *International Journal of Service Industry Management*, vol. 9 no. 1, pp. 64-73.

Dellaert, B. G. C. and Kahn, B. (1999), "How tolerable is delay?: consumers' evaluation of internet web sites after waiting", *Journal of Interactive Marketing*, vol. 13 no. 1, pp. 41-54.

Dubé-Rioux, L., Schmitt, B., and Leclerc, F. (1989), "Consumers' Reaction to Waiting: when delays affect the perception of service quality", *Advances in Consumer Research*, vol. 16, pp. 59-63.

Durrande-Moreau, A. and Usunier, J. (1999), "Time styles and the waiting experience", *Journal of Service Research*, vol. 2, no. 2, pp. 173-186.

Durrande-Moreau, A. (1999), "Waiting for service: ten years of empirical research", *International Journal of Service Industry Management*, vol. 10 no. 2, pp. 171-189.

Fraisse, P. (1984), "Perception and estimation of time", *Annual Review of Psychology*, vol. 35, p. 1-36.

Graessel, B. and Zeider, P. (1993), "Using quality function deployment to improve customer service", *Quality Progress*, Nov., pp. 39-63.

Grewal, D., Baker, J., Levy, M., and Voss, G. B. (2003), "The effects of wait expectations and store atmosphere evaluations on patronage intentions in service-intensive retail stores", *Psychology and Marketing*, vol. 79, pp. 259-268.

Groth, M. and Gilliland, S. W. (2001), "The role of procedural justice in the delivery of services: a study of customers' reactions to waiting", *Journal of Quality Management*, vol. 6 pp. 77-97.

Hall, R. W. (1991), *Queuing methods for service and manufacturing* Prentice Hall, Englewood Cliffs, NJ.

Haxholdt, C., Larsen, E. R., and van Ackere, A. (2003), "Mode locking and chaos in a deterministic queueing model with feedback", *Management Science*, vol. 49 no. 6, pp. 816-830.

Hornik, J. and Zakay, D. (1996), "Psychological time: the case of time and consumer behaviour", *Time and Society*, vol. 5, no. 3, pp. 385-397.

Hornik, J. (1984), "Subjective vs. objectives time measures: a note on the perception of time in consumer behaviour", *Journal of Consumer Research*, vol.11, pp.615-18.

Hui, M., Thakor, M., and Gill, R. (1998), "The Effect of Delay Type and Service Stage on Consumers' Reactions to Waiting", *Journal of Consumer Research*, vol. 24, no. 4, pp. 469-479.

Hui, M. K. and Tse, D. K. (1996), "What to tell consumers in waits of different lengths: an integrative model of service evaluation", *Journal of Marketing*, vol. 60, no. 2, pp. 81-90.

Ittig, P. T. (2002), "The Real Cost of Making Customers Wait", *International Journal of Service Industry Management*, vol. 13, no. 3, pp. 231-241.

Jones, P. and Peppiatt, E. (1996), "Managing perceptions of waiting times in service queues", *International Journal of Service Industry Management*, vol. 7 no. 5, pp. 47-61.

Katz, K.L., Larson, B.M. and Larson, R.C. (1991), "Prescription for Waiting-in-Line Blues: Entertain, Enlighten, and Engage", *Sloan Management Review*, vol. 32 no.2, Winter, pp. 44-53.

Kellaris, J. and Mantel, S. P. (1994), "The influence of mood and gender on consumers' time preceptions", *Advances in Consumer Research*, vol. 21, pp. 514-518.

Kostecki, M. (1996), "Waiting lines as marketing issue", *European Management Journal*, vol. 14, no. 3, pp. 295-303.

Larson, R. C. (1987), "Perspectives on Queues: Social justice and the psychology of queueing", *Operations Research*, vol. 35, no. 6, pp. 895-905.

Luo, W., Liberatore, M., Nydick, R. L., Chung, Q. B., and Sloane, E. (2004), "Impact of process change on customer perception of waiting time: a field study", *Omega: The International Journal of Management Science*, vol. 32 no. 1, pp. 77-83.

Maister, D. (1985),"The psychology of waiting lines", in Czepiel, J.A., Solomon M., and Surprenant C.S. (Ed.), *The Service Encounter*, Lexington Books, Lexington, pp.113-123.

Mantel, S. P. and Kellaris, J. J. (2003), "Cognitive determinants of consumers' time preceptions: the impact of resources required and available", *Journal of Consumer Research*, vol. 29, no. March, pp. 531-538.

Meyer, T. (1994), "Subjective Importance of Goal and Reactions to Waiting in Line", *The Journal of Social Psychology*, vol. 134 no. 6, pp. 819-827.

Nie, W. 2000, "Waiting: integrating social and psychological perspectives in operations management", Omega: The International Journal of Management Science, vol. 28, pp. 611-629.

Pruyn, A. And Smidts, A. (1993), "CUSTOMERS' EVALUATIONS OF QUEUES: THREE EXPLORATORY STUDIES", in European Advances in Consumer Research Volume 1, eds. W. Fred Van Raaij and Gary J. Bamossy, Provo, UT : Association for Consumer Research, pp. 371-382.

Pruyn, A. and Smidts, A. (1997), "Consumer time orientation: conceptualisation and cross-cultural differences", *Proceedings of the annual conference-European marketing academy*, vol. 26, pp. 1954-1964.

Pruyn, A. and Smidts, A. (1998), "Effects of waiting on the satisfaction with the service: beyond objective time measures", *International Journal of Research in Marketing*, vol. 15, pp. 321-334.

Pruyn, A. and Smidts, A. (1999), "Customers' reactions to waiting: effects of the presence of 'fellow sufferers' in the waiting room", *Advances in Consumer Research*, vol. 26, no. 1, pp. 211-216.

Rafaeli, A., Barron, G., and Harber, K. (2002), "The effect of queue structure on attitudes", *Journal of Service Research*, vol. 5, no. 2, pp. 125-139.

Rose, R. and Neidermeyer, M. (1999), "From rudeness to road rage: the antecedents and consequences of consumer aggression", *Advances in Consumer Research*, vol. 26, no. 1, pp. 12-17.

Ryan, G. and Valverde, M. (2003), "Waiting online: a review and research agenda", *Internet Research: Electronic networking applications and policy*, vol. 13 no. 3, pp. 195-205.

Sarel, D. and Marmorstein, H. (1998), "Managing the delayed service encounter: the role of employee action and customer prior experience", *The Journal of Service Marketing*, vol. 12 no. 3, pp. 195-208.

Sasser, W.E., Olsen, M. and Wyckoff, D.D. (1978) *The Management of Service Operations*, Allyn and Bacon: London.

Schmitt, B., Dubé, L., and Leclerc, F. (1992), "Intrusions Into Waiting Lines: Does the queue constitute a social system?", *Journal of Personality and Social Psychology*, vol. 63, no. 5, pp. 806-815.

Sheu, C., McHaney, R., and Babbar, S. (2003), "Service process design flexibility and customer waiting time", *International Journal of Operations and Production Management*, vol. 23, no. 8, pp. 901-917.

Smidts, A. and Pruyn, A. (1994), "How waiting affects customer satisfaction with the service: the role of subjective variables", M*anagement of Services: a multidisciplinary approach*, (3rd conference), pp. 677-696.

Tom, G. and Lucey, S. (1995), "Waiting time delays and customer satisfaction in supermarkets", *Journal of Services Marketing*, vol. 9, no. 5, pp. 20-29.

Taylor, S. (1994) Waiting For Service: The Relationship, Between Delays and Evaluations of Service, *Journal of Marketing, vol.* 58, no. 2, pp. 56-69.

Van Dierdonck, R. (2003), "Capacity Management", in Van Looy, B., Gemmel, P., and Van Dierdonck, R., *Service Management: an integrated approach*, Pearson Education limited, Harlow, pp. 277-316.

Weinberg, B. D. (2000), "Don't keep your internet customers waiting too long at the (virtual) front door", *Journal of Interactive Marketing*, vol. 14 no. 1, pp. 30-39.

Zhou, R. and Soman, D. 2003, "Looking back: exploring the psychology of queuing and the effect of the number of people behind", *Journal of Consumer Research*, vol. 29, no. 4, pp. 517-530.

Zohar, E., Mandelbaum, A., and Shimkin, N. (2002), "Adaptive behaviour of impatient customers in tele-queues: theory and empirical support", *Informs*, vol. 48 no. 4, pp. 566-583.