Discussion Record

SESSION NO. 32 - SUBSCRIBER BEHAVIOUR PROBLEMS

Chairman - R.I. WILKINSON (U.S.A.)
Discussion Leader - D.H. BARNES (U.S.A.)

D.H. BARNES: Gentlemen these papers complement themselves very well, I would like to have a few comments about that. The papers in the session as you point out are divided into two sections.

Mr Gosztony's paper No. 321 and Mr Myskja and Mr Aagesen's paper No. 322 both deal with customer reattempt behaviour mostly related to congestion, call party busy and call party doesn't answer. Both papers evaluate a wealth of previous work. Mr Gosztony uses a simulation technique with parameters obtained from various empirical study sources. Mr Myskja and Mr Aagesen make a statistical study comparing three previous models of repeated calls. This could generalize also on E11din's theory to counter variation of failure rates as a function of attempt numbers which is new.

I think these papers do complement each other well and perhaps should be studied together.

The other three papers are concerned with the fact of tariff changes and customer behaviour with the intention of giving direction toward the design of new tariffs. These papers also complement each other very well. Mr Kraepelien's paper No. 323 models hypothetical party doesn't answer. Both papers evaluate a wealth of giving direction toward the design of new tariffs. This simplification is justified by the fact that the non-uniform strings constitute only a relatively small part. I cannot now give any percentage, however, it is sufficiently low that we feel confident that it will not substantially influence the results. We have investigated mixed strings numerically by multi-dimensional tables, and we found that the persistence was primarily influenced by the last cause of failure.

The complication of the theory by non-uniform strings stems from the need of multi-indexing of failure safe (F) and persistence (w).

To the last part of your question, I will assume that the partition of failure causes, as well as subscriber categories, enable us to treat varying mixtures of both by means of linear combinations contrary to the macroscopic treatment by the simplified theories.

R.I. WILKINSON: As I understand it you believe that it is too simple to assume that the failure probability on successive attempts is independent of the attempt number. Again, I think you assume that the probability (p) of a reattempt after a failure does not change with trial X.

In a study report on at the 5th ITC we reported on the probability of failure on repeated attempts observed on several thousand toll calls, and found strong increases in failure on successive attempts: prob. of blocking attempts observed on 1 2 3

However, we found corresponding decreases in the probability of abandoning, with successive attempt failures: prob. of abandoning 0 1 2 3 4

On DDD calls we would find probabilities as large as 0.5 after first attempt failures, but only a probability of, say, 0.25 of abandonment after four unsuccessful trials. We took this to mean that as retrials continued, easily discouraged customers dropped out leaving a hard case of callers with great persistence.

What is your experience with customers observed in Norway?

A. MYSKJA: I completely agree with your statements about the increasing failure rate and decreasing probability of abandonment, which corresponds to an increasing persistence.

What I do believe is that both these effects are included in our theory, that even explains rather different curves for different failure causes, and here I will draw the attention to Table 4 in the paper.

It is true we assume that the probability 2X of a reattempt after a failure does not change with trial No. X for a given string of calls. However, the selection effect that leaves out early the strings of low Z-values is what retains the strings of high Z-values, and the latter ones come from the "hard core" of very persistent callers.
J. HARRINGTON (Australia): In section 2.2.0 of your paper, by local traffic as I correct in assuming that the measured traffic was generated by and destined for the 500 subscribers?

A. WYSKA: Calls were originated from a 500-group, but the destinations are arbitrary within a group of 15,000 subscribers.

J. HARRINGTON: With the PABX lines you could explain how you were able to observe the repeat attempt calls. I am assuming that a PABX extension would not necessarily access the same exchange line when re-attempting an unsuccessful call.

A. WYSKA: For PABX lines we observed the whole bundle of exchange lines. If the PABX's are not large, and they are not in this case, the fault done this way is considered negligible.

J. HARRINGTON: It would seem to me the success of repeat attempt calls to subscribers who were found busy is very dependent on the "P" sub class, the normal terminating traffic rate and the number of exchange lines available to terminate the traffic (PABX sequences). Did you measure according to terminating class and would you comment please?

A. WYSKA: You are quite correct in your assumption. However, this is taken into account by the distributions of failure state durations and interfailure intervals, which have a substantial impact on the results. The distributions depend on the subscribers class. In our test case we measured towards single lines to get a clear cut situation with quite well known parameters.

K. ROHDE (Germany): In cases of subscriber's sets having a push button for repeating automatically the number which has been dialled before, a very fast and constant repetition rate can be generated. How do you estimate the influence of subscriber's use of such equipment presupposed that a high percentage of subscribers might use it?

A. WYSKA: I have no experience with usage of such equipment, so my answer must be just a guess. Qualitatively one might expect a reduced reluctance towards repetition of calls, which might lead to increased persistence as well as shorter repetition intervals. Both effects would lead to increased average failure rate, even if the increased load on common control is not taken into account. Given a correctly dimensioned system for normal use, one might experience severe overloads from extensive use of this kind of equipment. I emphasize, however, that with no experience one cannot give any quantitative answer.

M. WIZGALL and H. WEISSCHN (Germany): To simulate switching systems, it is necessary to take into account the subscriber behaviour including repeated call attempts. For modelling repeated call attempt it seems to be sufficient to know the following values:

1. Distribution functions of the intervals between two repeated call attempts.
2. Probability to make a repeated attempt after a preceding unsuccessful call attempt.

My question is, is it possible to obtain these functions and the values of the parameters of these functions not taking into account the reason of failure?

A. WYSKA: My answer to your question is no. Our measurements, like measurements done by others, indicate that persistence as well as the distribution of re-attempt intervals depend on the failure cause.

Paper No. 323
Author: H.Y. KRAEPFLIEN (U.S.A.)

R.I. WILKINSON: I agree with the notion, in regard to figure 7 of your paper, that if usage rate were reduced to zero the calling rate could not be infinite and therefore, a discontinuity in the curve at Ty is called for. But for that matter the normal demand curve, which assumed asymptotic behaviour, in practice never leads us to believe that the demand is infinite at zero price. The concept of infinity has no meaning in real life. I appreciate your need to arrive at a finite value, but find the convexity of the bottom half of the curve disturbing from a demand point of view. At some inflection point along the curve the marginal rate of substitution of U for T changes direction. Please comment thank you.

H.Y. KRAEPFLIEN: I agree entirely with you that whether or not the demand for mean usage per subscriber line extends to infinity at flat rate is immaterial when we are concerned with the effect of a change in a measured tariff. When we analyse the usage repression caused by a switch from Flat Rate to measured service, our point of departure is a finite - and sometimes known - flat rate usage. The demand function I have assumed produced a point of inflection near the flat rate usage. It may very well be that there is no inflection. With available data it is of little importance whether there is or not, because the inflection occurs within a range of the rate per call which is not used in real operation. If, by change, empirical data from the future would indicate no inflection, the demand function should, of course be modified accordingly.

D.H. BARNES: In the last sentence of section 6 of your paper you state "further analysis of formula (25) reveals that the demand for local calls is inelastic, and that the elasticity is rather small for commonly used values of the rate ratio and allowance ratio". I don't understand here a concept of inelasticity. Would you expand please on the concept of inelasticity as used here?

H.Y. KRAEPFLIEN: I used the term inelastic as defined in economic textbooks, where a demand is considered to be inelastic if the elasticity is between zero and unity. I admit that inelastic could be misinterpreted as meaning that the demand for local calls is insensitive to tariff changes. Therefore, a better way to express it is that the demand for local calls is relatively inelastic for commonly used values of the rate ratio and allowance ratio.

J.A. BURGESS (United Kingdom): I would firstly like to congratulate the author on a very interesting paper. My question is a general one concerning subscribers reaction to a change in tariff. With a change in tariff, whether it be a drastic one of say a flat rate to measured rate or just an increase in the level of the existing tariff structure in practice there is usually a strong reaction initially resulting in a reduction in traffic but this tends to mellow with the passage of time and subscribers revert to their previous usage habits. Does the author agree with this and has he any data on the subject?

H.Y. KRAEPFLIEN: The pattern Mr Burgess refers to might appear under certain circumstances. I have reflected on what I call adjustment patterns in my previous paper and in my present research. My observation is that, generally, there will be a permanent reaction, although it may sometimes be obscured by other factors tending to increase the usage, especially in case of a mild measured tariff.
H.Y. Kraepelien: No. My belief is that the initial fee does have influence on subscriber's behaviour. It would not be part of the model for the individual guinea pig subscriber's usage, but definitely of the model for mean aggregate usage. This model presumes that we have a known, mean flat rate usage, and change the tariff components while everything else remains equal—including a negligible initial fee. In a complete model, the flat rate usage would not be a constant, but a variable which depends on such factors as the number of subscribers in the local service area, the initial fee, etc.

I think I can best describe it with this sketch.

**Demand Curves for Local Calls per Subscriber Line under Flat Rate at Varying Initial Fee**

Let the middle curve represent the demand for local calls per line at the prevailing initial fee. The curves to the left (broken) indicate the shift in demand if the initial fee is progressively lowered. When the initial fee is negligible the demand for calls per line approaches insignificant levels at very low flat rates. Curves to the right (dotted) show what happens when the initial fee is raised.
T. SAITO (Japan): The experimental study for tariff change is very interesting. However, it is often observed that effect is relatively large for a short period and will decrease relatively soon. What do you think is a reasonable experimental duration to get reliable data in the effect of tariff on the customer behavior?

G. COHEN: Mr. Saito makes a valid observation. Perhaps the implied difficulty may be even further complicated due to subscribers misunderstanding of the tariff change. See for example paper 374. Thus we may have a reaction that is either over damped or under damped. We plan to conduct the experiment for at least a year. Initial analysis indicates that we should achieve stability in four to six months.