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What about People in Behavioral Modeling? Ryuichi Kitamura (1949 – 2009)

Patricia L. Mokhtarian[1,*]

[1] University of California, Davis, One Shields Avenue
Davis, CA 95616

1 Introduction

On February 19, 2009, the travel behavior community lost a leading light when Ryuichi Kitamura passed away after a lengthy and spirited battle with cancer. Numerous tributes have appeared or will appear in other venues, including Richards (2009); Mahmassani (2009); Lam and Wong (2009); forthcoming special issues of Transportation, Transportation Research Part B, and Transportation Letters; special sessions at the upcoming conferences of the International Association for Travel Behaviour Research (IATBR) and the Transportation Research Board; and on the UC Davis web site at http://www. its. ucdavis. edu/ryuichi/index.php. So in terms of biographical facts I will here be very brief and mention only the following few highlights.

Ryuichi served on the faculty of Civil and Environmental Engineering at the University of California, Davis from 1978 to 1993, where he was instrumental, with Dan Sperling and Paul Jovanis, in launching the interdisciplinary Institute of Transportation Studies (and, incidentally, in recruiting me to join them in 1990). He accepted a prestigious offer from Kyoto University (where he had done his undergraduate work) in 1993, and remained on the faculty of Urban Management there until his death. He chaired the Transportation Research Board Committee on Traveler Behavior and Values from 1989 to 1995, and the IATBR from 1992 to 1994. He hosted the triennial IATBR conference in Kyoto in 2006, and there received its Lifetime Achievement Award for his contributions to the study of travel behavior. He was an Associate Editor of Transportation from 1990 onward.

I would like to focus the major part of this piece on Ryuichi's contributions to behavioral modeling. His scholarly output was prodigious in every sense of the word – he authored or co-authored more than 280 publications between 1975 and 2009 (a relatively complete listing is available at http://www. its. ucdavis. edu/ryuichi/publications. php).

* T: +1 530 752-7062, F: +1 530 752-7872, plmokhtarian@ucdavis.edu

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Accordingly, it is doubtful that any single person besides himself has a complete grasp of the extent of his contributions to the profession, especially considering the large body of Japanese-language works with enticing English titles such as “The model of post-motorization cities” (Kitamura, 2005) and “The sociology of urbanity and travel: Suburbs and public realm” (Kitamura, 2002). Certainly, in the time available I am unable to do full justice to his body of work. What follows is my own, necessarily idiosyncratic, selection of just a few key themes and fundamental contributions.

Ryuichi came of age, so to speak, during a period of rapid change for transportation modeling. The somewhat mechanical four-step process of the 1950s for forecasting regional travel demand was being updated with the newly-developed disaggregate discrete choice modeling structure pioneered by McFadden and others, and Ryuichi made some important contributions to discrete choice modeling in those early days. For example, Kitamura and Lam (1984) was one of the first studies to develop and apply an approach for parametrically modeling the probability that a given alternative belonged to an individual’s choice set, particularly by incorporating temporal constraints. In his dissertation research, Kitamura (1981) demonstrated a practical method for incorporating taste heterogeneity into choice models, using a modification of the Automatic Interaction Detection (AID) approach (Sonquist et al., 1971) to systematically identify socioeconomic-based strata having distinctly different model parameters.

In the 1980s, however, recognition was spreading that the four-step process was fundamentally flawed in its behavioral assumptions (such as its focus on isolated trips rather than patterns based on a series of linked trips, and its scant attention to the demand for activities underlying the trip). Ryuichi was in the front ranks of researchers pressing for a more faithful representation of travel-related behavior (e.g. Kitamura, 1988a), and was instrumental in helping to bring activity-based modeling into the transportation research mainstream. He led the development of the ambitious Sequenced Activity Mobility Simulator (SAMS) model, which “represents a departure from many of the conventional paradigms in travel demand forecasting” in that it incorporates adaptive dynamics, time-of-day, satisficing rather than optimizing assumptions, and the endogenous forecasting of socioeconomic variables, land use, and the vehicle fleet mix (Kitamura et al., 1996, p. 267). Far from being a mere theoretical exercise confined to the ivory tower, the model development was funded by federal, state, and regional government, and ultimately applied in Florida (Pendyala et al., 2005) and elsewhere. As it has progressed, the model system has woven together many of Ryuichi’s separate analyses, some of which are described below.

Much of Ryuichi’s work was characterized by the collection and analysis of specialized types of data, using (and often extending) methodological approaches specifically suited to such data, applied to a policy-relevant context. Two of these “data-method-application” bundles are especially important. In both cases his own original empirical work was preceded or accompanied by one or more papers having what might be considered a pedagogical focus, in which he cogently laid out the importance of this particular type of data, the sorts of questions that this type of data could uniquely answer, and the challenges associated with analyzing this type of data. These papers are still cited as cornerstones in their respective areas.

1. Employing time use and activity data to analyze time allocation decisions, space-time prisms, and trip chaining behavior.

In the cornerstone paper on time use data, Kitamura et al. (1997a, p. 225) articulated the “needs for behavioral analysis based on more extensive and richer data” than could be found in standard travel diary datasets. As an example, they point out that such data can address the important question of the demand for travel induced by transportation improvements that reduce (say) commute time: whether new trips are generated by the time saved, as opposed to spending more time at home, is in essence a time allocation issue (for other treatments of induced demand, see Fujii and Kitamura, 2000; Kitamura, 1994). The same principle can be applied in a project evaluation context, to measure the benefit of travel time savings by assessing the utility of the activities to which the saved time would be allocated.

More than a decade earlier, however, Ryuichi (Kitamura, 1984) had already broken new ground with his discrete-continuous model of activity engagement and time allocation. He was able to place earlier work done by others in this area into a utility maximization framework for the first time, deriving a Tobit model with selectivity correction under that framework.

Although the foundational concepts of time-space paths and prisms dated back to 1970 and before (e.g. Hägerstrand, 1970, whose memorable title is the basis for mine), Kitamura et al. (1981) were among the first to explore them empirically, as well as develop their theoretical properties more extensively. In 1987, Kondo and Kitamura used the concept of time-space prisms to constrain the opportunity set in the context of modeling trip chaining decisions. They also argued that the benefit of conducting an in-home activity could be measured by the size of the time-space prism, since an individual would be rejecting an opportunity space of that size if an in-home activity were chosen instead. This was an early approach to understanding the trade-off between in-home and out-of-home activity engagement, a theme continued throughout later work.

More recently, Ryuichi and his co-authors (Pendyala et al., 2002) applied the novel (to transportation) stochastic frontier modeling approach to actually estimate the temporal vertices of time-space prisms. Interestingly, although many studies (e.g. Pas and Sundar, 1995) have demonstrated the day-to-day variability in actual travel behavior, this one found considerable stability in the expected temporal prism vertices across a two-day period, hinting that fluctuations in observed disaggregate behavior may fall within a fairly predictable envelope in the aggregate.

2. Using repeated-observations (panel) data to analyze dynamic processes such as response to habit disruption, route choice, and departure time.

Ryuichi well understood the importance of the dynamic aspects of travel behavior analysis, and much of his work was devoted to improving the methods by which those aspects are modeled, as well as to discovering new empirical findings. Some of his earliest work explored the use of Markov chains to model trip chaining (e.g. Kitamura and Kermanshah, 1983), and both trip chaining and Markov-chain related approaches were recurring themes in his research.

Probably Ryuichi's best-known contributions to the study of dynamic behavior, however, center around the analysis of panel data. His cornerstone paper on this subject (Kitamura, 1990) is a valuable introduction to the advantages and disadvantages of taking multiple observations from the same individuals over time. In this paper he articulately argues the importance of panel data for tracking changes in behavior (revealing patterns that even repeated cross-sections cannot, let alone single cross-sections), and points out the stringent assumptions required (that changes be instantaneous and symmetric, and that relationships remain stationary over time) for cross-sectional data to be applicable to forecasting trends.

Of course, as he also notes, panel data requires more sophisticated analysis tools as well. In particular, panels are subject to attrition over time, and failing to account for the selective nature of that attrition can lead to biased estimators of model parameters. Prior work by himself and others dealt separately with accounting for (a) attrition in panel studies (see Kitamura and Bovy, 1987 for a novel application to modeling household trip generation, using the Dutch Panel Survey data), and (b) non-randomness in choice-based samples, but to my knowledge, Kitamura et al. (1993) were the first to develop and apply a weight-creation model that accounts for both types of bias simultaneously. Pendyala and Kitamura (1997) extended that work to deal with weighting refreshment cases in a panel. Ryuichi and his colleagues made additional significant contributions to the science of sampling with his papers on weighting under complex endogenous sampling conditions (Kitamura et al., 2003), and sampling alternatives from a massive choice set (such as the set of possible activity patterns) using a Markov chain Monte Carlo algorithm (Yamamoto et al., 2001).

The contexts for Ryuichi's application of panel/repeated-observation data methods are diverse, each yielding valuable empirical insights. They include route choice (Abdel-Aty et al., 1995), departure time choice (Senbil and Kitamura, 2004), adaptation to the creation of a high-occupancy vehicle lane (Golob et al., 1997), and response to habit disruption due to a planned freeway closure (Fujii et al., 2001) or to the experimental provision of free bus tickets (Fujii and Kitamura, 2003). Some of these areas are addressed in several different papers; I have only selected somewhat arbitrary exemplars in those cases.

In terms of empirical applications, a few other areas were especially prominent in Ryuichi's work. For example, he addressed the role of car ownership decisions in numerous papers, both in his early work (Kostyniuk and Kitamura, 1986) and later (Yamamoto and Kitamura, 2000). Funded by the California Energy Commission to support its petroleum consumption forecasts, Ryuichi and his colleagues (Bunch et al., 1993) developed discrete choice models to address the demand for alternative-fueled vehicles, apparently well before anyone else in the profession did so (aside from work by Train, 1980, which used only revealed preference data on existing vehicle types). Similarly, Ryuichi and his students were the first to conduct rigorous analyses of the transportation impacts of telecommuting, using travel diary data collected from participants in the precedent-setting State of California Telecommuting Pilot Project (Pendyala et al., 1991). They found, for example, that the activity spaces of telecommuters contracted substantially after telecommuting began – not only on telecommuting days, but also on non-telecommuting days – suggesting that telecommuting prompted participants to find ways of fulfilling their demand for activities that were closer to home. These examples illustrate Ryuichi's visionary nature – always scanning the horizon for trends that could be relevant to travel behavior, and in the forefront of the profession in trying to understand the implications of those trends.

Some of Ryuichi's early work (e. g. Kitamura, 1988b) referred to the important role played by land use in general, and residential location in particular, in influencing travel behavior. We were able to explore this area together in a project we conducted for the California Air Resources Board in the early 1990s. In what is probably the first effort of its kind, we collected both travel diary data and an extensive set of attitude and lifestyle measures (together with standard socioeconomic variables and externally-measured land use characteristics) from residents of five different neighborhoods in the San Francisco Bay Area. Our mode-specific travel behavior models (Kitamura et al., 1997b) showed that attitudes explained far more about travel behavior than did indicators of the built environment once attitudes were controlled for. This seminal paper helped crystallize an understanding of the nature of self-selection into certain neighborhoods due to attitudinal predispositions, and helped stimulate numerous subsequent studies to further explore the extent to which travel behavior differences associated with different land use patterns can be attributed to attitudes rather than to the built environment itself. It is Ryuichi's (and my) single most often-cited paper, by a factor greater than two.

Perhaps I have been able to convey a flavor of Ryuichi's extensive contributions to the field, rather like dipping a few teaspoons out of the ocean. But the contributions are rendered all the more meaningful by the character of the person who made them. How can I describe Ryuichi to those who haven't had the privilege – and fun – of knowing him? Committed to scientific rigor, in his own and others' research. Relentlessly curious about how people "work". Endlessly creative in finding and adapting methodologies for exploring behavioral questions, and in identifying interesting questions to which to apply them. Interdisciplinary in outlook, creating elegant mathematical and statistical models while endowing them with solid economic, psychological, and geographic content and making them relevant to transportation and urban planners and engineers. Engaged with real-world planners and policy-makers. Continually mindful that the key purpose for transportation planning is to make people's lives better. Completely invested in the welfare of his students, literally to his final breath. Generous with his time and assistance to younger colleagues. Utterly approachable and unconcerned with symbols of status or hierarchy. Unquenchably optimistic in the face of adversity. And with a skewer-sharp, mischievous wit. The excerpt below, from Kitamura et al. (1997a, pp. 226-227), offers a vivid glimpse of some of these traits:

> [C]onventional … demand forecasting model systems have not addressed the relationship between transportation and the everyday life of urban residents. … [T]hese tools focused on trips and aimed at cleaner, faster and more transportation; their scopes, however, have never extended to quantify what changes in transportation mean to urban residents' welfare. . . The following simulated dialogue illustrates this point.
>
> Q. How do we determine which TCMs are best suited for our MPO region?
> A. Why not get the best model available and do a scenario analysis?
>
> Q. What shall we compare?
> A. Work trip mode use.
>
> Q. Because fewer commuters in single-occupant vehicles result in reduced congestion and improved air quality?
> A. Exactly!
>
> Q. But, would people be happier then? You see, the end goal of transportation planning is after all the welfare of our residents.
> A. Of course, why not? Carpooling is fun. And you can read in the bus.
>
> Q. But waiting for a bus is no fun when the weather is bad.
> A. Well, that's already in the model. It's called the alternative-specific constant.
>
> Q. How about the errand I have to run on the way to work?
> A. Well, I'm not sure. . .. That's not in the model. So it must not be that important. . . Well, let me see. Are we missing something?

Although we mourn Ryuichi's untimely departure from this life, he has provided us an eternal legacy, in his work and in his person. Ultimately, the most important model Ryuichi offered us was himself. With his life, he modeled for all of us how to be better researchers and better human beings.

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