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RELATIONSHIP BETWEEN TRAVEL-RELATED FEELINGS, ON-TRIP ACTIVITIES AND USE OF VARIOUS TRANSPORT MEANS IN URBAN AREAS

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ABSTRACT

One of the key issues in contemporary transport research is to achieve a better balance in the use of different travel means in urban areas, particularly promoting the use of both transit and active modes (feet, bicycle). However, such behavioral change cannot fully be achieved only acting on the relative performances of the means themselves, for example in terms of travel times and costs. This paper considers some dimensions of the travelling experience, namely, if the trip was only important to reach a destination or not, if it was tiring, if it was pleasant or unpleasant, and relates these aspects to the completion of activities during the trip and to the use of different transport modes. Correspondence analysis and Association analysis are jointly developed on some categorical variables of the French National Travel Survey. Such combined technique is picking up the strengths of each method and has proven its effectiveness. It is therefore a potentially interesting method to be also used with unstructured and dispersed dataset such as the "Big Data" ones. On the applicative side, our results show that, all else being equal, evaluations are often more depending on the fact of traveling alone or with others than on the travel means being used. Previous research results related to the symbolic and affective value of driving are specially confirmed when traveling alone, whereas the experience of traveling with others as a driver or a passenger is more similar to the use of transit services.

KEYWORDS

Correspondence analysis, association analysis, data mining, travel feelings, on-trip activities, multimodality, co-modality

INTRODUCTION

Transport policies around the world are seeking to achieve a better balance in the use of different transport means, as a way to improve the overall efficiency of the system also in economic terms, reduce its environmental impacts and promote social equality. From an engineering point of view, this goal can mainly be achieved by acting on the characteristics of the offer of travel services, namely by improving the performances (e.g., travel times and costs) of those means that one wants to incentivize. However, there is an increasing consensus among the scientific community on the importance of affective factors in shaping travel demand, particularly concerning modal choice (*1*-*8*).

Additionally, the ever increasing possibility of making travel time a "productive time" by performing a variety of activities (from the most traditional ones, such as reading or talking with others, to the possibility of benefitting from a true working environment with an Internet connection) is likely to have an impact on personal evaluations on mobility choices (*9*-*12*). Concerning the latter aspect, multimodality and co-modality issues are particularly important in urban areas, where trip characteristics, for example in terms of length and offer of different services, often make it possible to complete the same trip through several alternative travel means.

The objective of this paper is to check whether some travel-related evaluations and feelings, along with the possibility of performing on-trip activities and of taking a trip for the sake of it, are more associated with the use of a given transport mode. More specifically, on the basis of the data availability of our experimental context that will be later presented, we consider the following dimensions of the travel experience:

- if the trip was only important to reach a destination or if trip-related feelings and activities were important as well,
- if the trip was tiring or not,
- if the trip was pleasant or unpleasant,
- if some activities have been performed during the trip,
- if the trip was taken without having a well-defined destination.

These elements are admittedly not fully representative of the whole range of subjective factors affecting mobility choices that have been considered in previous research, such as preferences, opinions, attitudes and perceptions (*1*), intentions and motivations (*2*), social values and behavioural norms (*13*), affective-symbolic motives (*7*), perceived responsibility and control, emotional states, habits (*14*), lifestyles, personality traits (*4*), identities (*8*), situational factors such as health conditions and so on. However, under several aspects they represent a more basic and coherent set of indicators for many of these factors.

In order to effectively achieve our objective, we need an experimental framework that is as more general as possible, since limiting ourselves to specific kinds of trips (e.g. commute trips, or trips made by specific groups of individuals) would introduce biases in our findings. For example, commute trips have higher chances of being made through transit. On the other hand, such trips are probably felt quite differently from trips aimed at reaching more pleasurable destinations. Therefore, we consider here a sample that is representative of the general population of a whole nation, namely France, by analyzing the daily mobility observations of the French National Travel Survey (FNTS) of 2007-2008. Of course, this dataset has somewhat less information on subjective factors affecting mobility attitudes, evaluations and choices compared to what could be obtained through a more targeted survey. Indeed, most of the above mentioned

studies use in-depth data from a limited sample (e.g. commuters, students, or transit riders). Here we follow a different approach, trading off the possibility of using a richer dataset with a much stronger general validity of our results. On the other hand, the FNTS has some distinguishing features that are helpful in pursuing our goals, as it will be shown in the next section.

Compared to the state of the art, this paper complements other research efforts aimed at clarifying in more general terms under which circumstances a trip is taken for the sake of it (*15*) or it is felt pleasant and/or tiring (*16*). In particular, unlike most of the previous research efforts, the present work seeks to build knowledge by processing information that is not expressed through metric variables, as it is apparent from the above mentioned dimensions of the travel experience. We also focus on the intertwined interrelationships of several variables, rather than on the dependence between one outcome and some explanatory factors. Under these two points of view, our method is suit to work with those unstructured and dispersed data sets that are increasingly available and that are generally referred to as "Big Data".

EXPERIMENTAL FRAMEWORK AND DATASET

The protocol of the 2007-2008 FNTS introduced some novelties compared to standard national travel surveys. These latter usually focus only on "acted behaviors" of individuals and refrain from asking about subjective evaluations, feelings, preferences or opinions, that on the other hand are sometimes found in local travel surveys (e.g. *17*, *18*). Of particular interest for this study, some questions of this kind were instead inserted in the FNTS "primary utility inset". The purpose of this specific part of the survey was to investigate if a subset of trips among those being reported had some utility per se, which is here called primary utility, beyond the derived utility of getting from one place to another that is customarily considered in travel demand models. Related questions were asked for a randomly selected trip among those being reported by 17940 survey respondents and pertaining to daily and short distance mobility (*19*). The operational definition of the primary utility construct, available from previous studies (*20, 21*), informed the list of questions to be posed in the survey. Such questions and the related variables are quite relevant also for our study, since they match the dimensions of the travelling experience that have been listed in the introduction.

The first four rows of Table 1 show the definition of the four variables from the primary utility inset that are considered here. The fifth row represents a binary variable that we derived for the present research and that indicates whether the trip purpose was "going around without having a well-defined destination" or not. This specific trip purpose was defined when designing the survey in order to better identify which trips were taken for the sake of it. Taken together, these five variables operationalize the concepts of travel-related feelings and presence of on-trip activities that were discussed in the introduction. We point out that it is not common to dispose of such a big and nationally representative dataset for this kind of information.

The last row of Table 1 shows a variable that is derived from the list of travel means being used to complete the trip. Respondents could indicate up to four of them, so that 237 different combinations are found in the dataset. To simplify the analysis, we collapse them into the 12 categories indicated in the table. The resulting classification is rather effective, since less than 5% of the trips are made of several legs with different modes, for which the MODE variable is therefore not defined, and there are at least 50 observations for each retained category. Consistently with the goals of the analysis, such classification is also based on the personal representation of individual transport means (e.g. driver alone or not versus passenger) rather

than on mere technology-driven considerations, in line with previous research recommendations (*22*).

The weights we used to compute the categorical frequencies in the third column are those from the original dataset, that made those individuals that were surveyed on their travel day representative of the French population older than 5. Descriptive statistics for those variables, also in relation with the socioeconomic characteristics of the sample, are available elsewhere (*15, 16*).

The penultimate column of Table 1 reports the number of observations. We see much lower numbers in the first four rows compared to the total number of respondents, since the questions in the primary utility inset were asked only if the randomly selected trip lasted at least 10 minutes; the remaining discrepancies between these four rows are due to nonresponse. PROMENADE is defined for all observed trips, whereas MODE could not be defined for about 5% of trips as previously discussed. Finally, the last column of the first five rows shows the number of observations that are available for the following analysis, since the variable MODE could be defined.

[Table 1 about here]

In the following, we look at how MODE is associated with the other variables that are listed in the table. Since all these are categorical rather than metric, we cannot rely on more common statistical analyses such as regression, analysis of variance or correlation analysis. We therefore use two techniques that are appropriate in this framework, namely correspondence analysis and association analysis. These two techniques are complementary, since the former one is designed to focus on a limited set of variables, whereas the latter is a data mining method that is suit to simultaneously process big dataset. We believe that, taken together, they can represent an effective method to exploit the travel-related information that is hidden in a range of data sources beyond the typical contents of travel surveys.

CORRESPONDENCE ANALYSES

Correspondence analysis allows the researcher to visualize the associations among two or more categorical variables in a single plot. It is an increasingly popular tool, widely implemented in statistical analysis packages, that is helpful in disentangling those complex patterns of interdependences among factors that cannot be metrically expressed (*23*). All the categories are displayed through points in a single chart, whose position reflects the corresponding cell frequencies of the variables cross tabulations.

Figure 1 shows the patterns of association between MUFATIGUE and MODE, where the categories of the two variables are respectively shown with triangles and dots. As expected, active travel means (feet and bicycles) are associated with more physically tiring trips. It is on the other hand interesting to note that school bus trips are instead more associated with mentally tiring trips. This is probably a sign of the stress related to going to school, rather than an indication of problems related to the trip itself. Finally, trips involving the use of suburban trains are the most tiring under both points of view, since they are likely to be overlong and taken for commuting. The top-right corner of the figure shows five travel means that are more associated to trips neither physically nor mentally tiring: car passenger, motorbike driver, car driver not alone, bus and tramway.

[Figure 1 about here]

Turning the attention to the relationship between mode usages and trip pleasantness, Figure 2 displays the same kind of analysis between the corresponding categories. It is apparent that pleasant trips are more associated with active travel means and with car trips taken with others. At the other extreme, trips with suburban trains and subways are often unpleasant: it is likely that such means are used mainly for their superior performance on factual elements such as travel times, absence of parking problems etc.

Mostly interesting and quite unexpectedly, there is a more neutral attitude towards trips taken driving a car alone. This result seems at odds with results from the research on the affective and symbolic value of driving a car (*24*). However, these trips are the majority in our sample and are also more diversified in terms of purposes, length and other characteristics that have an influence on the traveler's perceptions. Our sample is also representative of a general population and is not focusing on specific groups, which could like to drive a car more than the average. It is nevertheless interesting to better investigate this issue by jointly considering other elements related to the travelling experience while driving: this will be the object of the following section.

[Figure 2 about here]

Finally, Figure 3 represents the correspondence analysis plot of MURAISON and MODE. Interestingly enough, trips where feelings were considered important are predominantly made by bike, whereas those whose activities are important are associated with walking. With the partial exception of motorcyclists, trips that are taken predominantly for the need of reaching a well-defined destination are more associated with the remaining travel means. This analysis is under some points of view complementary with the preceding ones: the symbolic value of driving a car does not clearly emerge, since the related trips are more done for necessity than others.

[Figure 3 about here]

ASSOCIATION ANALYSES

Method

Correspondence analyses allowed us to uncover how the use of different travel means is linked with single aspects of the overall travel experience, as described by each of the variables listed in Table 1. However, there are good reasons to think that more complex relationships, involving several of the above variables, are also in place. For example, unpleasant trips could be often considered also mentally tiring trips and, most importantly for our research, this could particularly happen with some travel means. We resort on a data mining technique in order to explore such more complex patterns, namely Association Analysis (*25*), that was already used in a previous study on modal usages patterns according to socioeconomic characteristics of the travelers (*26*).

The first step of the method is to represent each trip in the dataset through a set of binary dummy variables that code all categories listed in Table 1. For example, we define two dummies for MUSENSATION, that take the value of (0, 0) when MUSENSATION=Pleasant for a given

trip, (1, 0) for MUSENSATION=Unpleasant and (1, 1) MUSENSATION=Neutral. It is then possible to build an incidence matrix with as many rows as trips and as many columns as dummy variables (equal to the number of categories listed in table 1 minus the number of variables).

An *itemset* is defined as any combination of categories that are associated to a specific trip, for example {MUACTI=Yes, PROMENADE=No}. In other words, any subset of dummies having value equal to one in a given row of the incidence matrix can be an itemset. Therefore, itemsets need not necessarily contain one category for each variable, so that in our case the size of an itemset is comprised between 1 and 6, i.e. the number of variables. The number of possible itemsets is huge, but for the purpose of this analysis it is however relevant to consider only those itemsets with minimum size equal to two and including a category pertaining to MODE that we index with k, with $1 \leq k \leq 12$ according to Table 1. The relevant itemsets are in fact only those that associate the use of a given travel means k with at least one of the other features listed in the first five rows of Table 1. There are 4260 itemsets in the FNTS dataset that have these characteristics and are contained in at least one trip. Among these, those itemsets of size equal to two and containing a category from MUFATIGUE, MUSENSATION or MURAISON are globally reproducing the results of the previous section.

Interestingness measures are defined to focus the attention on a manageable number of itemsets (*25*). The most commonly used measure is the *support*, namely the fraction of observations (trips) that contain the itemset. Higher support values are therefore indicating stronger associations between the corresponding items (categories), since the corresponding trip characteristics are more commonly found together in the dataset. Therefore, we run a preliminary analysis considering the three itemsets with highest support for each of the 12 categories of MODE. Categories MUFATIGUE=Not_tiring and PROMENADE=No were thus found to be associated to all means within these first three positions. Additionally, MUACTI=No was associated with the use of bikes and mopeds (two-wheeled vehicles are not conducive to performing other on-trip activities) and MURAISON=Direct with suburban trains and tramways.

Concerning the latter finding, Figure 3 from the previous section shows that MURAISON=Direct is also associated to many other travel modes. However, when jointly considering several dimensions of the travelling experience, itemsets with size equal to two and containing MUFATIGUE=Not_tiring or PROMENADE=No show higher support compared to those with MURAISON=Direct. This happened considering all travel modes, except rail. This is a good example of the complementarity of correspondence analysis and association analysis: when considering more than one dimension of the travelling experience, we realize that the link between MURAISON=Direct and most of travel means is relatively weaker. On the other hand, correspondence analysis can more easily show the association of several categories for a limited number of variables.

The frequency of the different categories is widely different in the FNTS dataset, as shown in Table 1. Therefore, considering only itemsets with highest support is not a good selection criterion, because for example we would most likely not consider any itemset containing less frequently used travel means. To overcome this problem, in the following we also consider the *lift*, that is commonly defined as the ratio between the support of an itemset and the product of the frequencies of the categories belonging to the same itemset (*25*). Large lift values are an indication of the absence of independence among the corresponding categories. On the other hand, itemsets with too large lifts are often spurious, since they could be present in few observations, thus inflating the denominator of the lift.

To overcome the above shortcoming of the lift measure, we propose to apply it only on a subset of the above 4260 itemsets, that is defined as follows. We consider only those complete

itemsets (i.e. containing six categories, one for each variable) that satisfy both the following two conditions: (1) they must be found in at least 1% of all the trips made by mode k, and (2) they must be contained in at least 5 trips. More formally, we define a new interestingness measure that we name *partial frequency*. The partial frequency of an itemset i (PF_i) is a function of its support SUP_i, of the total number of trips made by mode k (TRP_k) and of the total number N of trips in the dataset (that is equal to 17940 in our case):

$$PF_i = SUP_i \frac{N}{TRP_k} \ .$$

Then, we define a subset of the above mentioned 4260 itemsets such that $PF_i \geq 0.01$, $SUP_i \geq 5/\mathrm{N}$ and *size* (i) = 6.

From this subset, the three itemsets having the highest lift for each mode k are selected. After considerable experimentation, we believe that this process of selecting the itemsets upon which to focus our attention is the best compromise between the need of considering the most frequent itemsets and the widely different frequency of use of the means.

Thirty-five itemsets have thus been identified, since only two itemsets satisfying the three above constraint are available for Mopeds. They are presented in Table 2, along with their partial frequency (PF) and lift values in the last two columns. Several different comments are possible on the basis of these results.

[Table 2 about here]

Results and comments

The three itemsets related to the two non-motorized travel means “On foot” and “Bicycle” follow similar patterns. For example, partial frequency values are generally lower and lifts are higher than those related to the other modes. This is an indication of the fact that trip-related feelings patterns are more differentiated compared to other means, but form more identifiable clusters. The first five itemsets in the table are also the only ones where the related trip purpose is “promenade”. This does not necessarily mean that such purpose is not present also for other modes, but rather than there are other stronger associations in place. It is very important in general to avoid separately considering each individual variable when interpreting the results related to an itemset: we mined itemsets with highest lifts, so the combination of different categories rather than the individual ones are of central interest here. By looking at the first five rows of the table, we can therefore conclude that “promenade” trips are strongly associated with positive feelings. The same goes for physically tiring bike trips that are not “promenades”, an interesting and policy relevant finding in that if physical effort does not negatively affect the traveler’s mood, then the potential for such travel means is much higher.

The nine itemsets related to car trips show well how trip-related feelings change not only with the use of a given mode but also with the role that is taken by the traveler. Concerning “car driver alone” trips, affectively neutral trips (for which it is only important to get to destination) are almost 34%, a number that reinforces the interpretation of the related results from Figure 2 that was offered in the previous section. Such trips are more pleasant than the contrary even if no-on trip activity is performed. Interestingly enough, when the driver is not alone trip activities are more strongly associated with pleasant trips and with the importance of on-trip feelings, so that the itemset patterns are completely different. These latter three itemsets are also strikingly similar with the “Car passenger” ones. This is a relevant finding for the vast literature investigating the

symbolic meaning of cars and of the driving activity (*24*). Actually, the fact of traveling with others seems to override the fact of driving a vehicle and the related psychological implications, a perhaps decisive scientific support to the potential of schemes such as carpooling also towards a "better education" of travelers, even if private means are still used and cars are still driven.

Trips with mopeds and motorbikes show similar patterns of trips made by solo car drivers. Driving a motorbike, like driving a car, made the trip pleasant and made the related feeling important without performing other activities for around 15% of reported trips through both means. However, the association of these categories in the case of motorbikes is much stronger, so that the pleasure of driving affects higher proportions of motorcyclists than of car drivers.

Concerning transit modes, whose itemsets are reported in the last fifteen rows of Table 2, it is noteworthy that subways and buses were associated with a physically tiring experience whenever it is only important to get to destination. Again, considering the relationship between MODE and MUFATIGUE in Figure 1 does to allow finding a direct association between those two transit modes and trips considered physically tiring. We can jointly interpret these two results assuming that those traveling only to get to destination and without having good feelings from the trip are more sensitive to physical accessibility barriers of the travel means (e.g. stairs to get into the vehicle or lack of seats). Therefore, only for this subset of travelers there is an association between some forms of public transport and trips that were physically tiring. Conversely, the two associations in Figure 1 between mentally tiring trips and school bus, and both physically and mentally tiring trips and suburban trains are dispelled when jointly considering the possibility of performing on-trip activities or having a pleasant trip. These are probably "high stakes-high rewards" means, in the sense that travelers can have potentially high benefits when using them, but such means can be rather tiring if this does not happen.

"Neutral" sensations are more frequently found in itemsets related to public transport (7 itemsets out of 15) compared to other means. However, itemsets containing MUSENSATION = "Pleasant" are still the majority among those fifteen and moreover are very similar to the six itemsets pertaining to "Car driver not alone" and "Car passenger" that were previously interpreted and commented. This confirms the importance of considering a categorization of transport modes that is more based on the fact of travelling alone or with others, rather than on the actual kind of vehicle and of service being used, whenever we are considering traveler's values and affective factors.

DISCUSSION AND CONCLUSIONS

In this paper we presented some analyses aimed at uncovering the relationships between a set of constructs pertaining to the individual traveling experience and the use of different travel means, that were categorized also considering the individual point of view (e.g. travelling alone or with others) rather than exclusively referring to the standard classification operated in transport planning studies (car, rail, bus etc.). On an analytical point of view, the main difficulty was the need of working with non-metric information, which prevented us from using standard multivariate statistical analysis techniques. Two complementary methods have then been used to this effect. Correspondence analysis allowed us to examine the association between each variable and the 12 travel means that were defined, whereas association analysis jointly considered all variables for each travel means. To the best of our knowledge, these two techniques have been combined for the first time in a published work. Such methodology seems particularly suit to be

374 employed also with "big data", where massive amounts of unstructured and often non-
375 quantitative databanks need to be processed in order to extract the relevant information.
376 Several different findings have been shown when presenting the results in detail. We
377 believe that the most important outcome from this research is having shown the importance of
378 defining the set of travel modes in a different way, compared to what it is customarily done when
379 the objective is modeling travel demand. Empirical evidence from this study has shown that, all
380 else being equal since we consider a general sample, travel-related feelings are even more
381 depending on the fact of travelling alone or with others, than on the actual means being used.
382 Travelling with others is more associated to pleasant trips, irrespective of the fact of driving,
383 being a passenger or riding transit. It is likely that most of previous studies concerning the
384 symbolic and affective value of driving a car specially apply to solo drivers (cars and even more
385 motorbikes).
386 The above results potentially have deep implications in transport planning and modeling
387 practices. The importance of often neglected determinants for travel demand and mobility
388 choices, ranging from the fact of travelling alone or with others to the possibility of performing
389 different activities during the trip, has emerged. This suggest both new travel demand models
390 specifications and new policy measures, for example to make environmentally benign means
391 more attractive, reduce congestion, improve public health through the promotion of walking and
392 cycling or assess the market potential of new services such as driverless cars.
393 Coming to the characterisation of different transport modes, active travel means (bicycles
394 and walking) are associated with more pleasant but more physically tiring trips, and also with
395 trips where feelings and on-trip activities are important, beyond the interest of getting to a
396 destination. Jointly considering all variables, physically tiring bike trips are even associated with
397 positive feelings. The effort needed to ride a bike constitutes a barrier for its use for those never
398 riding, but our results indicate that this is not an issue for those using it. If the two groups of
399 individuals are not significantly different, then creating occasions for anybody to try this means
400 would be very important to overcome such "activation barrier".
401 Public transit can be tiring, especially for trips where it is only important to get to
402 destination. These are probably mandatory trips mostly taken during rush hours, where the
403 performances of the services probably worsen. We also have a higher proportion of neutral
404 sensations, but also a lot of pleasant trips, following patterns that are similar to those traveling by
405 a private mode but not alone. Among the different forms of transit, suburban train trips are
406 overall most tiring and most unpleasant, also because of the higher share of potentially
407 mandatory trips. On the other hand, at least when having the possibility of performing on-trip
408 activities, passenger evaluations radically change. It seems therefore particularly important to
409 improve the performances of these means and introduce the possibility of performing on-trip
410 activities on suburban trains. On the other hand, if we consider other transit modes such as buses,
411 also different factors, such as travelling not alone, seem to play a role in shaping the passenger
412 experience.
413 The interpretation of the above findings suggests that additional factors should be
414 considered in future research efforts. In particular, considering also trip-related contextual
415 variables, primarily the trip purpose (but also others such as travel distance), could help in better
416 understanding some of the above commented relationships, since the proportion of trips made for
417 different purposes or the distribution of travel distances are clearly not constant across several
418 different modes. For example, we already mentioned that findings related to trips by public
419 transport and suburban trains could be affected by a higher proportion of mandatory or
420 commuting trips, so that it would be interesting to control for this effect. We believe that

Association Analysis can accommodate for this kind of analyses of increased complexity, although the selection process of the itemsets that should be scrutinized needs to be fine-tuned, also considering the method that was proposed here.

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TABLE 1 Definition of the Considered Variables and Corresponding Sample Sizes

Variable	Question	Categories and related weighted frequencies	Total obs.	Useful obs.
MUFATIGUE	Was the trip tiring?	Physically (2.4%), Mentally (4.6%), Both (1.8%), Not tiring (91.2%)	13063	12539
MUSENSATION	Was the trip pleasant?	Pleasant (50.1%), Unpleasant (3.4%), Neutral (46.5%)	13061	12537
MURAISON	Was it only important to get to destination, or were on-trip activities or feelings important?	Direct (83.4%), Activity (10.4%), Feeling (6.2%)	13007	12485
MUACTI	Were some activities performed on-trip?	Yes (40.7%), No (59.3%)	13076	12552
PROMENADE	Was the trip purpose "going around without destination"?	Yes (2.9%), No (97.1%)	17940	17270
MODE	*Trip classification according to travel means (derived variable)*	On foot (21.1%), Bicycle (2.9%), Moped driver (0.8%), Motorbike driver (0.6%), Car driver alone (31.3%), Car driver not alone (18.5%), Car passenger (19.2%), School bus (1.1%), Urban bus (2.3%), Tramway (0.3%), Subway (1.5%), Suburban train (0.5%)	17270	-

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TABLE 2 Selected Itemsets for Each Travel Mode

MODE	MUFATIGUE	MUSENSATION	MURAISON	MUACTI	PROMEN	PF	Lift
On foot	Not tiring	Pleasant	Feeling	Yes	Yes	1.51%	146.34
On foot	Not tiring	Pleasant	Feeling	No	Yes	1.32%	84.40
On foot	Not tiring	Pleasant	Activity	Yes	Yes	1.10%	70.90
Bicycle	Not tiring	Pleasant	Feeling	Yes	Yes	1.10%	106.58
Bicycle	Not tiring	Pleasant	Feeling	No	Yes	1.54%	98.61
Bicycle	Physically	Pleasant	Feeling	No	No	1.76%	64.11
Car driver alone	Not tiring	Neutral	Direct	No	No	33.93%	5.91
Car driver alone	Not tiring	Pleasant	Direct	No	No	15.54%	2.50
Car driver alone	Not tiring	Unpleasant	Direct	No	No	1.00%	2.47
Car driver not alone	Not tiring	Pleasant	Activity	Yes	No	3.96%	7.72
Car driver not alone	Not tiring	Pleasant	Feeling	Yes	No	2.37%	6.93
Car driver not alone	Not tiring	Pleasant	Direct	Yes	No	17.51%	4.27
Car passenger	Not tiring	Pleasant	Activity	Yes	No	4.94%	9.64
Car passenger	Not tiring	Pleasant	Feeling	Yes	No	2.65%	7.77
Car passenger	Not tiring	Pleasant	Direct	Yes	No	23.78%	5.80
Moped driver	Not tiring	Neutral	Direct	No	No	31.46%	5.48
Moped driver	Not tiring	Pleasant	Direct	No	No	22.47%	3.62
Motorbike driver	Not tiring	Pleasant	Feeling	No	No	14.13%	27.36
Motorbike driver	Not tiring	Pleasant	Direct	No	No	32.61%	5.25
Motorbike driver	Not tiring	Neutral	Direct	No	No	14.13%	2.46
School bus	Not tiring	Neutral	Direct	Yes	No	32.73%	8.63
School bus	Not tiring	Pleasant	Direct	Yes	No	21.82%	5.32
School bus	Not tiring	Pleasant	Direct	No	No	11.82%	1.90
Suburban train	Not tiring	Neutral	Direct	Yes	No	16.67%	4.39
Suburban train	Not tiring	Pleasant	Direct	Yes	No	14.81%	3.61
Suburban train	Not tiring	Neutral	Direct	No	No	12.04%	2.10
Subway	Physically	Neutral	Direct	Yes	No	2.47%	12.26
Subway	Not tiring	Pleasant	Activity	Yes	No	5.25%	10.24
Subway	Not tiring	Pleasant	Feeling	Yes	No	1.85%	5.42
Tramway	Not tiring	Neutral	Direct	Yes	No	20.00%	5.27
Tramway	Not tiring	Neutral	Direct	No	No	30.00%	5.23
Tramway	Not tiring	Pleasant	Direct	Yes	No	17.50%	4.27
Urban bus	Physically	Neutral	Direct	No	No	2.70%	8.77
Urban bus	Not tiring	Pleasant	Feeling	Yes	No	2.70%	7.82
Urban bus	Not tiring	Pleasant	Activity	Yes	No	3.00%	5.79

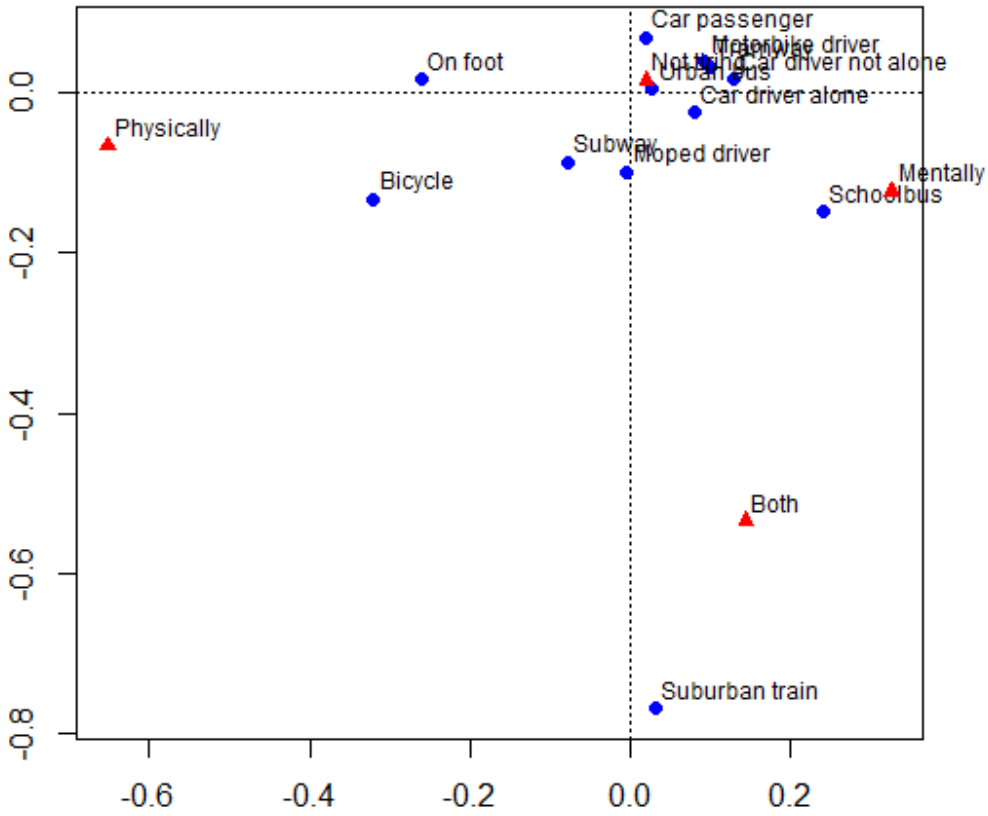

FIGURE 1 Correspondence analysis of MUFATIGUE (triangles) and MODE (dots).

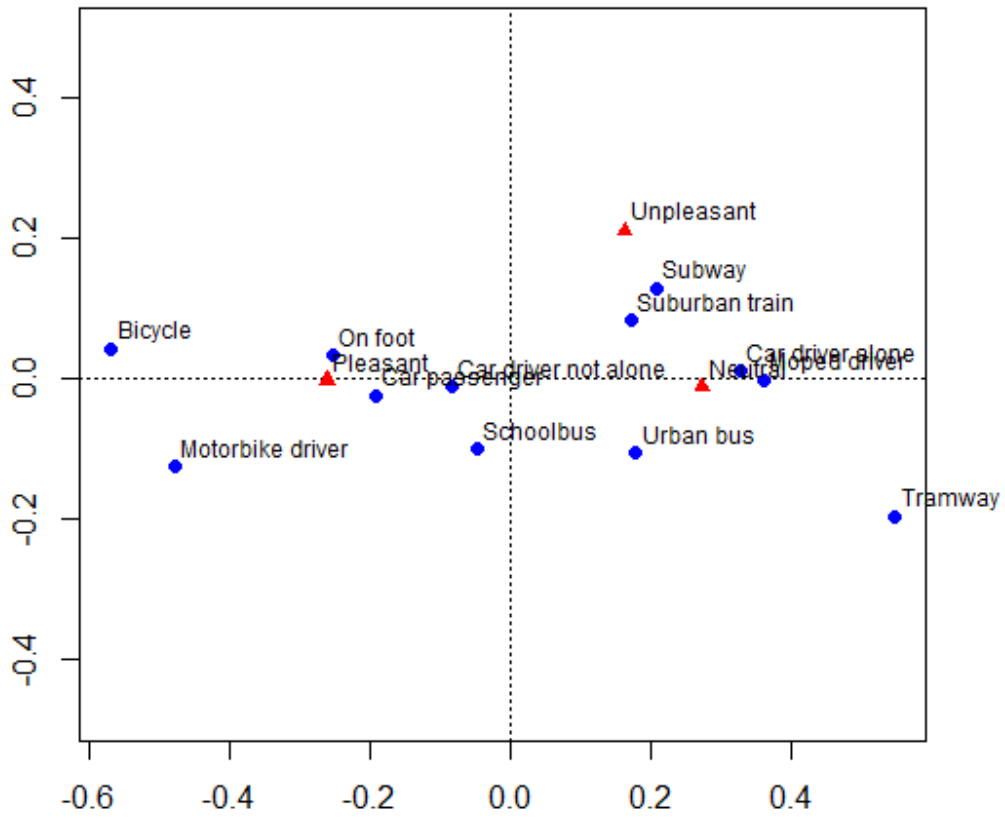

FIGURE 2 Correspondence analysis of MUSENSATION (triangles) and MODE (dots).

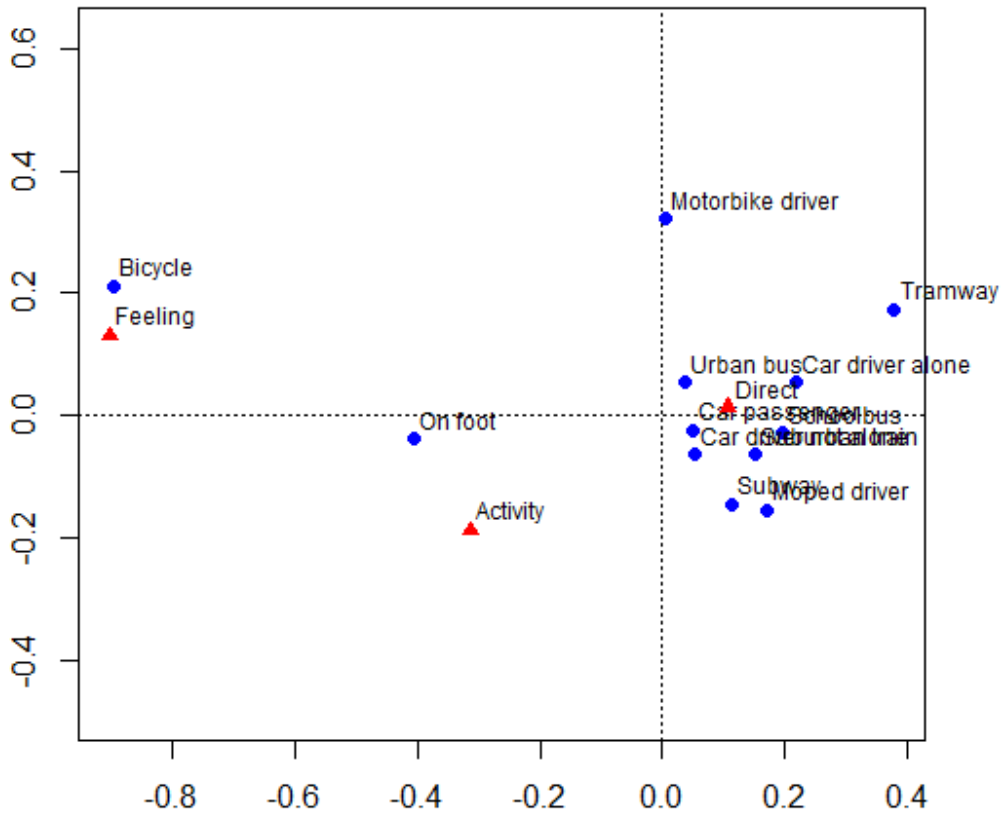

FIGURE 3 Correspondence analysis of MURAISON (triangles) and MODE (dots).