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Visualizing multinational daily life via multidimensional scaling (MDS)

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Abstract

One of the notable innovations in social-science methodology developed during the 1960s was Multi-Dimensional Scaling (MDS). MDS made it possible for social scientists to discover, uncover or model the underlying spatial structure of relations between various social collectives (like countries or communities), social objects (like music or artifacts) or social attitudes. One early application of MDS described the dimensional contours of Americans' views of other countries in terms of "perceptual maps of the world". More recently, it has been used to map country differences in the World Values Survey. Spurred by its initial successful applications, MDS was extended to time-diary data collected in the pioneering 1965 Multinational Time-Budget Study, in which it again provided insightful portrayals of daily activity across the 15 national settings in that study. This present article updates and extends these results by applying MDS methods to the most recent diary collection in the Oxford University MTUS data archive – covering more than 20 (mainly European) countries. Once again, the result was plausible (but somewhat different) configurations again emerged from MDS visualizations. Moreover, these mappings were compatible with conclusions from the 1965 mapping and with earlier more conventional analyses.

JEL-Codes: B16, C15, C21, C39, N30, O50

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1 Introduction

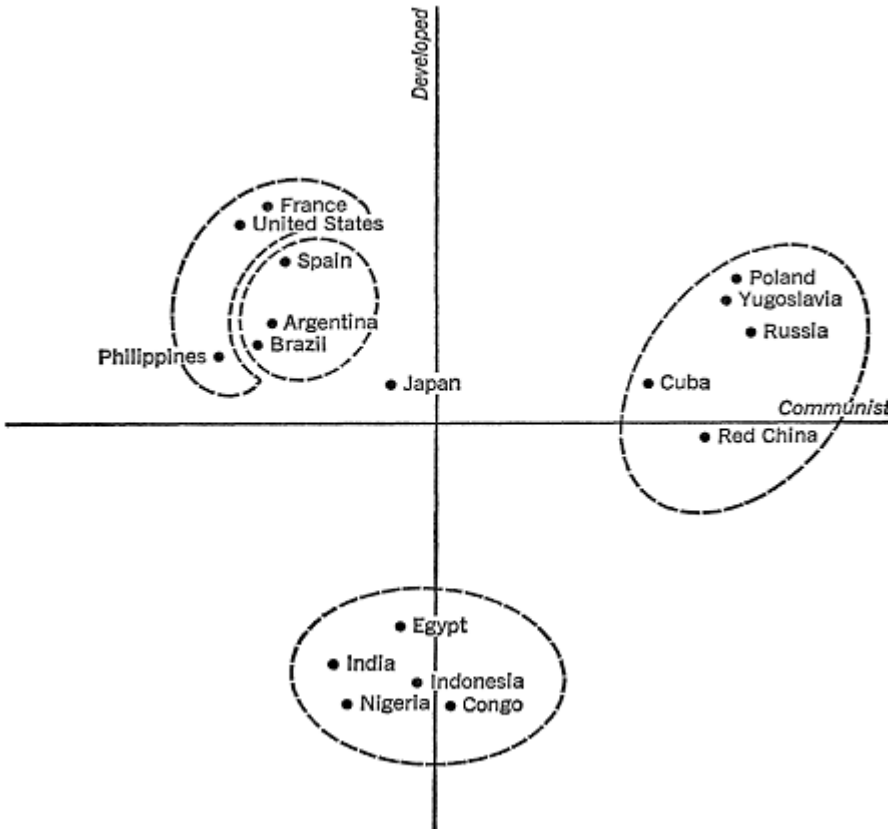
The 1960s marked a decade of great societal experimentation in politics, culture and science. One of the more notable methodological innovations in the social sciences during this decade was a technique called "Smallest Space Analysis" or SSA (Guttman 1968; Kruskal 1964). It later went under the name of Multi-Dimensional Scaling (MDS), and it has become one of the standard analytic tools available in SPSS. Based on calculations and procedures in mathematical topology (or "rubber-sheet geometry", in which the simple order of distances in a space was employed as the central metric, rather than the magnitude of original distances themselves – as in city subway maps), MDS made it possible for social analysts to discover (or uncover) the underlying spatial structure of relations between various groups of people, social collectives (like countries or communities), social objects (like music or artifacts), and social attitudes and values.

Bloombaum (1970) described SSA thusly: Smallest space analysis (SSA) is one among the new methods of nonmetric analysis ....methods recommended for those jobs where the investigator desires a rigorous multivariate analysis under the constraints of no special assumptions. A pleasing related feature of the techniques discussed here is that the results achieved are directly and intuitively interpretable by relatively untutored persons, as well as by the scientist who takes responsibility for his project in its entirety.

One initial application of MDS described the dimensional contours of American perceptions of the countries of the world, or "perceptual maps of the world" (Robinson and Hefner 1968). In this case, a random sample of Detroit respondents and a sample of academic "experts" were given the names of one country (like Argentina or Poland) and asked to which of 16 other countries it was most similar, the term "similar" purposely left undefined in order to allow smallest-space analysis to discover its underlying perceptual structure. Based on these perceptual responses, MDS generated the map in Figures 1 (for the public) and 2 (for the experts), which made it possible to visualize these similarity ratings as reducible to three dimensions, which are highlighted with the dotted circular lines.

In Figure 1, the political (horizontal) perceptual dimension separated mainly Eastern "Iron Curtain" communist countries (like Russia and Poland, but also Cuba and China) on the right from mainly Western capitalist countries, like the US and France, on the left. The second vertical dimension then separated more economically prosperous countries (again like the US and France) at the top from "third world" countries, like India and Nigeria at the bottom. The third cultural dimension (shown by the dotted lines in Figure 1) then separated those countries that had Spanish (or Portugese) roots or lineage, from those that had other cultural connections.

Figure 1
Country positions (for the first two dimensions)
determined by smallest space analysis



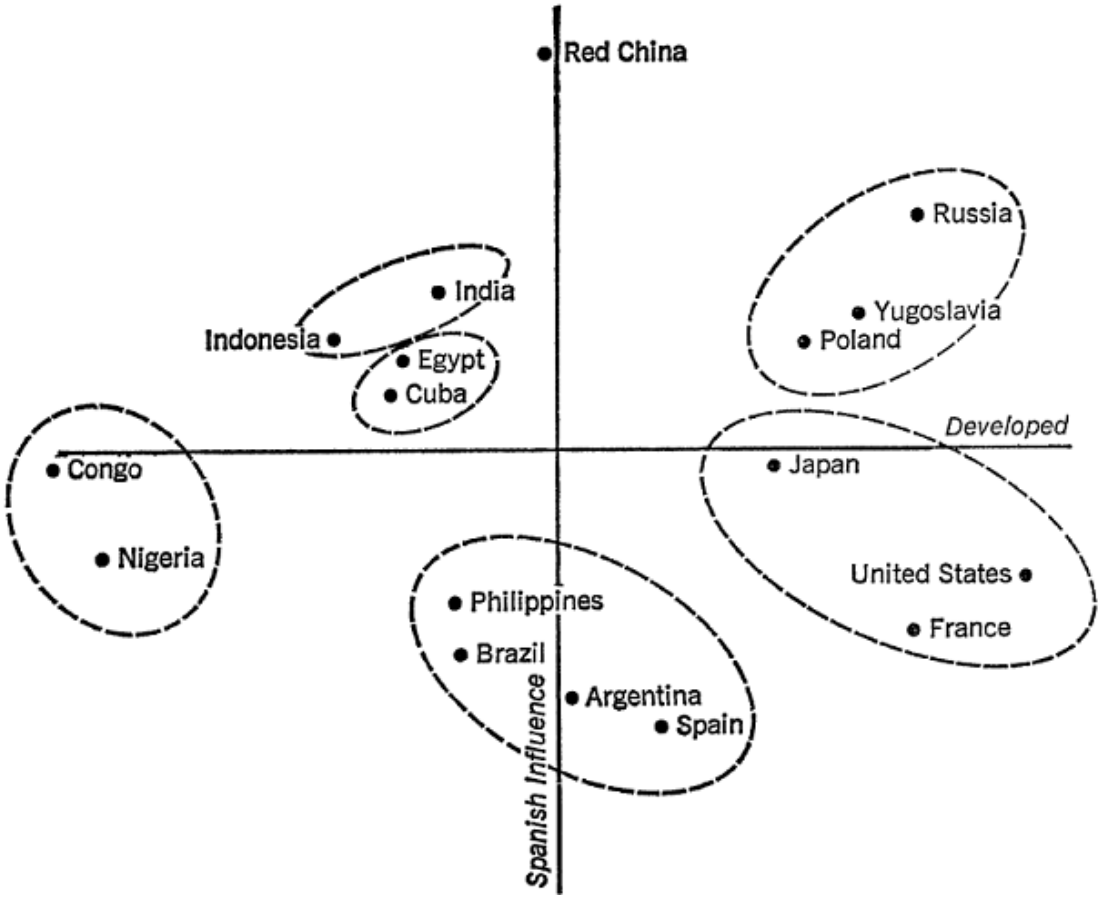
Note: Dashed lines indicating groupings suggested by three dimensional solution.
Source: 1963 Detroit public sample, as reported in Robinson and Hefner(1968),
Own illustration.

Three parallel dimensions were also found in similarity ratings made by a separate sample of academic experts in the Detroit area, but as shown in Figure 2, they differed in the salience or ordering of these three dimensions. The academic sample perceived the economic dimension as of paramount importance, as shown by the horizontal distinction between US, France and Russia on the right and Congo and Nigeria on the left. Their second vertical dimension then emphasized the "Spanish influence" countries (including the Philippines) from the rest, especially China. Their third dimension then separated the politically different communist from capitalist countries, although they saw China as much more distant from this bloc than the public in Figure 1. Indeed, one can see that the countries in Figure 2 are generally more scattered or less clustered than in the public's Figure 1, indicating more indicating more differentiated or nuanced judgments than the public in Figure 2. Here, then, in the two samples, the academics stressed economic factors vs. the public's more political factors.

These mappings, moreover, predicted differences in attitudes toward several foreign policy issues, like the Vietnam War, foreign aid and general isolationism. Members of the Detroit public

who saw more difference economically than politically in their mappings tended to share the academics' greater opposition to that war and support of aid to less developed countries.

Figure 2
Country positions from smallest-space analysis



Note: Dashed lines indicate grouping suggested by three-dimensional solution.
Source: 1964 Academic sample, as reported in Robinson and Hefner (1968),
Own illustration.

Objective Measures: These discoveries then led to the question of how well these MDS perceptual mappings reflected "real world" differences between countries. Here MDS was used to uncover similar dimensions based on "harder" or more accepted measures of national differences, such as a country's GNP, literacy level or type of political representation. Here, two separate dimensions emerged from the available indicators at the time, one economic (mainly based on UNESCO data sources) and one political (based on a set of ratings of political structure types in countries) developed by a Yale University panel of political scientists (Banks and Texter 1963).

The technique has more recently been applied to summarize subjective data collected from the World Values Survey. Based on the public's acceptance of various value statements in different countries, Inglehart and his colleagues (2011) have generated a map that reduced the complex responses of people in these countries to a large battery of value statements to a simple two-

dimensional space. That map can be viewed directly at www.worldvaluessurvey.org, again with the clusterings being of main interest.

Among the wide variety of other social objects and concepts in several academic disciplines analyzed by MDS or SAA are occupations (Laumann and Guttman (1966), occupational interests (Meir 2010), work values (Elizur 1984), workplace values (Singh et al, 2011), leadership styles (Shapira 1976), ,personality beliefs (Kumar, Ryan and Wagner (2012), career adaptability (Johnston et al. 2006), gender differences (Elizur 1994), sex-role attitudes (Ruch 1984), forgiveness likelihood, (Kumar et al. 2009), child intelligence (Fiorello 2006), anthropology of migration (Lalouel and Langaney 1980) and national socio-political characteristics (Bloombaum 1970). Again most of these analyses focus on the clusterings rather than the dimensions that may define them.

2 Data and Methods

The Multinational Time Use Study (MTUS: as described in Fisher and Robinson 2011) is a retrospectively (post-fieldwork) harmonized archive of nationally representative time- diary studies. It currently includes some 60 surveys from 25 countries, the earliest currently dating from 1961 (www.timeuse.org). The statistical approach adopted in the remainder of this article uses a purely inductive method for the investigation of the cross-national record of time use. The authors of this paper intend simply to update the conclusions of Converse (1972) described below. What emerges nevertheless also corresponds to a remarkable degree to the "life-balance triangle" framework discussed in Gershuny (2009).

We employ the same multidimensional scaling technique of Smallest Space Analysis as did Converse. The technique involves, first, constructing **difference half-matrices** by calculating the mean squared differences for each pair of data points, For a pair of data points i and j (representing two countries) and a set of k activities the (generalised Euclidean) distance measure is the square root of the sum of the squared differences in the time devoted to each activity in the pair of countries:

$$D^{ij} = \sqrt{\left(\left(a_1^i - a_1^j\right)^2 ... \left(a_k^i - a_k^j\right)^2\right)}. \quad (1)$$

These 20-country data points yield a total of 380 (20x19) pairs to be arranged in the form of a half-matrix of distances between each pair of points. The straightforward intuitive explanation of SSA technique, is to imagine just such a half matrix but representing distances between cities as in a road atlas, and the SSA program as generating a 2-dimensional mapping of the relative positions of these cities in geographical space. A half matrix of distances among any real set of cities will (disregarding the curvature of the earth) indeed be capable of reconstruction into a map in the two geographical dimensions using a standard SSA programme. Any randomly generated half matrix of distances among n points will be certainly be interpretable as representing

a space in n-1 dimensions, and with increasing degrees of stress in n-2 dimensions, n-3 dimensions, and so on.

It is important to recognize certain limitations in this SSA application, which is intended mainly to illustrate its power to reduce complex time-diary data to provide simple two-dimensional mappings at a single points in time for two data sets (here separated by 40 years in time) examining different countries, and using (somewhat) different diary methods and coding. It is not possible then to reach any conclusions about increasing temporal convergences or divergences across countries or daily activity. We simply present two maps, one for 1965 and one for 1998-2005, that employed different methods and examined different countries, but with the simple conclusion that in both studies, the conclusion about the geo-cultural dominance in country time-use similarity. We are unable to tell whether this convergence is greater or lesser across time.

2.1 SSA/MDS maps of 1965 multinational time-use data

When the multinational time-diary data from Szalai's (1972) pioneering 1965 time-diary study became available soon after the SSA or MDS technique was developed, interest was naturally aroused about how well the method might capture the similarity in daily-life patterns across various countries. MDS techniques here were simply and directly applied to the daily hours/minutes people in each country spent their time – how much time they worked, slept or used the mass media.

Converse (1972) published these MDS results that generated the dimensional visualizations in Figure 3 that provided immediate and plausible insights into how similar life was in the different national settings involved in the study. (It was most helpful in this analysis that Szalai had established a common set of sampling, field and coding procedures that were strictly followed to ensure data comparability across countries.)

Converse succinctly described the resulting MDS diagram in his Figure 3 as follows:

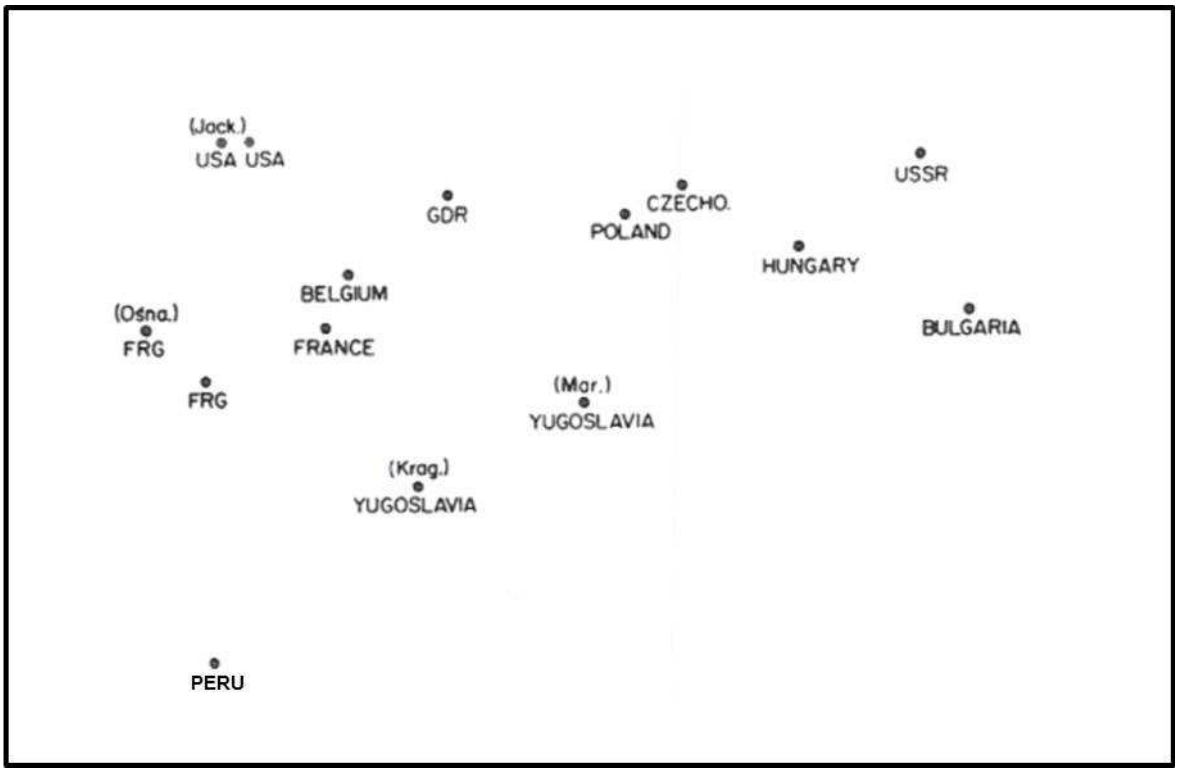
In Figure 3 we have plotted the 'locations' of all our 15 sites with respect to the two major dimensions that arise from such an analysis. We discover to our considerable interest that we have retrieved from these time use profiles a 'picture' that bears a substantial resemblance to a map of the western world, especially if the Atlantic Ocean is removed as though continental drift had not occurred. Peru is off to the 'southwest', both Jackson and the U.S.A. samples are close together to the 'northwest', while Pskov (USSR) and Kazanlik, (Bulgaria), lie fairly near to one another far to the 'eastern' edge of our field of view. The rest of the European sites are filled in along lines, that do only modest violence to a simple geographic representation. (p150)

However, Converse immediately cautioned against this simple explanation on the basis of geographical proximity:

Clearly, the solution is not pure physical geography. The position for the

Kragujevac (Yugoslavia) point is far to the 'West' of its physical location. The Osnabruck (F.R.G.) pair of observations is interchanged with the France-Belgium pair of positions, and so on. However, if we may paraphrase George Bernard Shaw, the marvel is less that our Figure 3 reproduces physical geography poorly, that that it should reproduce it at all. After all, we have not fed the slighted shred of geographical information into the computer, and even if country names rather than code characters had slipped into the machine, the computer would have lacked the wit to impose any kind of geographical ordering whatever onto the results.

Figure 3
Two-dimensional solution for time-use map of 1965



Source: Multinational data from Szalai (As reported in Converse 1972), own illustration.

All that entered the computer were 455 proportions indicating how people at 15 anonymous sites distributed their 24-hour day across 37 disparate and unidentified activity categories. It is remarkable that statistical compression of these raw data yields anything a physical map.

Anticipating the type of analysis to be undertaken next with subsequent diary data collections below, Converse speculated: "Finally, it is natural to wonder how solutions of this sort might look if it were possible to carry them out on data collected at different points in time".

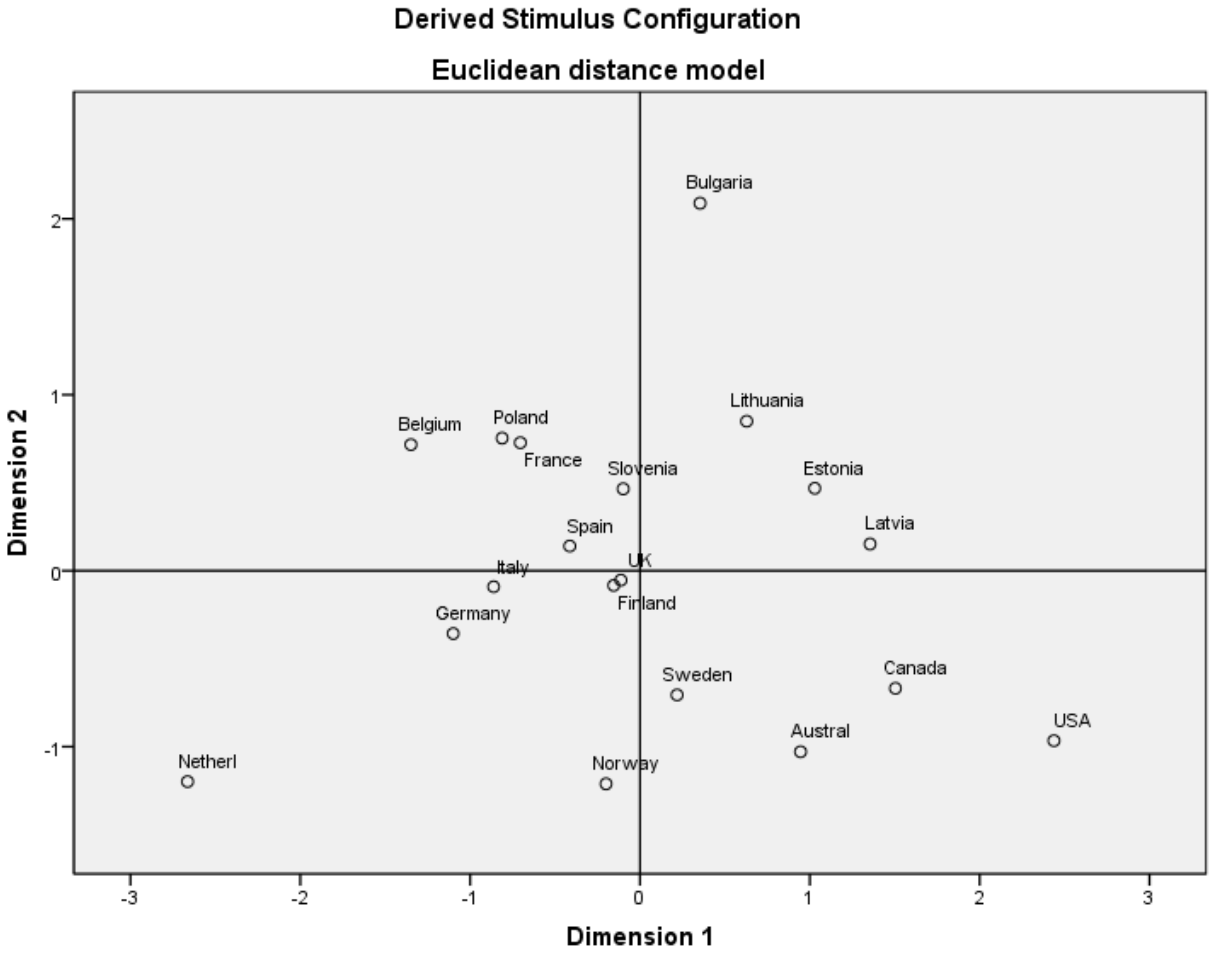
2.2 Updated 1998-2005 MTUS mappings

The recent availability of parallel "harmonized" diary data from the MTUS data archive project initiated and housed at Oxford University – involving more than 25 (mainly European) countries – allows the possibility of replicating, updating and extending these 1965 results to con-

temporary life. Appendix B shows the daily activity differences across these countries by rough geographic categories, as reported in Fisher and Robinson (2011) from the MTUS cross-country files covering 30 daily activities between 1998 and 2005. Here, there is more cross-national variation in diary methods and field procedures than in the Szalai study, although most of the MTUS countries paid very close attention to ensuring multinational and cross-time comparability using agreed-upon statistical guidelines.

Here again, MDS generated maps that represented the major differences between countries in mainly geographic terms, as shown in Figure 4.

Figure 4
MDS plot of multinational positions based on 1995-2005 MTUS diary data



Source: MTUS 1995-2005 (Aggregate data shown in Table 1-Table 4), own illustration.

Using the same basic procedures as Converse employed, the Euclidian distances between countries were calculated from the raw data in Appendix B before entering them into the MDS program in SPSS. Figure 4 reflects different configurations in these MTUS data than in 1965, but then again, there are far more counties available in the MTUS archive (along with different ways of spending time within these countries). Only five of these countries were common to

those in 1965 (France, Germany, Poland Bulgaria and the US), but several other countries had begun collecting national diary data in the 1970s and 80s to track cross-decade trends.

Figure 4 also clearly shows the influence of geography, but often more along language/culture lines than pure physical proximity. For example, the first horizontal dimension contrasts the US and Canada with the Netherlands (and less so Belgium, Germany and Italy), reflecting the sort of continental separation absent from Figure 3. While continental differences are not reflected in the proximity of Australia to the US and Canada, they are for several other countries on the right side of Figure 4 including the three Baltic states, which have less in common with these three Anglophone countries. However, both Baltic and Anglophone counties have more in common, than either does in their difference from Netherlands. In Table 1-Table 4, it can be seen that the Dutch can be seen to be relatively unique in their lower paid work hours, combined with higher socializing and much lower TV hours during free time. These seem to underlie and define most of the difference along the horizontal dimension in Figure 4

Similarly, the second (vertical) dimension mainly serves to contrast Bulgaria at the top from Nordic countries of Norway and Holland at the bottom. While turning Figure 4 upside down does better preserve a north-south dimension, the inclusion of the US and Australia in the "north", and Poland with Lithuania in the "south" does not fit this interpretation particularly well; nor does the placement of Italy and Spain, in the middle of this dimension, make the north-south interpretation any more plausible. What does define Bulgaria's isolation at the top of the vertical dimension are its greater hours on housework, sleep and home meals, combined with lower hours on educational activity, shopping, grooming and various forms of leisure.

Along with the proximity of the three Baltic states (Estonia, Latvia and Lithuania), a number of blocs or groupings in Figure 4 also reflect geographic location: 1) the three Nordic states of Sweden, Norway and Finland, and the pairings of Belgium with France and Italy with Spain. Nonetheless, there are too many "strays" in Figure 4 to consider it a simple replication of the 1965 map in Figure 3.

At the same time, however, these MTUS mappings are consistent with previous analyses of broad trends and shifts in time use using the more conventional procedures reported in Gershuny (2009).

Converse (1972) thus appears to have been too cautious in concluding that:

…..Certainly the reader has reflected on that fact that the strong gradients associated with home use of television are almost certainly transient, being mere functions of the specific period (1965-1966) during which the field works took place. In the United States at one extreme, television use had certainly approached saturation by that period; and in due course of time, it might be expected that its use will have approached saturation as well at the other extreme of our field of view. If this occurs, one of the mainstays of our geographic patterning will have disappeared. (p. 176)

Table 1
Multinational differences weekly hours spent on 31 activities –
South and North America/English speaking

Total hours and minutes per week – Whole population aged 18 to 64	Brazil 2001	Australia 2006	Canada 2005	USA 2003
Paid work/related activity (away from home)	25.8	26.1	28.7	28.6
Paid work at home	2.6	2	NA	1.6
Study & job or skill training	2.1	0.7	1.2	1.1
Homework	1.2	0.9	1.1	0.9
Commuting, job & study-related travel	5.8	3.2	3.0	2.5
Cooking & food related housework	5	6.2	4.8	3.5
All other housework and repairs, gardening	6.2	7.2	8.2	7.8
Shopping, services, other domestic work	3.2	4.6	4.3	3.7
Housework & personal care travel	1.4	2.7	2.7	4.3
Physical/medical child care	1.4	2.2	1.9	2
Interactive & other child care	0.7	3.2	1.0	2
Child care-related travel	0.5	0.8	0.6	0.6
Pet care (excluding walking dogs)	0.1	0.6	0.5	0.4
Sleep & naps	56.4	58.7	58.7	58.6
Wash, dress, & other personal care	7.2	6.2	4.5	5.6
Meals (at home & packed luches)	7.1	6.7	6.2	5.8
Walking (including walking dogs)	0.7	0.7	0.7	0.5
Sport & other exercise	0.9	1.9	2.5	1.6
Organizational & voluntary	3.2	1.3	3.7	3.6
Restaurant, bar, pub, café	2.6	1.3	2.6	1.8
Party, visits & socialise away from home	3.4	2.2	1.5	0.7
Party, visits & socialise at home	2.9	0.4	4.3	6.1
Leisure away from home	0.6	2.5	2.5	1.1
Other travel	3	2	2.0	2.2
Relax, do nothing	1.6	1.5	2.9	1.9
Computing & internet (including games)	0.5	0.4	1.7	1.2
Television	13.3	12.3	13.5	15.6
Radio, Ipod, other audio	0.8	2.3	0.2	0.4
Read	0.7	2.1	2.0	1.9
Other leisure and hobbies	1.3	4.6	0.3	0.3
Unrecorded time (average day)	5.8	0.5	0.3	0.1
Total	168	168	168.0	168

Note: Activities from Fisher and Robinson 2010,
Source: MTUS 1995-2005, own calculations.

Table 2
Multinational differences weekly hours spent on 31 activities – Central European

Total hours and minutes per week – Whole population aged 18 to 64	United Kingdom 2000-01	Belgium 2005-06	France 1998-99	Germany 2001-02	Nether-lands 2000
Paid work/related activity (away from home)	23	18.8	22.1	20.4	18.7
Paid work at home	2.1	1.1	1.3	1.2	1.1
Study & job or skill training	0.9	2	1.9	1.6	1.6
Homework	0.4	1.2	1.2	0.7	0.9
Commuting, job & study-related travel	3.2	3.2	2.8	3	2.8
Cooking & food related housework	6	5.8	6	4.9	6.4
All other housework and repairs, gardening	6.9	8.8	7.9	8.4	7.1
Shopping, services, other domestic work	4.8	4.2	4.7	4.8	4.3
Housework & personal care travel	2.2	1.9	0.1	2.5	2.1
Physical/medical child care	2.3	1.3	1.9	1.3	2.1
Interactive & other child care	1.4	0.7	0.9	0.9	1.9
Child care-related travel	0.9	0.4	0.5	0.4	0.7
Pet care (excluding walking dogs)	0.4	0.4	0.6	0.4	1.2
Sleep & naps	58.8	58.3	61.1	57.3	59.5
Wash, dress, & other personal care	5.4	5.1	5	6.1	6.1
Meals (at home & packed luches)	8.8	11	12.4	10.9	9
Walking (including walking dogs)	1.9	1.8	1.9	1.9	NA
Sport & other exercise	1.3	1.3	1.1	1.6	1.8
Organizational & voluntary	1.5	0.8	1.3	2.2	3.2
Restaurant, bar, pub, café	1.1	1.5	3.2	0.8	1.9
Party, visits & socialise away from home	5.3	4.4	3.2	4.6	8.2
Party, visits & socialise at home	1.9	2.5	1.8	3.3	2.9
Leisure away from home	0.9	1.3	1.4	1.6	1.1
Other travel	3.3	5	3.6	4.2	3
Relax, do nothing	2.2	3	0.7	1.8	1.4
Computing & internet (including games)	1.2	2.6	0.6	2	1.8
Television	15.6	15.4	13.2	12.1	8.1
Radio, Ipod, other audio	0.7	0.5	0.4	0.6	4
Read	2.5	2.5	2.2	3.9	3.7
Other leisure and hobbies	0.7	1.1	3	2.2	1.4
Unrecorded time (average day)	0.4	0.1	NA	0.4	0
Total	168	168	168	168	168

Note: Activities from Fisher and Robinson 2010,
Source: MTUS 1995-2005, own calculations.

Table 3
Multinational differences weekly hours spent on 31 activities – Northern European/Nordic/Baltic

Total hours and minutes per day – Whole population aged 18 to 64	Norway 2000-01	Sweden 2000-01	Finland 1999-2000	Estonia 1999-2000	Latvia 2003	Lithuania 2003
Paid work/related activity (away from home)	24.5	26.7	22.2	27.1	29.3	24.9
Paid work at home	1.2	1.2	2.1	1.5	2.6	5.6
Study & job or skill training	1.4	1.4	1.8	1.1	1.9	2
Homework	0.8	0.7	0.7	0.5	0.7	0.7
Commuting, job & study-related travel	3.2	2.9	2.5	3.3	4.3	3.4
Cooking & food related housework	5.6	5.8	5.1	7.4	5.7	7
All other housework and repairs, gardening	6.3	6.8	7.7	9.5	7.7	9.6
Shopping, services, other domestic work	4.1	4.2	3.9	3.5	2.6	2
Housework & personal care travel	1.6	2.2	1.8	2.1	2.5	2.2
Physical/medical child care	2.3	2	1.9	0	1.1	1.4
Interactive & other child care	0.8	0.9	0.8	0.9	0.6	0.8
Child care-related travel	0.4	0.6	0.2	0.2	0.2	0.1
Pet care (excluding walking dogs)	0.1	0.2	0.4	0.2	0.1	0.1
Sleep & naps	56.2	56.4	59	59.5	59.9	58.9
Wash, dress, & other personal care	5.5	5.3	4.9	6.2	4.7	6.4
Meals (at home & packed luches)	8.5	10.3	8.4	8.4	9.8	10
Walking (including walking dogs)	1.8	2	2	1.6	1.9	1.2
Sport & other exercise	2.1	2	2.3	1.1	1.5	1.1
Organizational & voluntary	1.5	1.6	2	1.8	1.4	1.9
Restaurant, bar, pub, café	0.9	0.4	0.7	0	0.5	0.1
Party, visits & socialise away from home	5.6	4.1	3.7	2.3	2.7	2.5
Party, visits & socialise at home	6.5	3.2	2.6	1.4	1.4	1.5
Leisure away from home	0.9	0.7	0.7	0.6	0.7	0.2
Other travel	4.1	4.6	4.2	2.6	3.1	2.8
Relax, do nothing	1.3	2.6	2.1	1.8	2.1	1.2
Computing & internet (including games)	1.3	1.4	0.9	0.4	0.5	0.8
Television	12.6	11.9	14.7	15.4	13.8	15.3
Radio, Ipod, other audio	0.7	0.5	0.9	0.7	0.5	0.6
Read	3.7	3.3	4.9	4.1	2.8	2.5
Other leisure and hobbies	2.1	1.6	1.8	1.3	1	0.9
Unrecorded time (average day)	0.4	0.5	1.1	1.5	0.4	0.3
Total	168	168	168	168	168	168

Note: Activities from Fisher and Robinson 2010,
Source: MTUS 1995-2005, own calculations.

Table 4
Multinational differences weekly hours spent on 31 activities – Eastern/Southern Mediterrean Europe

Total hours and minutes per day - whole population aged 18 to 64	Poland 2003-04	Slovenia 2000-01	Bulgaria 2001-02	Turkey 2006	Italy 2002-03	Spain 2002-03
Paid work/related activity (away from home)	20.1	23.6	23.7	20.8	23.6	24.6
Paid work at home	3.5	1.1	0.2	NA	0.5	0.7
Study & job or skill training	2	1.5	0.6	2.8	1.1	2
Homework	1.3	1.6	0.5	NA	1.4	1.2
Commuting, job & study-related travel	2.9	2.9	2.8	NA	3.5	3.6
Cooking & food related housework	8.2	7.2	8.6	8.9	7.1	7.1
All other housework and repairs, gardening	8.1	11.9	11.6	7.5	8.9	6.7
Shopping, services, other domestic work	2.9	2.5	1.8	1.6	3.6	4.3
Housework & personal care travel	2.1	1.9	1.9	NA	1.8	1.3
Physical/medical child care	1.8	1.4	1.1	3.4	1.5	2.1
Interactive & other child care	1.6	1.1	1.1	NA	1.2	0.6
Child care-related travel	0.2	0.2	0.1	NA	0.5	0.6
Pet care (excluding walking dogs)	0.2	0.2	0.1	NA	0.1	0.1
Sleep & naps	58.7	58.1	62.4	59.3	57.3	59
Wash, dress, & other personal care	6.1	4.7	4.4	18.8	7.1	5.6
Meals (at home & packed luches)	10.4	9.6	12.6	NA	11.7	11.3
Walking (including walking dogs)	2.1	2.5	2.1	NA	2.3	3.9
Sport & other exercise	1.1	1.6	0.9	0.8	1.3	1.3
Organizational & voluntary	2.9	1.4	1.1	4.4	1.8	1.4
Restaurant, bar, pub, café	0.2	0.6	1.8	NA	1.5	0.9
Party, visits & socialise away from home	3.4	4.1	2.6	0.4	4.6	5.1
Party, visits & socialise at home	2.8	2.9	1.9	8.3	1.9	1.4
Leisure away from home	0.4	0.6	0.1	NA	0.7	0.8
Other travel	3.1	3.2	2.4	9.3	4.7	3.3
Relax, do nothing	1.3	3.4	0.9	4	3.3	2.7
Computing & internet (including games)	1.1	0.7	0.1	NA	0.7	1.1
Television	15.3	13.2	16.6	13.8	10.6	12
Radio, Ipod, other audio	0.9	0.6	0.5	0.5	0.4	0.4
Read	2.6	2.5	2	1.3	2	1.6
Other leisure and hobbies	0.5	1	1.3	2.1	1	1.1
Unrecorded time (average day)	0.2	0.2	0.2	NA	0.3	0.2
Total	168	168	168	168	168	168

Note: Activities from Fisher and Robinson 2010,
Source: MTUS 1995-2005, own calculations.

Indeed, as can be seen in the substantial and leisure-dominating TV figures for all countries (except the Netherlands, one of the main activities isolating the Netherlands in Figure 4) , all countries have come close to TV saturation in the early 21_{st} century, but with viewing hours that are closer to 40% of free time (in the 12-15 weekly hour range). This, in contrast to the 25% of free time among TV set owners across countries in the 1965 Szalai study, where viewing hours were less than 10 hours per week.

3 Summary and conclusions

MDS has again generated useful visualizations that summarize differences between countries over the last half century, using its two-dimensional plot from these differences in time use across countries. The present article updates and extends Converse's (1972) conclusion about applying MDS methods to the more recent time-diary collection in the Oxford University MTUS data archive – covering more than 20 (mainly European) countries. Again, plausible and insightful (but somewhat different from 1965) configurations emerged from MDS visualizations, even though there were only five of the 1965 countries for which updated diary data were available.

Even though it is not possible to quantify whether this represents any increasing convergence in time-use across countries, the MDS-generated country groupings from the 1998-2005 multinational diary data in Table 1 - Table 4 were again largely based on geographical or cultural proximity, much as Converse concluded four decades earlier. Moreover, these updated mappings were compatible with conclusions from earlier more conventional analyses of these recent data described in Gershuny (2009).

Figure 4 makes it possible to confirm that differences in methods across MTUS countries did not obscure the fundamental uniqueness of life in each country. These results extend Converse's geographic interpretation, but not in all respects:

…..There is, however, a difference between the transient weight of specific activities on these patterns, and the persistence of the patterns themselves. If we had completed our field work 25 years earlier, mass television use would have exerted no influence whatever on the outcome, but it is very likely that radio and movie gradients, working in an opposite sense from those we have seen here, would have sustained these geographic patterns with much the same strength (p180).

At least over the last half century, television may have diminished in its ability to differentiate daily life in different countries, but it has been replaced by paid work, family care and other activities that reflect strong geographic/cultural connections (as shown in Table 1 - Table 4 and as described further in Robinson and Martin 2010).

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