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**REPRESENTATIVENESS AND CULTURAL
VARIATION OF ETHNIC GROUPS FROM THE
FORMER POLISH-LITHUANIAN COMMONWEALTH
IN G.P. MURDOCK'S ETHNOGRAPHIC ATLAS¹****Reprezentatywność i zróżnicowanie kulturowe grup
etnicznych z dawnej Rzeczypospolitej w Atlasie
Etnograficznym G.P. Murdocka**

Abstract. George P. Murdock's *Ethnographic Atlas* is one of the largest and most popular ethnographic databases in the world. It takes the form of a table containing systematically coded cultural characteristics for nearly 1,300 societies from around the world, and its structured form is particularly suited to cross-cultural quantitative research. One issue often raised in the context of using the Ethnographic Atlas is the underrepresentation of European ethnic groups. The aim of this paper is to examine how the database represents the territory of the Polish-Lithuanian Commonwealth: what are its deficiencies and what are the potential opportunities for its improvement in terms of representativeness and cultural diversity. For this purpose, a descriptive-statistical analysis of representativeness, cultural variation, and cultural similarities and differences between ethnic groups from the territory of the Commonwealth was conducted. The purpose of this paper is to help ethnographers decide what data in the Ethnographic

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Atlas can be added to or improved in a way that is effective in terms of the character and application of the dataset.

Keywords: Ethnographic Atlas, the Polish-Lithuanian Commonwealth, methodology, cross-cultural studies

Streszczenie. *Atlas etnograficzny* George’a P. Murdocka to jedna z największych i najpopularniejszych baz danych etnograficznych na świecie. Ma formę tabeli zawierającej systematycznie zakodowane cechy kulturowe prawie 1300 społeczeństw z całego świata, a jej ustrukturyzowana forma jest szczególnie odpowiednia do międzykulturowych badań ilościowych. Jedną z kwestii często poruszanych w kontekście korzystania z *Atlasu Etnograficznego* jest niedoreprezentowanie europejskich grup etnicznych. Celem artykułu jest zbadanie, w jaki sposób baza danych reprezentuje terytorium Rzeczypospolitej Obojga Narodów: jakie są jej braki i jakie są potencjalne możliwości jej poprawy pod względem reprezentatywności i różnorodności kulturowej. W tym celu przeprowadzono opisowo-statystyczną analizę reprezentatywności, zróżnicowania kulturowego oraz podobieństw i różnic kulturowych między grupami etnicznymi z obszaru Rzeczypospolitej. Celem tego artykułu jest pomoc etnografom w podjęciu decyzji, jakie dane w atlasie etnograficznym można dodać lub ulepszyć w sposób efektywny pod względem charakteru i zastosowania zbioru danych.

Słowa kluczowe: atlas etnograficzny, Rzeczpospolita Obojga Narodów, metodologia, studia międzykulturowe

Introduction

Murdock’s *Ethnographic Atlas* (1967) is one of the largest and most popular ethnographic databases in the world. It takes the form of a table containing cultural traits coded in a systematic way for nearly 1300 societies from around the world. Not only is it used in a variety of quantitative studies (sometimes distant from ethnology - e.g., in economics, see Lowes 2021), but it is constantly being expanded, combined with other

collections, and projects to build large digitized ethnographic databases (e.g., the D-PLACE database - see Kirby et al. 2016) are being developed on its basis. An additional impetus for interest in this database is the development of a research area called “cultural evolution,” that is, the use of contemporary understanding of evolutionary processes and complex systems dynamics to explain cultural processes. Because researchers in this field use mathematical and statistical models, this research requires appropriately structured data. The structure of the Ethnographic Atlas meets these needs very well, as seen in the widespread use of this database (Kirby et al. 2016). It should be mentioned, however, that both the approach and the database received various critical responses (see: Tobin 1990; Burton, White 1987).

When looking at the Ethnographic Atlas, it is not difficult to see that the ethnic groups it represents do not represent cultural diversity very well. The collection focuses primarily on pre-modern societies, with the exception of highly urbanized communities integrated into the global marketplace and dependent on functioning in states of the post-industrial complex. There is also a clear interest in some areas of the world (Africa, the Americas) and a poor description of others (Europe). As Murdock wrote about Europe:

The author acknowledges no special competence in this area and has included only a small and unrepresentative fraction of the many adequately described societies—and these only because of his conviction that the exclusion of the Western peoples and their cultures from the ethnographic universe is totally unwarranted. He makes no pretense that his selection is other than arbitrary or that the ethnographic sources utilized for them are other than highly incomplete (Murdock 1967: 2).

Moreover, Murdock’s intention was to build a database to enable cross-cultural comparative research. To this end, it was more important for him to represent the diversity of cultural profiles as fully as possible than to collect many very similar variants of the same cultural type or many instances of borrowing the same set of cultural elements (Murdock 1967: 3-4).

In this paper, I would like to examine how the aforementioned database represents the territory of Poland, or more broadly, the area of the Polish-Lithuanian Commonwealth, what its shortcomings are, and what potential opportunities there are to improve it in terms of representativeness and cultural variation. The focus on the area of the former Commonwealth stems from the fact that there are no Poles in the database, thus forcing the reader interested in the representation of Poland to approximate its cultural profile by averaging the cultural profiles of neighboring Central European societies. The Poland-Lithuania historical area is large enough to encompass a wide variety of ethnic groups that share a common historical experience of political affiliation. This seems to be a good starting point to assess how this region of Europe could be described in the database.

The question of the representativeness of the Ethnographic Atlas for Central Europe has practical implications. The Atlas is a popular source of ethnographic data. While it may be relatively easy and natural for a Polish researcher to be critical of the representation of Central Europe in this type of collection, the representation of Poland and neighboring countries in the Atlas may be treated much less carefully by researchers from outside the region (especially that in quantitative cross-cultural studies this region covers at most a few observation points). An example of this potentially risky use of the Ethnographic Atlas is the conversion of data on individual societies into a country-level format based on contemporary national boundaries. This is sometimes done by matching the geographical coordinates of the ethnic groups included in the Atlas to a political map (Bentzen 2019). In a more sophisticated approach, ethnic groups from the Murdock Atlas are matched to ethnic territories (Rijpma, Carmichael 2016) or combined with the territories of the linguistically closest populations and then aggregated to the country level (Alesina, Giuliano, Nunn 2013). The latter method was used, for example, in the “*Database of Global Cultural Evolution*”², where Poles are matched to the EA-listed *Czechs*, *Hutsuls*, and *Ukrainians*, and Belarusians are matched to the EA-listed *Byelorussians* and *Russians* (Bahrami-Rad, Becker, Henrich

² The database is accessible by the website: <http://dgce.fas.harvard.edu/>

2021). Even if Murdock's intention was to represent cultural diversity, this kind of application rather requires adequate spatial representativeness. Representativeness is also required by the problem of regionalization (an issue signaled by Burton et al. 1996) and it is possible that future uses of the database will be even more challenging in this regard.

Therefore, it would be reasonable to verify whether the Ethnographic Atlas adequately captures the characteristics of Lithuanians, Belarusians, Ukrainians, etc., and whether it would not be a good idea to expand it to include additional ethnic groups from within the Commonwealth by researchers working on these communities who have better access to source materials and are familiar with the appropriate languages and dialects. If there are errors or omissions in the atlas, they should make proper corrections and additions to it. The purpose of this article is to help ethnographers decide what data on ethnic groups could be effectively supplemented or revised, considering the character and use of the Ethnographic Atlas.

The article is based on an expanded version of the database provided by the D-PLACE database project (as the original version of the Atlas was modified many times). It takes into account, among others, extensions introduced by Russian researchers (Bondarenko, Kazankov, Khaltourina, Korotayev 2005), who coded variables for groups from the territory of the former Russian Empire, including the eastern part of pre-partition Poland-Lithuania. It should be noted that in the first variant of Murdock's database (*World Ethnographic Sample* - Murdock 1957), the number of European societies was larger than in the Ethnographic Atlas (for example, there were Germans from Prussia or Danes from Lolland). However, these groups did not appear in subsequent editions, were only assigned 30 features, and are also not part of the D-PLACE database.

Selection for the study and representation of the ethnic groups from the area of the Polish-Lithuanian Commonwealth in the Ethnographic Atlas

To make the selection of cultural groups for the study less arbitrary, a two-stage criterion was used. First, all groups from the historical territory

of the Polish-Lithuanian Commonwealth were included (based on the geographical coordinates of the societies in the EA): Belarusians (referred to as *Byelorussians* in the Atlas, although this ethnonym is not used in current Belarusian literature), Hutsuls, Latvians, Lithuanians, Lithuanian Karaites, Lithuanian Tatars, Livonians, and Ukrainians. Because this area does not include all ethnic groups that could potentially be similar to the societies of the Commonwealth not represented in the collection (e.g., Poles), the collection was expanded to include cultural groups close to them linguistically, historically, or geographically: Czechs, Estonians, Magyars, Moldovans, and Russians. It should be noted that, in addition to Poles, two quantitatively significant and distinct groups inhabiting the territory of the Poland-Lithuania are absent in the EA: Jews and Germans, not to mention their regional variations. In the case of Armenians, although they are present in the EA, information is given only for their settlement in Armenia, and therefore they were not included in the study.

The general spatial distribution of the communities coded in the Atlas is shown in Fig. 1 (with reference to the borders of the Polish-Lithuanian Commonwealth of 1618, when the territory of the state had the largest territorial extent). As can be seen, the wide belt (600 km wide) between the southern border of the former Commonwealth and the modern area of Lithuania is not represented in the Atlas.



Source: own, based on the Ethnographic Atlas (geographical coordinates of the groups come from the D-PLACE database). Filled dots indicate ethnic groups studied in the study, empty circles - ethnic groups not included in the analysis.

Ethnic groups are described with varying degrees of accuracy. First, the information is not synchronous - it refers to different years. As can be seen in Table 1, the range of focal years to which the data refer is between 1847 (Livonians) and 1955 (Russians) - a range of more than 100 years. Also, the selection of sources for some groups seems inadequate - e.g., data for Belarusians and Ukrainians come from single unpublished notes and manuscripts. With the total number of variables (which is 94), the number of non-missing values for all groups is much smaller - in the range of 63-84. The number of variables assigned non-missing values for all societies is only 44. The list of missing values (only for groups from the Commonwealth) is presented in Table 2.

Table 1. Focal year to which data refers, number of non-missing values and number of non-missing values of variables used in further analysis.

Ethnic group	Main focal year	Non-missing values	Non-missing values in the study	Number of sources of the data in the EA	
				Published	Unpublished
Belarusians	1910	72	68	0	1
Czechs	1940	80	73	1	1
Estonians	1908	80	75	12	0
Hutsuls	1890	75	67	3	0
Latvians	1881	84	74	14	0
Lithuanian Karaim	1895	77	71	10	0
Lithuanian Tatar	1905	83	78	5	0
Lithuanians	1930	76	71	1	0
Livs	1847	82	77	8	0
Magyar	1940	63	58	1	0
Moldovans	1900	84	74	10	0
Russians	1955	75	66	11	0
Ukrainians	1930	74	70	0	1

Source: own, based on the D-PLACE database.

Table 2. Missing values for the ethnic groups from the Polish-Lithuanian Commonwealth in the Ethnographic Atlas.

ID	Variable	BE	UK	LI	LA	LV	KA	TA	HU
EA023	Cousin marriages permitted				■		■		■
EA024	Cousin marriages permitted: subtypes				■		■		■
EA025	Cousin marriages preferred				■		■		■
EA026	Cousin marriages preferred: subtypes				■		■		■
EA027	Kin terms for cousins						■		
EA032	Jurisdictional hierarchy of local community								■
EA033	Jurisdictional hierarchy beyond local community								■
EA035	Games		■			■			
EA036	Post-partum sex taboos	■	■	■	■	■		■	■
EA038	Segregation of adolescent boys				■		■	■	
EA046	Sex differences: leather working	■	■				■		
EA048	Sex differences: boat building								■
EA049	Sex differences: house con- struction	■	■	■					
EA050	Sex differences: gathering	■	■	■					
EA052	Sex Differences: fishing								■
EA057	Age or occupational speciali- zation: leather working	■	■				■		
EA059	Age or occupational speciali- zation: boat building								■
EA060	Age or occupational speciali- zation: house construction	■	■	■					
EA061	Age or occupational speciali- zation: gathering	■	■	■					
EA063	Age or occupational speciali- zation: fishing								■

EA068	Caste differentiation: primary								
EA069	Caste differentiation: secondary features								
EA072	Political succession								
EA073	Political succession: hereditary succession								
EA078	Norms of premarital sexual behavior of girls								
EA081	House construction: wall material								
EA082	House construction: shape of roof								
EA083	House construction: roofing materials								
EA084	House construction (secondary house type): ground plan								
EA085	House construction (secondary house type): floor level								
EA086	House construction (secondary house type): wall material								
EA087	House construction (secondary house type): shape of roof								
EA088	House construction (secondary house type): roofing materials								
EA090	Political integration								
EA094	Political succession: version from Murdock (1957)								
EA112	Trance states								
EA113	Societal rigidity								
EA202	Population size								

Source: own, based on D-PLACE database. Black cells indicate missing data for a given society. Abbreviations: BE- Belarusians, UK – Ukrainians, LI – Lithuanians, LA – Latvians, LV – Livs, KA – Lithuanian Karaims, TA – Lithuanian Tatars, HU – Hutsuls.

For some variables, a large number of missing values is common at the level of the entire dataset, not only in the selected 8 groups (e.g., missing data on societal rigidity affects 1259 out of 1291 societies, more than 50% share of missing values is noticeable for 15 variables in the table). The correlation between number of missing values by variables for the selected groups and in the entire EA is quite high (80%). However, as can be seen in Table 2, the missing data for the groups in the Commonwealth area relate to some characteristics for which information is easily available (house construction, population size).

For the purposes of this analysis, some variables were excluded according to the following criteria: 1) variables that were created from other variables (EA011, EA013, EA042, EA043); 2) continuous variables because they overestimate differences between ethnic groups (one variable - EA202 - population size); 3) variables with less than two non-missing observations for 8 key ethnic groups from the Polish-Lithuanian Commonwealth, because they cannot be used for comparisons (EA113, EA036, EA084, EA085, EA086, EA087, EA088, EA090, EA094, EA112). It should be noted that four of these (EA090, EA094, EA112, EA113) were not part of the original Ethnographic Atlas, but were included in Gray's Corrected Ethnographic Atlas (Gray 1999) and thus became part of the D-PLACE database.

Finally, 79 variables were used for further analysis. The last column of Table 1 shows the number of observations remaining for each group after eliminating redundant and uninformative variables. The number of variables with non-missing values for all societies is 40.

Cultural diversity of ethnic groups from the area of the Polish-Lithuanian Commonwealth

Among the 79 variables with no missing observations, 12 (about 15%) have the same value for all groups marked in Fig. 1. When restricted to the 8 groups from the Commonwealth, as many as 18 variables (23%) have the same value. Traits common for analyzed groups are presented in Table 3.

Table 3. Variables with values that are common to all analyzed ethnic groups

ID	Variable definition	Value
13 societies from North-Eastern Central Europe		
EA001	Dependence on the gathering of wild plants and small land fauna, relative to other subsistence activities.	Zero to 5 percent dependence
EA017	The largest type of patrilineal kin group reported for the society.	None
EA018	The largest patrilineal kin group characterized by exogamy.	No patrilineal exogamy
EA019	The largest type of matrilineal kin group reported for the society.	None
EA020	The largest matrilineal kin group characterized by exogamy.	No matrilineal exogamy
EA022	The presence or probable absence, and the typology, of secondary cognatic kin groups. This variable highlights societies for which both kindreds (bilateral descent) and ramages (ambilineal descent) are reported.	No secondary cognatic groups

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EA034	The range of beliefs in high gods. A high god is defined, following Swanson, as a spiritual being who is believed to have created all reality and/or to be its ultimate governor, even if his sole act was to create other spirits who, in turn, created or control the natural world.	A high god present, active, and specifically supportive of human morality
EA041	Indicates whether or not domestic animals milked.	Domestic animals milked more often than sporadically
EA065	Age or occupational specialization in agriculture.	Normally performed by many or most adult men, women, or both
EA070	The forms and prevalence of slave status, treated quite independently of both class and caste status.	Absence or near absence of slavery
EA079	Ground plan of the prevailing type of dwelling.	Rectangular or square
EA080	Floor level of the prevailing type of dwelling.	Floor formed by or level with the ground itself
8 societies from the Polish-Lithuanian Commonwealth		
EA006	Prevailing type of transfer or exchange at marriage.	Dowry, i.e., transfer of a substantial amount of property from the bride's relatives to the bride, the groom, or the kinsmen of the latter
EA007	Alternative types of transfer or exchange at marriage, or supplementary practices.	No alternate mode or supplementary practices
EA044	Specialization by sex in such arts as smelting, casting, and forging, i.e., only those which involve the application of fire.	Males alone perform the activity, female participation being negligible

EA055	Age or occupational specialization in such arts as smelting, casting, and forging, i.e., only those which involve the application of fire.	Craft specialization, i.e., the activity is largely performed by a small minority of adult males or females who possess specialized skills. Occupational castes are treated as instances of craft specialization
EA064	Age or occupational specialization in animal husbandry.	Normally performed by many or most adult men, women, or both
EA077	Following the inheritance rule for movable property, this variable indicates how movable property is distributed among several individuals of the same category.	Equal or relatively equal distribution among all members of the category

Source: own, based on the D-PLACE database.

Common values of variables are not very rare in the context of the whole Ethnographic Atlas, with the single exception of the value of variable EA006 (dowry), which occurs in only 3% of all societies in the database (mainly in Europe, less frequently in Southeast Asia). Also considering the geographical distribution, the common values of most variables are typical for Europe (with small exceptions in Southern Europe). The most regionally specific variable is EA080 (“floor level of dwelling”) - in neighboring areas the dominant type is “slightly elevated” - and, the already mentioned variable EA006 (dowry).

What characteristics are most diverse among groups from the Polish-Lithuanian Commonwealth area? To answer this question, three indicators were used:

1. the sum of the number of groups assigned to the modal value (how many groups are covered by the single most common value) and

missing values (assuming that the actual data for missing values are equal to the modal value) (M1)

2. the number of distinct categories found among groups in the sample (M2).
3. the number of distinct, non-empty and non-missing categories present among all groups from Europe (selected according to the regional classification in the D-PLACE database), after excluding 8 groups from the Polish-Lithuanian Commonwealth (M3).

These three measures (M1, M2, M3) allow us to assess how the groups are concentrated in one category (lower M1 - lower concentration), what the diversity of values is among them (higher M2 - higher diversity) and how it is represented from the perspective of other European groups (M2 close to M3 - diversity of selected groups is as high as European groups). The results (without the variables in Table 3, because by assumption they are not differentiated) are presented in Table 4.

Table 4. Variation of the variables for the ethnic groups of the Polish-Lithuanian Commonwealth (ordered decreasingly by frequency of modal and missing values and increasingly by number of distinct non-empty categories)

Variable		Freq. of modal categories (A)	Miss-ings (B)	M1. A+B	M2. N of distinct categories	M3. N of distinct categories: Europe
EA005	Subsistence economy: agriculture	2	0	2	7	8
EA053	Sex differences: animal husbandry	2	0	2	5	6
EA004	Subsistence economy: animal husbandry	3	0	3	4	7
EA031	Mean size of local communities	3	0	3	4	6

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EA045	Sex differences: weaving	3	0	3	4	4
EA008	Domestic organization	4	0	4	4	5
EA048	Sex differences: boat building	3	1	4	3	4
EA063	Age or occupational specialization: fishing	3	1	4	3	3
EA015	Community marriage organization	4	0	4	3	5
EA030	Settlement patterns	4	0	4	3	5
EA047	Sex differences: pottery making	4	0	4	3	5
EA014	Marital residence with kin: alternate	4	0	4	3	4
EA058	Age or occupational specialization: pottery making	4	0	4	3	4
EA056	Age or occupational specialization: weaving	4	0	4	3	2
EA023	Cousin marriages permitted	2	3	5	4	5
EA024	Cousin marriages permitted: subtypes	2	3	5	4	5
EA054	Sex differences: agriculture	5	0	5	4	6
EA012	Marital residence with kin: prevailing pattern	5	0	5	4	5
EA075	Inheritance distribution for real property (land)	5	0	5	4	5
EA052	Sex Differences: fishing	4	1	5	3	5
EA059	Age or occupational specialization: boat building	4	1	5	3	4
EA003	Subsistence economy: fishing	5	0	5	3	4
EA029	Agriculture: major crop type	5	0	5	3	3
EA050	Sex differences: gathering	3	2	5	2	3
EA061	Age or occupational specialization: gathering	3	2	5	2	2

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EA032	Jurisdictional hierarchy of local community	4	1	5	2	3
EA071	Slavery: timing	5	0	5	2	3
EA051	Sex differences: hunting	5	0	5	2	2
EA062	Age or occupational specialization: hunting	5	0	5	2	2
EA072	Political succession	4	2	6	3	3
EA010	Marital residence with kin: first years	6	0	6	3	6
EA067	Class differentiation: secondary features	6	0	6	3	3
EA057	Age or occupational specialization: leather working	3	3	6	2	4
EA083	House construction: roofing materials	4	2	6	2	5
EA027	Kin terms for cousins	5	1	6	2	5
EA028	Agriculture: intensity	6	0	6	2	5
EA066	Class differentiation: primary	6	0	6	2	5
EA040	Domestic animals: type	6	0	6	2	4
EA039	Domestic animals: plow cultivation	6	0	6	2	3
EA046	Sex differences: leather working	4	3	7	2	8
EA078	Norms of premarital sexual behavior of girls	4	3	7	2	5
EA081	House construction: wall material	5	2	7	2	5
EA035	Games	5	2	7	2	4
EA082	House construction: shape of roof	5	2	7	2	4
EA033	Jurisdictional hierarchy beyond local community	6	1	7	2	4

EA068	Caste differentiation: primary	6	1	7	2	1
EA074	Inheritance rule for real property (land)	7	0	7	2	4
EA002	Subsistence economy: hunting	7	0	7	2	3
EA021	Cognatic kin groups	7	0	7	2	3
EA037	Male genital mutilations	7	0	7	2	3
EA076	Inheritance rule for movable property	7	0	7	2	3
EA009	Marital composition: monogamy and polygamy	7	0	7	2	3
EA016	Organization of clan communities	7	0	7	2	2
EA201	Marital residence with kin: change after first years	7	0	7	2	2
EA038	Segregation of adolescent boys	4	4	8	1	2
EA049	Sex differences: house construction	5	3	8	1	5
EA025	Cousin marriages preferred	5	3	8	1	2
EA026	Cousin marriages preferred: subtypes	5	3	8	1	2
EA060	Age or occupational specialization: house construction	5	3	8	1	2
EA073	Political succession: hereditary succession	6	2	8	1	2
EA069	Caste differentiation: secondary features	7	1	8	1	1

Source: own, based on the D-PLACE database.

The most varied variable is dependence on agriculture (from 36-45% to over 86%). Values for specialization by gender in animal husbandry vary, but within a narrow range of values (equal participation or sex specialization unspecified to mostly females). The next group of variables are: dependence on animal husbandry (from over 6% to 36-45%), average community size (from 100-199 to over 50,000), and sex specialization in weaving (but within a similarly narrow range as for animal husbandry). Overall, the most diverse variables relate to environmental and demographic differences. The most diverse variables related to social organization are: domestic organization (from nuclear, limited polygyny, by nuclear monogamous to minimal or small extended), community marriage organization (demes, agamous, clans), alternative ways of marital residence with kin (mostly without alternate with the exception for neolocal and uxorilocal), then (being cautious about missing values) permission of cousin marriages (no first cousins, no first/second cousins to no second cousins) and prevailing pattern of marital residence with kin (ambilocal, neolocal, virilocal, ambi-virilocal). The values for “*Inheritance distribution for real property (land)*” are really two – primogeniture and equal distribution (the last value is “no inheritance of real property”).

From a European perspective, however, the diversity of social organization is not exceptionally high - the number of distinct categories among the selected ethnic groups is lower than the maximum number of values assigned to other European societies. The only exceptional variable for which the diversity of values is higher than in other European countries is caste differentiation (general lack of distinctions with exceptionally de-spised occupational groups among Lithuanians).

Cultural similarities and differences of the ethnic groups in Central Europe

If certain variables differentiate a set of ethnic groups, one can ask what the differences and similarities between them are. To find out, a similarity matrix was calculated - first, taking into account all common values

of variables between pairs of ethnic groups, and second, taking into account only those variables that were not omitted for the 13 ethnic groups from the Commonwealth and surrounding areas and have different values for at least one society. Together with the excluded variables and without variables with values common to all 13 societies, this leaves only 28 characteristics. The results are presented in Tables 5. and 6. Similarity was calculated as the number of identical values of variables in a given pair of ethnic groups.

Table. 5. Cultural similarities between 13 ethnic groups from Central Europe (all common values between pairs)

	RUS	CZE	BEL	LIT	UKR	MAG	HUT	MOL	LAT	EST	LIV	LTAT	LKAR
RUS	54	28	20	21	23	22	25	30	26	24	22	27	24
CZE	58%	61	39	41	40	31	29	31	29	29	29	30	27
BEL	44%	74%	56	41	43	26	28	30	26	31	26	24	19
LIT	46%	72%	77%	59	45	32	31	30	30	30	27	23	20
UKR	48%	71%	83%	80%	58	34	30	33	32	35	33	25	22
MAG	59%	69%	63%	74%	77%	46	26	24	24	22	25	20	19
HUT	54%	57%	61%	66%	65%	65%	55	33	27	29	28	24	23
MOL	57%	55%	59%	56%	62%	59%	61%	62	40	36	35	30	29
LAT	49%	52%	51%	56%	60%	59%	50%	65%	62	44	37	32	31
EST	44%	51%	60%	55%	65%	52%	53%	58%	71%	63	34	31	23
LIV	42%	49%	48%	47%	58%	57%	53%	57%	61%	56%	65	28	28
LTAT	51%	50%	44%	40%	44%	44%	44%	48%	52%	50%	43%	66	45
LKAR	46%	51%	38%	39%	42%	48%	45%	49%	53%	39%	48%	76%	59

Source: own, based on the D-PLACE database. Abbreviations: RUS – Russians, CZE – Czechs, BEL – Belarusians, LIT – Lithuanians, UKR – Ukrainians, MAG – Magyars, HUT – Hutsuls, MOL – Moldovans, LAT – Latvians, EST – Estonians, LIV – Livs, LTAT – Lithuanian Tatars, LKAR – Lithuanian Karaims. The upper triangle of matrix shows the number of common values values for a pair of groups, the lower triangle – the percentage of common values in the total number of non-missing values for a pair of groups.

Table 6. Cultural similarities among the 13 ethnic groups from Central Europe (only variables without missing observations and with varying values)

	RUS	CZE	BEL	LIT	UKR	MAG	HUT	MOL	LAT	EST	LIV	LTAT	LKAR
RUS	28	18	14	16	16	16	15	16	16	14	11	9	8
CZE	64%	28	21	23	24	21	15	19	20	18	17	13	13
BEL	50%	75%	28	21	23	18	16	18	17	19	13	12	10
LIT	57%	82%	75%	28	24	22	18	20	21	19	16	12	12
UKR	57%	86%	82%	86%	28	23	18	19	20	20	16	13	13
MAG	57%	75%	64%	79%	82%	28	16	16	20	18	16	11	11
HUT	54%	54%	57%	64%	64%	57%	28	17	18	16	15	11	10
MOL	57%	68%	64%	71%	68%	57%	61%	28	22	18	17	12	13
LAT	57%	71%	61%	75%	71%	71%	64%	79%	28	21	17	12	13
EST	50%	64%	68%	68%	71%	64%	57%	64%	75%	28	14	15	8
LIV	39%	61%	46%	57%	57%	57%	54%	61%	61%	50%	28	11	12
LTAT	32%	46%	43%	43%	46%	39%	39%	43%	43%	54%	39%	28	17
LKAR	29%	46%	36%	43%	46%	39%	36%	46%	46%	29%	43%	61%	28

Source: own, based on the D-PLACE database. Abbreviations: RUS – Russians, CZE – Czechs, BEL – Belarusians, LIT – Lithuanians, UKR – Ukrainians, MAG – Magyars, HUT – Hutsuls, MOL – Moldovans, LAT – Latvians, EST – Estonians, LIV – Livs, LTAT – Lithuanian Tatars, LKAR – Lithuanian Karaims. The upper triangle of matrix shows the number of common values values for a pair of groups, the lower triangle – the percentage of common values in the total number of non-missing values for a pair of groups.

Both methods allow us to distinguish three clusters. The largest of these included Ukrainians, Belarusians, Lithuanians, Czechs, and to a lesser extent Magyars. The similarity in this cluster exceeds 80%. The second cluster included Estonians and Latvians, but also Moldovans. The position of Livs and Hutsuls is ambiguous - they are culturally similar to each of the clusters at a maximum level of about 60%. Livs are closer to the second cluster, Hutsuls to the first. In the last cluster are Lithuanian Karaites and Lithuanian Tatars, who are the most culturally distant from the other

groups. The Russians are also quite isolated-the closest groups to them are the Czechs, Magyars, and Moldavians, but at no more than 60%.

The Central European cluster is particularly interesting because it contains the three main ethnic groups of the former Polish-Lithuanian Commonwealth as well as the Czechs and Magyars - although geographically they are relatively distant societies. Depending on the method of calculating similarity, the most similar pairs within it are Ukrainians-Belarusians or Ukrainians-Lithuania-Czechs. The cluster's similarity to Magyars is mediated by their similarity to Ukrainians. One can speculate that the cultural profile of Poles (if they were included in the database) should also be similar to this cluster.

It is worth noting which variables (and their values) make the clusters internally heterogeneous and different. Table 7. shows which variables are responsible for the differences between and within the distinguished clusters.

Table 7. Variables responsible for differences within and between the clusters.

Variable	UKR-BEL-LIT-CZE-MAG	LAT-EST-LIV	LTAT-LKAR	HUT-MOL-RUS
Variables differentiating all the clusters				
EA005. Subsistence economy: agriculture	56-65% (U,B) 46-55% (L) 66-75% (C,M)	66-75% (LA) 56-65% (E) 6-15%* (LI)	86-100% (T) 76-85% (K)	36-45%*** (H) 56-65% (M) 66-75% (R)
EA012. Marital residence with kin: prevailing pattern	Virilocal (U,L,C,M) Ambilocal* (B)	Virilocal (LA,LI) Ambi-viri (E)	Ambi-viri (T) Virilocal (K)	Neolocal (H,R) Virilocal (M)
EA031. Mean size of local communities	50000+ (U,L,C,M) 5000-50000 (B)	50000+ (LA,E) 100-199** (LI)	100-199** (T) 400-1000*** (K)	5000-50000 (H,R) 50000+ (M)

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EA053. Sex differences: animal husbandry	Females more (U,L) Equal participat. (B) Females alone*** (C) Missing (M)	Different., equal (LA,E) Equal participat. (LI)	Males more (T) Unspecified*** (K)	Different., equal (H) Males more (M,R)
Variables differentiating three clusters				
EA067. Class differentiation: secondary features	No secondary type	Wealth distinctions (LA,E) No secondary type (LI)	Dual stratification*** (T) No secondary type (K)	No secondary type (H,R) Wealth distinctions (M)
EA071. Slavery: timing	Never practiced	Past slavery (LA,LI) Never practiced (E)	Never practiced (T) Past slavery (K)	Never practiced (H,R) Past slavery (M)
EA003. Subsistence economy: fishing	6-15% (U,B,L,M) 0-5% (C)	6-15% (LA,E) 76-85%*** (LI)	0-5%	6-15% (H) 0-5% (M,R)
EA004. Subsistence economy: animal husbandry	26-35% (U,B,C) 36-45% (L) 16-25% (M)	16-25% (LA) 26-35% (E) 6-15% (LI)	6-15%	36-45% (H,M) 26-35% (R)
EA015. Community marriage organization	Demes (U,M) Agamous (B,L,C)	Agamous (LA,E) Clans** (LI)	Demes	Demes (H) Agamous (M,R)
EA047. Sex differences: pottery making	Unspecified (U,B,L,M) Sex irrelevant (C)	Males alone (LA,LI) Activity absent (E)	Activity is absent	Unspecified (H) Males alone (M) Missing (R)
EA075. Inheritance distribution for real property (land)	Ultimogeniture (U) Equally distribut. (B,L,C) Missing (M)	Primogeniture* (LA,E) No inher. of real property* (LI)	Equally distributed	Equally distribut. (H) Uimogeniture (M) No inher. of real property* (R)
EA058. Age/occupational specialization: pottery making	Most adults (U,B,L,M) Industrial (C)	Craft (LA,LI) Activity is absent (E)	Activity is absent	Most adults (H) Craft (M) Missing (R)

EA063. Age/occupational specialization: fishing	Most adults (U,B) Craft (L) Activity absent (C) Missing (M)	Craft (LA) Most adults (E,LI)	Activity is absent	Missing (H) Most adults (M) Activity absent (R)
EA052. Sex differences: fishing	Males alone (U,B,L) Activity absent (C) Missing (M)	Males alone (LA,E) Equal participat. (LI)	Activity is absent	Missing (H) Males alone (M) Activity absent (R)
EA072. Political succession	Election (U) <i>Missing</i> (B,C,M) Inf. consensus*** (L)	Election (LA,E) Appointed by auth.* (LI)	Election	Missing (H) Election (M) Appointed by auth.* (R)
EA057. Age/occupational specialization: leather working	<i>Missing</i> (U,B,M) Most adults (L) Industrial** (C)	Craft (LA) Most adults (E,LI)	Craft (T) Missing (K)	Most adults (H) Craft (M) Missing (R)
EA010. Marital residence with kin: first years	Virilocal (U,L,C,M) Ambilocal* (B)	Virilocal (LA,LI) Ambi-viri (E)	Ambi-viri (T) Virilocal (K)	Virilocal
EA045. Sex differences: weaving	Sex irrelevant (U,B,L,C) Females alone (M)	Different., equal** (LA,E) Females alone (LI)	Activity absent*** (T) Females alone (K)	Females alone (H,M) Missing (R)
EA054. Sex differences: agriculture	Males more (U,B,L,M) Equal participat. (C)	Males more (LA,E) Equal participat. (LI)	Different., equal (T) Unspecified*** (K)	Males more
EA056. Age/occupational specialization: weaving	Industrial (U,B,L,C) Most adults (M)	Industrial (LA,E) Most adults (LI)	Activity absent*** (T) Most adults (K)	Most adults (H,M) Missing (R)
Variables differentiating two clusters				
EA030. Settlement patterns	Villages/towns	Dispersed homesteads (LA,E) Villages/towns (LI)	Complex permanent	Dispersed homesteads (H) Villages/towns (M,R)

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EA066. Class differentiation: primary	Complex stratification	Complex stratification (LA,E) Wealth distinctions (LI)	Complex stratification	Wealth distinctions (H) Complex stratification (M,R)
EA051. Sex differences: hunting	Males alone (U,B,L,C) Missing (M)	Activity absent (LA) Males alone (E,LI)	Activity is absent	Males alone (H,M) Activity absent (R)
EA062. Age/occupational specialization: hunting	Most adults (U,B,L,C) Missing (M)	Activity absent (LA) Most adults (E,LI)	Activity is absent	Most adults (H,M) Activity absent (R)
EA074. Inheritance rule for real property (land)	Patrilineal by sons (U,B,L,C) Missing (M)	Patrilineal by sons (LA,E) No inher. of real property* (LI)	Patrilineal by sons	Patrilineal by sons (H,M) No inher. of real property* (R)
EA059. Age/occupational specialization: boat building	Most adults (U,B,L,C) Missing (M)	Craft (LA) Most adults (E,LI)	Activity is absent	Missing (H) Craft (M) Activity absent (R)
EA014. Marital residence with kin: alternate	Neolocal	No alternate (LA,LI) Uxorilocal (E)	Uxorilocal (T) No alternate (K)	No alternate
EA008. Domestic organization	Minimal extended (U,B,C) Small extended (L) Large extended (M)	Nuclear, monogamous	Nuclear, monogamous (T) Nuclear, limited polygyny* (K)	Nuclear, monogamous
EA006. Transactions at marriage: prevailing type	Dowry (U,B,L,C) Gift exchange (M)	Dowry	Dowry	Dowry (H,M) Gift exchange (R)
EA021. Cognatic kin groups	Bilateral kindreds (U,B,L,C) Bilateral inferred (R)	Bilateral kindreds (LA) Bilateral inferred (E,LI)	Bilateral kindreds	Bilateral kindreds

Variables differentiating only the Central-European cluster				
EA029. Agriculture: major crop type	Cereals (U,L,C,M) Roots/tubers** (B)	Cereals	Vegetables**	Cereals
EA032. Jurisdictional hierarchy of local community	Extended families (U,B,L,M) Independent families (C)	Independent families	Independent families	Missing (H) Independent families (M,R)
EA033. Jurisdictional hierarchy beyond local community	Four levels (U,B) Three levels (L,C,M)	Four levels	Four levels	Missing (H) Four levels (M,R)
EA068. Caste differentiation: primary	Absence (U,C,M) Missing (B) Despised occupation groups*** (L)	Absence of distinctions	Absence of distinctions	Absence of distinctions
EA050. Sex differences: gathering	Females alone (U) Missing (B,L) Activity absent (C,M)	Females alone	Activity is absent	Activity is absent
EA061. Age/occupational specialization: gathering	Most adults (U) Missing (B,L) Activity absent (C,M)	Most adults	Activity is absent	Activity is absent
EA046. Sex differences: leather working	Missing (U,B,M) Unspecified (L) Sex irrelevant** (C)	Males alone	Males alone (T) Missing (K)	Males alone (H,M) Missing (R)
EA023. Cousin marriages permitted	No 1st/2nd cousins (U,M) Only 2nd cousins (B,C) No 1st cousins* (L)	Missing (LA,E) No 1st/2nd cousins (LI)	Some 2nd only*** (T) Missing (K)	Missing

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EA024. Cousin marriages permitted: subtypes	No 1st/2nd cousins (U,M) Only 2nd cousins (B,C) No 1st cousins* (L)	<i>Missing</i> (LA,E) No 1st/2nd cousins (LI)	Some 2nd only*** (T) Missing (K)	Missing
Variables differentiating the Baltic-Finn cluster				
EA016. Organization of clan communities	No exogamous clans	No exogamous clans (LA,E) Clans** (LI)	No exogamous clans	No exogamous clans
EA076. Inheritance rule for movable property	Patrilineal by sons (U,B,L,C) Missing (M)	Children, less for daughters* (LA) Children (E) Patrilineal by sons (LI)	Patrilineal by sons (T) Patrilineal by sons (K)	Patrilineal by sons (H,M) Missing (R)
EA077. Inheritance distribution for movable property	Equally distributed (U,B,L,C) Missing (M)	Equally distributed (LA,LI) Best qualified (E)	Equally distributed	Equally distributed (H,M) Missing (R)
EA082. House construction: shape of roof	<i>Missing</i> (U,L,C,M) Two slopes (B)	Two slopes (LA,LI) Four slopes (E)	Two slopes	Four slopes
EA083. House construction: roofing materials	<i>Missing</i> (U,L,C,M) Grass, leaves or thatch (B)	Wood (LA,LI) Grass, leaves or thatch (E)	Wood	Grass, leaves or thatch
Variables differentiating only the Lithuanian Tatar-Karaites cluster				
EA009. Marital composition: monogamy and polygamy	Monogamous	Monogamous	Monogamous (T) Limited polygyny* (K)	Monogamous
EA037. Male genital mutilations	Absent	Absent	Absent (T) Shortly after birth*** (K)	Absent
Variables differentiating only groups outside the three main clusters				
EA002. Subsistence economy: hunting	0-5%	0-5%	0-5%	6-15% (H) 0-5% (M,R)

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EA007. Transactions at marriage: alternate type	No alternate	No alternate	No alternate	No alternate (H) Insignificant (M) Dowry (R)
EA028. Agriculture: intensity	Intensive	Intensive	Horticulture**	Intensive (H,M) Intensive irrigated*** (R)
EA044. Sex differences: metal working	Males alone	Males alone	Males alone	Males alone (H,M) Unspecified*** (R)
EA055. Age/occupational specialization: metal working	Craft	Craft	Craft	Craft (H,M) Industrial*** (R)
EA201. Marital residence with kin: change after first years	Same	Same	Same	Different (H,R) Same (M)
EA064. Age/occupational specialization: animal husbandry	Most adults (U,B,L,C) Missing (M)	Most adults	Most adults	Most adults (H,R) Craft* (M)
EA048. Sex differences: boat building	Unspecified (U,B,L,C) Missing (M)	Males alone	Activity is absent	Missing (H) Males alone (M) Activity absent (R)
EA035. Games	Missing (U) All types (B,L,C,M)	All types (LA,E) Missing (LI)	All types	Chance only*** (H) All types (M) Missing (R)
EA049. Sex differences: house construction	Missing (U,B,L,M) Males alone (C)	Males alone	Males alone	Males alone (H) Different., equal*** (M) Unspecified*** (R)

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EA078. Norms of premarital sexual behavior of girls	<i>Missing</i> (U,B,L,C) Prohibited, strongly sanctioned (M)	Prohibited, strongly sanctioned	Prohibited, strongly sanctioned	Permitted, no sanctions** (H) Prohibited, weakly sanctioned (M,R)
EA081. House construction: wall material	<i>Missing</i> (U,L,C,M) Wood (B)	Wood	Wood	Plaster, clay etc.*(H) Wood (M,R)
Variables differentiating only between clusters				
EA039. Domestic animals: plow cultivation	Present	Present	Not aboriginal but present	Present
EA040. Domestic animals: type	Bovine	Bovine	Equine	Bovine
EA060. Age/occupational specialization: house construction	<i>Missing</i> (U,B,L,M) Craft (C)	Most adults	Most adults	Most adults
EA027. Kin terms for cousins	Eskimo	Descriptive	Eskimo (T) Missing (K)	Eskimo
EA038. Segregation of adolescent boys	No segregation	<i>Missing</i> (LA,LI) Partial*** (E)	Missing	No segregation (H,R) Missing (M)

Source: own, based on the D-PLACE database. Letter in parenthesis mean the initials of ethnic groups in a given cluster. Symbols: *** - value occurring in single society in the European subsample of the EA, ** - value occurring twice, * - value occurring three times. The colors indicates whether the cell contains rare values (the darkest grey for *** and the lightest gray for *).

The number of variables with common values for all ethnic groups in the cluster (excluding those for which values are missing) is: 18 for Central European societies, 26 for Latvians-Estonians-Livs, 42 for Tatars-Karaites, 18 for Hutsuls-Moldavians-Russians. The coherence of the Tatar-Karaite cluster can be explained by its small size - the more groups, the more likely that some values will differ. In comparison, the cohesion

of the Ukrainians-Belarusians-Lithuanians sub-cluster is much higher than that of the Central European cluster (38 variables with a common value).

In some cases, cluster cohesion is broken by values that are very rare from a European perspective. The highest number of unique values in the European part of the Ethnographic Atlas is attributed to Lithuanian Tatars (5), Lithuanian Karaites (4) and Russians (4). Among the values occurring 2 times in the European sample, the highest number is attributed to Tatars and Livs (3). In general, the rarest values (1-3 occurrences in Europe) are mainly attributed to Lithuanian Tatars (12), Lithuanian Karaites (9) and Livs (8).

The most differentiating variables concern dependence on agriculture (from very low dependence of Livs to very high dependence of Tatars-Karaites), mean community size and sex specialization in animal husbandry. It is worth noting that sex differences for the other activities range from equal participation to predominance of one gender - only animal husbandry shows opposite patterns. Marital residence with relatives also falls within a limited range of possibilities: from ambilocal through ambivirilocal to virilocal with some exception of neolocality.

Focusing only on the Central European cluster, it can be seen that the differences between groups are often a matter of magnitude/intensity that do not go beyond a fairly narrow range (subsistence variables, with differences by activity of the order of 20 p.p.). Some of these are further reinforced by missings/observations about the inactivity/insignificance of the phenomenon. However, a general trend is evident: heavy dependence on agriculture, the European pattern of bilateral and patrilineal social organization (see Burton et al. 1996), no clans, not permitting marriages of first cousins, and living in a state. The most distinguishing characteristic of this cluster is the role of the extended family (compared to nuclear families in the other clusters). The most important deviations are the Ukrainian ultimogeniture in land inheritance, the Lithuanian succession of local headmen through informal consensus and some manifestations of class differentiation, the Belarusian ambilocal pattern of the marital residence, and dependence on roots/tubers (probably potatoes - see discussion in Appendix C in Mayshar, Moav, Pascali 2022) instead of cereals.

The Tatar-Karaim cluster has the highest dependence on agriculture, which is horticulture (rather than intensive agriculture as with the others) and vegetable-based. As already mentioned, there are a number of very rare features: double social stratification (secondary) (Tatars), absence of weaving (Tatars), and genital mutilation shortly after birth (Karaites). Karaite marital characteristics include limited polygamy, which is unique to the Polish-Lithuanian Commonwealth but not so rare in Europe. The Baltic-Finnish cluster is distinguished mainly by Livonian traits: the lowest dependence on agriculture (and the highest on fishing), the presence of clans, but also Estonian partial segregation of adolescent boys. It should be recalled that, according to Table 1, data on Livs refer to the earliest year. Similarly, information on Russians refers to the latest period (1955). The relatively independent position of Livs and Russians may be due to their extreme position on the timeline.

Discussion

The above analysis shows that the representation of ethnic groups from the former Polish-Lithuania in the Ethnographic Atlas is quite modest (only 8 ethnic groups from this area and 5 groups in the neighborhood). For all ethnic groups, observations are missing for at least 10% of the variables, and the information comes from sources of varying quality and from different periods (with a span of more than a century). It is clear that the Ethnographic Atlas needs additions and revisions, if only to fill in the gaps and to re-examine current sources using alternative sources. In particular, unpublished notes and manuscripts should be confronted with published and appreciated material. Central European contributions may also have the added benefit of more mundane issues, such as the correction of ethnonyms (e.g., from *Byelorussians* to the more common *Belarusians*).

The diversity of ethnic groups in the Polish-Lithuanian Commonwealth is not exceptionally large from a pan-European perspective. About one-fifth of the analyzed variables have the same values for all ethnic groups.

The larger groups (Lithuanians, Ukrainians, Belarusians) are even more similar (they share about 80% of common characteristics), indicating that using any of these groups as a representative of the Central European cultural profile in global cross-cultural research should not lead to significant errors in many cases.

However, from the perspective of studying sociocultural regularities of the second type (within cultural regions - see Korotayev, Kazankov, Borinskaya, Khaltourina, Bondarenko 2004), the number of societies and the quality of data are insufficient. One may even wonder to what extent the small differences between groups are due to the use of a small number of sources from different years, which leads to low geographical resolution and large temporal spread of data about the region. To enrich the diversity of cultural profiles in the Ethnographic Atlas by adding more ethnic groups from the Commonwealth, appropriate criteria should be used to select new societies to expand the database. An analysis of the variables that most account for differences between ethnic groups, conducted above, may be helpful in these decisions. For example, given that European societies show only two types of class differentiation in the atlas (wealth distinctions and complex stratification) and almost no caste differentiation (with the exception of Lithuanians), one might wonder whether, for example, groups from northern Mazovia, where the petty nobility lived among peasants without occupational differences, can be described as unique phenomena in Europe. Also, due to the high dependence of the analyzed societies on agriculture, some groups more associated with animal husbandry or gathering (inhabitants of Kurpie or Podhale) could enrich the cultural diversity of the Atlas. It should be noted that relatively small, linguistically, religiously, or geographically isolated minorities (Karaites, Tatars, Livs, Hutsuls) play a special role in the diversity of cultural characteristics. This is also an indication that groups with similar characteristics should be of particular interest (e.g., Jews, Kashubians/Pomorans, Gypsies, Polesians).

Moreover, many differences may have been blurred by the common exposure of the studied ethnic groups to the Catholic and Orthodox Churches, the early industrial activities of the state, and the departure

from the feudal economy. The uniqueness of the Livs may be due not only to their linguistic and ethnic distinctiveness, but also to the fact that the data on them pertain to the earliest year (1840) among the studied groups. Therefore, in order to increase the diversity of cultural profiles, special attention should be paid to sources relating to 19th century (or earlier) societies (especially since they are numerous and often quite reliable). An example of a variable whose values may have been more diverse in the past in Central Europe is the “Norms for premarital sexual behavior of girls”. According to Wiślicz (2018: 37-100), in early modern Poland premarital intercourse was treated with indulgence (at least in practice). Ethnographic notes suggest that in some communities in the former territory of the Polish-Lithuanian Commonwealth in the nineteenth century, sexual activity may have been less sanctioned than described in the dataset (see Kolberg’s notes on Kurpie - Kolberg 1964: 238-239). Finally, the three main groups from the former Polish-Lithuanian Commonwealth (Ukrainians, Belarusians, Lithuanians - but also Czechs) assigned missing values to the variable, so there is still a gap to be filled.

Finally, given the synchronic and diachronic variation, it should be mentioned that some variables may deserve more attention because of their theoretical importance. A big issue related to Central Europe is the debate on the diversity of patterns of marriage and family, referring to the famous division of Europe according to the Hajnal line (Hajnal 1965). For this reason, data on the national / family organization (before and during industrialization) seem to be particularly valuable as material for the expansion and revision of the Atlas. And I hope this article will encourage researchers to take up this task.

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