Quantifying world geography as seen through the lens of Soviet propaganda

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(Dated: October 22, 2024)

Abstract.
Cultural data typically contains a variety of biases. In particular, geographical locations are unequally portrayed in media, creating a distorted representation of the world. Identifying and measuring such biases is crucial to understand both the data and the socio-cultural processes that have produced them. Here we suggest to measure geographical biases in a large historical news media corpus by studying the representation of cities. Leveraging ideas of quantitative urban science, we develop a mixed quantitative-qualitative procedure, which allows us to get robust quantitative estimates of the biases. These biases can be further qualitatively interpreted resulting in a hermeneutic feedback loop. We apply this procedure to a corpus of the Soviet newsreel series 'Novosti Dnya' (News of the Day) and show that city representation grows super-linearly with city size, and is further biased by city specialization and geographical location. This allows to systematically identify geographical regions which are explicitly or sneakily emphasized by Soviet propaganda and quantify their importance.

Impact Statement.
We develop a novel approach to study biases in the way cities are represented in a media corpus. We apply the developed systematic quantitative-qualitative procedure to a historical corpus of Soviet news, elucidating the distorted representation of world geography in the Soviet propaganda. This approach is transferable to a variety of cultural datasets, opening up new ways to examine, quantify and interpret biases in geographical representation.

I. INTRODUCTION

Large scale cultural data is subject to quantitative patterns originating from complex interplay of general trends, local specifics and selection biases. These patterns in many cases lend themselves to measurement and interpretation, this is especially clear in the study of the fortune of urban centers in cultural history[1–5].

Representation and selection biases in the cultural data are crucial for understanding such quantitative patterns. One particular example is unequal representation of geographical locations in the media. The ability to pinpoint and quantify this unequal representation can give essential insights into the underlying normative worldview of the media-producing society. Attention to different geographical locations in the media has been studied for a long time [6–9]. Visibility of a country in the international news scene is known to be influenced by multiple reasons[8]: ad-hoc political and economic events and regional centrality can be reasons for over-representation, while under-representation can be driven by peripheral geographical position and by invisible conflicts. Administrative status, economic development, number of central institutions, tourist resources and distance to the capital may affect the amount of online media attention received by cities as shown for contemporary China [10]. Population adjusted Tweet density is known to be lower in "left behind" areas [11].

While geographical and spatial biases are present at all spatial scales, from continents to neighbourhoods, we argue that cities form a natural probe to study representation of geographical space in historical media. Cities are numerous, their size is relatively well-defined, spans multiple orders of magnitude, and is reasonably well-documented historically [12, 13]. Recent influx of ideas from complex systems theory into urban science, especially the idea of urban scaling[3, 14–17] (see also books [18–20] and recent reviews [21, 22]) provides a useful conceptual framework for understanding the city representation.

Here we provide a general procedure for extracting insights regarding the representation of geographical space in historical media from the data on how cities are mentioned in a historical news corpus. Our method consists of following feedback-loop-forming steps: (i) formulation of a hypothesis about parameters governing city representation; (ii) calculation of the parameters of the hypothesis by minimization of an explicitly defined loss function, (iii) elimination of irrelevant parameters based on a predetermined information-theoretic criterion, and (iv) correction of the hypothesis based on qualitative analysis of the outliers.

We exemplify this procedure by the systematic study of the corpus of Soviet newsreels "Novosti Dnya" (News of the day)[23]. Newsreels – short news films shown in cinemas before the evening's feature film – were influential means of depicting the world for the cinema goers in the 20th century, visualizing events, individuals and places that the spectators could read about in the newspapers. Throughout almost all history of the Soviet Union, the newsreels were heavily censored. News production should have served the goal of building communism by representing the contemporary world accordingly, i.e. the goals of objectivity or impartiality where explicitly rejected and the purpose of news was to show the events in the light of innate social, economic, political, and cultural superiority of the communist system [38]. Thus, the content of newsreels reflects the prescribed worldview, the set of topics, places and individuals, which were considered appropriate to be presented and discussed in an official source. They provide therefore an interesting glimpse into the history of the Soviet Union and its political and media culture.

Spatial history of Russia and the Soviet Union has identified entanglements of imperial politics, practices, and identities with spatiality [24–27], including the persistent connection of the Russian and Soviet imperial identities with the idea of the vastness of the country, covering "one sixth of the world" [28, 29], the connection of imperial visions and territorial expansion [30], Eurasianism and its political interconnections [31], and the spatial and geographical arrangements during the Stalinist era (late 1920s to early 1950s)[32–35].

Despite the official Soviet ideology of equality, interconnected social and spatial hierarchies were at the core of the Soviet system. These hierarchies originated in both the political ideology and the pragmatic considerations of usefulness for the state and where entangled with spatial hierarchy, where Moscow and major cities were at the top, capitals of the Soviet republics at the second tier, and small cities far away from Moscow were at the bottom [32, 36, 37]. Likewise, the Soviet media system was hierarchically and geographically organized with most important newspapers, radio stations and film studios located in Moscow.

Following the general principle of politicisation of news, representation of the outside world in the Soviet media was determined by current politics, and its shifting tendencies of isolationism or expansionism [38, 39]. Soviet Union was depicted as a focal point of world history, its socialist allies were seen as "younger brothers", following the lead of the Soviet Union, and the whole socialist camp - as surrounded by capitalist enemies, shaken by social hardships [39]. However, since the mid-1950s the Soviet culture started to open up to the outer world [29, 40–42], and the presentation of both socialist "allies" and capitalist "enemies" was further graduated according to how friendly the relations with a particular foreign country were [43].

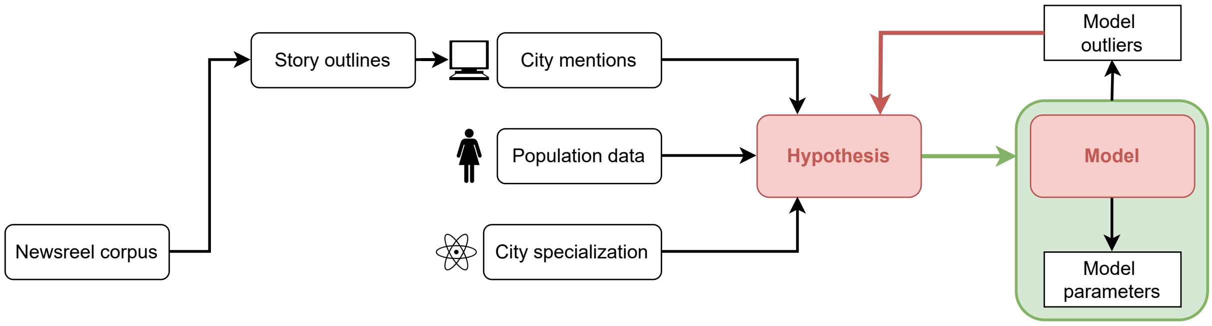

Figure 1: The workflow pipeline of the procedure extracting information on media representation of cities. The black arrows correspond to the flow of data. The green arrow denotes classification of hypothetical parameters into relevant and irrelevant according to a predetermined information theoretic criterion. The red arrow signifies the feedback loop, i.e. the systematic refinement of the hypothesis based on the qualitative study of model outliers.

II. METHODS

The method we develop here aims to extract the quantitative estimates of the factors determining the frequency of mentions of the cities in a robust and reliable way. Input consist of a list of N cities with the numbers of times $n_i(i = 1, \ldots, N)$ they are mentioned, and a *hypothesis*, i.e. an assumption that the expected number of mentions

$$m_i = m(\mathbf{A}_i, \mathbf{K}) \tag{1}$$

is a certain function of a vector of city attributes $\mathbf{A}_i = \{A_{i,1}, \ldots, A_{i,m}\}$ (e.g., city population or binary variables like whether the city serves a certain administrative function) and a vector of numerical parameters $\mathbf{K} = \{K_1, \ldots, K_l\}$, common for all cities.

We assume that actual number of mentions n_i is a Poisson random variable with mean m_i, and that mentions of different cities are independent. This implies the loss function

$$L(\{n_i\}, \{\mathbf{A}_i\}, \mathbf{K}) = \sum_{i=1,\ldots,N} \log p(n_i, m(\mathbf{A}_i, \mathbf{K})), \quad p(n,m) = 2\min\left[\frac{\Gamma(n+1,m)}{n!}; 1 - \frac{\Gamma(n,m)}{(n-1)!}\right] \tag{2}$$

where the incomplete gamma-function $\Gamma(n, m)$ comes from the cumulative distribution function of the Poisson distribution with average m: $Prob(x < n|m) = \Gamma(n, m)/(n-1)!$. Function $p(n, m)$ in (2) estimates how improbable it is to observe a value n of a variable with expected value m, i.e. is a p-value for the Poisson distribution.

For a given hypothesis $m(\mathbf{A}, \mathbf{K})$ the optimal values of the parameters $\mathbf{K}_0$ come from the maximal likelihood estimate

$$\mathbf{K}_0 = \mathrm{argmax}_{\mathbf{K}} L(\{n_i\}, \{\mathbf{A}_i\}, \mathbf{K}) \tag{3}$$

Contrary to the commonly used least-square method, this procedure, inspired by [44], explicitly accounts for the difference in the scale of fluctuations for frequently and rarely mentioned cities, including cities with zero mentions[45].

This allows to calculate optimal values of parameters given a hypothesis. We add two procedures to systematically improve the hypotheses (see Fig. 1): one, in the spirit of [46], avoids overfitting by removing irrelevant parameters, another allows to include overseen aspects into the hypothesis.

Consider overfitting first. Adding parameters to the model is beneficial only if better description of the data, i.e., information content of the discrepancy between the model and the data, outweighs the increase in the complexity of the model, i.e., its information content, which can be approximated as Δl, where l is the number of parameters used and Δ is information content per parameter. Then, having a parameter in the model is beneficial only if its presence results in a gain in the loss function ΔL larger than Δ (we choose $\Delta = \log 100$ in this work). In practice, we start with a hypothesis with maximal set of parameters and try excluding them one by one, each time checking if ΔL is larger than Δ. We repeat the procedure consequentially until no more parameters can be excluded.

Finally, after the model is pruned of irrelevant parameters, it produces a list of outliers — cities with smallest p-values. We study these outliers qualitatively, search for possible explanations of their behavior, refine the hypothesis accordingly, and repeat the fitting and parameter removal procedure. This feedback loop is repeated until we are not able to identify any new relevant attributes, thus inserting a quantitative modelling step into the usually qualitative cycle of hermeneutic interpretation.

III. DATA

We use the corpus of the Soviet Newsreel "Novosti Dnya" (News of the Day) sourced from the Russian footage archive Net-Film[47] with owners' permission. It consists of over 1700 short (approximately 10-minute) films that is almost complete for 1954–1992 (excluding 1965) with some additional issues from 1944-53. In 1954-86 the issues are weekly, and in 1987-91 bi-weekly. Most newsreels contain multiple short news stories, although there are occasional single-topic issues dedicated to major political events (see [23] for more details).

The corpus metadata includes story outlines in Russian, which we cleaned, split into stories (12,707 overall) and used for further analysis (see [48] for the details of data preparation). Approximately 97.5% of the stories are from the period between 1954 and 1986, the median being 1968.

Cities are included in the list of cities of interest if they exceed preset population levels [48] (for USSR cities we use 1959, 1970 and 1979 census data [49], for cities outside USSR we mostly use the UN Population Division data for 1970 [50]). The mentions of each city where manually classified by native Russian-speakers into 5 categories: (i) direct mention of a city and city-dwellers, (ii) mention of organizations and industrial enterprises located in the city and named after it, (iii) mentions of the region surrounding the city, and organizations located there, (iv) entities named after the city but located elsewhere, (v) homonyms and coincidences. In what follows, only mentions of type (i) and (ii) are considered.

IV. RESULTS

City	Mentions	Pop, mln	City	Mentions	Pop, mln
Moscow	2831	7.06	Tokyo	16	23.3
St. Petersburg	339	3.95	New York	29	16.2
Kyiv	95	1.63	Osaka	3	15.3
Tashkent	45	1.38	Mexico	6	8.83
Baku	38	1.26	Buenos Aires	3	8.42
Kharkiv	43	1.22	Los Angeles	0	8.38
Nizhny Novgorod	45	1.18	Paris	39	8.21
...	...	...	...	...	...
Minsk	72	0.92	Berlin	62	3.21
Volgograd	62	0.86	Warsaw	64	1.30
Riga	73	0.73	Prague	51	1.08

Table I: Number of mentions of selected cities in (left) and outside (right) the USSR. Population values are for 1970, data is for the top 7 cities by population, and 3 most mentioned ones outside the top 7.

Table I summarizes the mentions of the seven largest cities plus three most mentioned cities outside the top 7. Notably, mentions of Soviet cities are systematically larger than those outside; correlation between mentions and population is much clearer for Soviet cities; Moscow is completely out of comparison, not surprisingly for a Moscow-based newsreel. Given these observations, we exclude Moscow from further analysis, and consider mentions of Soviet and foreign cities separately.

A. Cities in the USSR

Population only model. To study representation patterns of the Soviet cities we collected the data on all 309 cities with population above 0.03% of the population of the USSR (this threshold is chosen because it roughly corresponds to 1 mention per city), see Fig. 2. Our first hypothesis, in the spirit of urban scaling theory, is that

$$m_{I,i}(\mathbf{K}, P_i) = cP_i^a, \quad \log m_{I,i} = \log c + a \log P_i \tag{4}$$

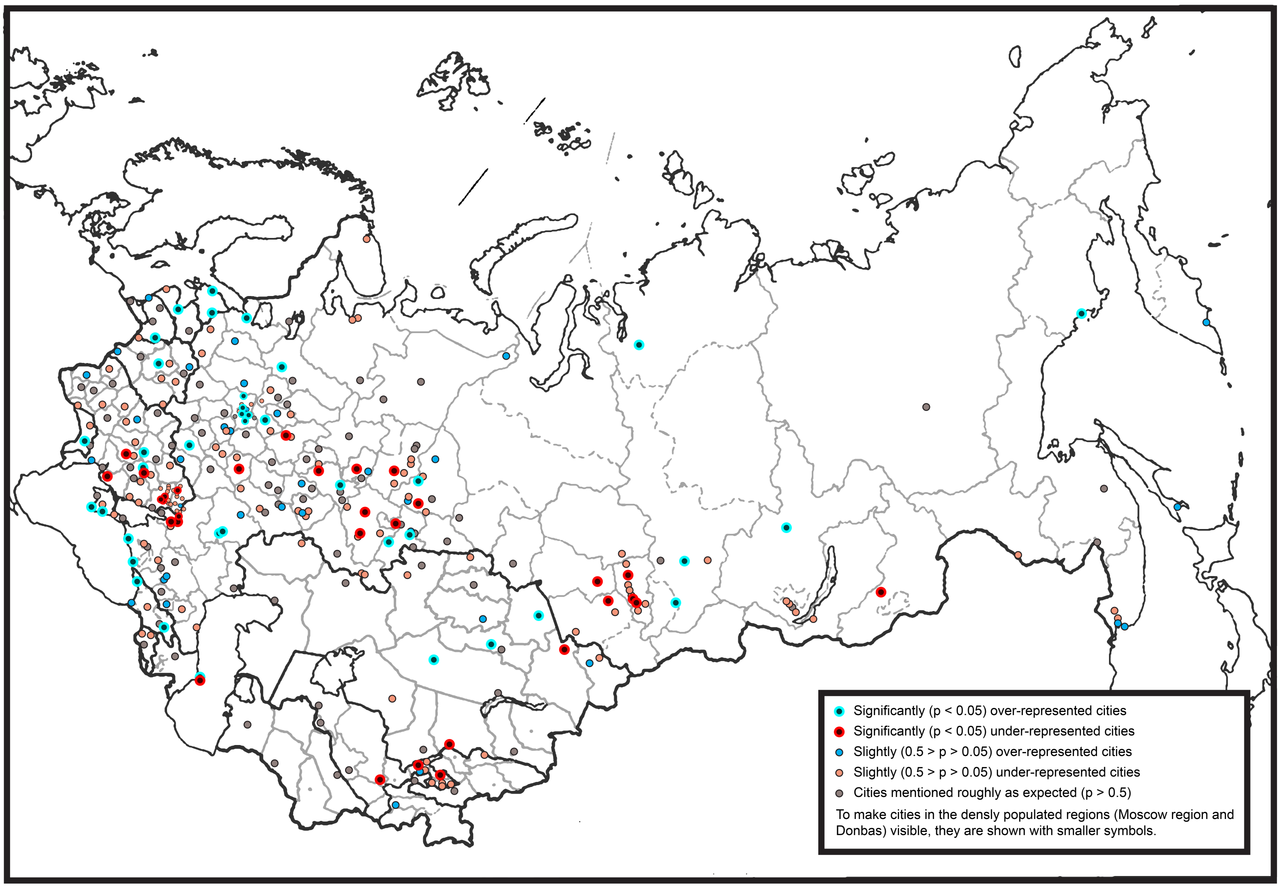

Figure 2: Cities with population exceeding 0.03% of the USSR population and their mentions vs. expected from population-only model. Significantly ($p < 0.05$) over- and under-represented cities, insignificantly ($0.5 > p > 0.05$) over- and under-represented cities and cities which are mentioned roughly as expected ($p > 0.5$) are shown with cyan, red, grey-cyan, grey-pink and grey circles, respectively. Cities in Moscow and Donbas regions are shown in smaller circles to reduce their overlap.

where the parameter P_i is the rescaled average fraction of the USSR population living in this city

$$P_i = \frac{1}{3 \times 10^{-4}} \frac{1}{3} \left(\frac{Pop_{i,1959}}{Pop_{USSR,1959}} + \frac{Pop_{i,1970}}{Pop_{USSR,1970}} + \frac{Pop_{i,1979}}{Pop_{USSR,1979}} \right) \tag{5}$$

and numerical constants $\mathbf{K} = \{c, a\}$ are obtained by maximal likelihood estimation (3) and equal $c = 1.34 \pm 0.12, a = 1.33 \pm 0.04$ (here and below we provide 95% confidence intervals). Notably, the scaling constant a is larger than 1, indicating an agglomeration effect[3, 51].

As shown in Figs. 2 and 3 (A), while the model describes the majority of cities reasonably well, there is a significant number of outliers: 30 (10%) with p-value below 0.001, and 39 (13%) more with p-value between 0.001 and 0.05 (see [48] for the full list). Many of the outliers are geographically clustered, some others share industrial specialization (e.g., hydroelectricity and steelworks). To allow for that, we constructed two competing models – one allowing for city geographical location, another — for city specializations.

Geolocation model. The hypothesis here is that the USSR was split into geographical regions with different intrinsic levels of representation, i.e. the expectation (1) is

$$\log m_{II,i} = \log c + a \log P_i + \sum_\alpha \log k_\alpha \mathbb{I}_{i,\alpha} \tag{6}$$

where $\mathbb{I}_{i,\alpha}$ is the indicator function of i-th city belonging to α-th region, $\sum_\alpha \mathbb{I}_{i,\alpha} = 1$.

A priori the set of geographic regions is unknown. To determine it, we start with a set of 40 seed regions (see Fig. 4 A), including all Union-level republics separately [58], three larger republics – Kazakhstan, Russia and Ukraine are further split into subregions.

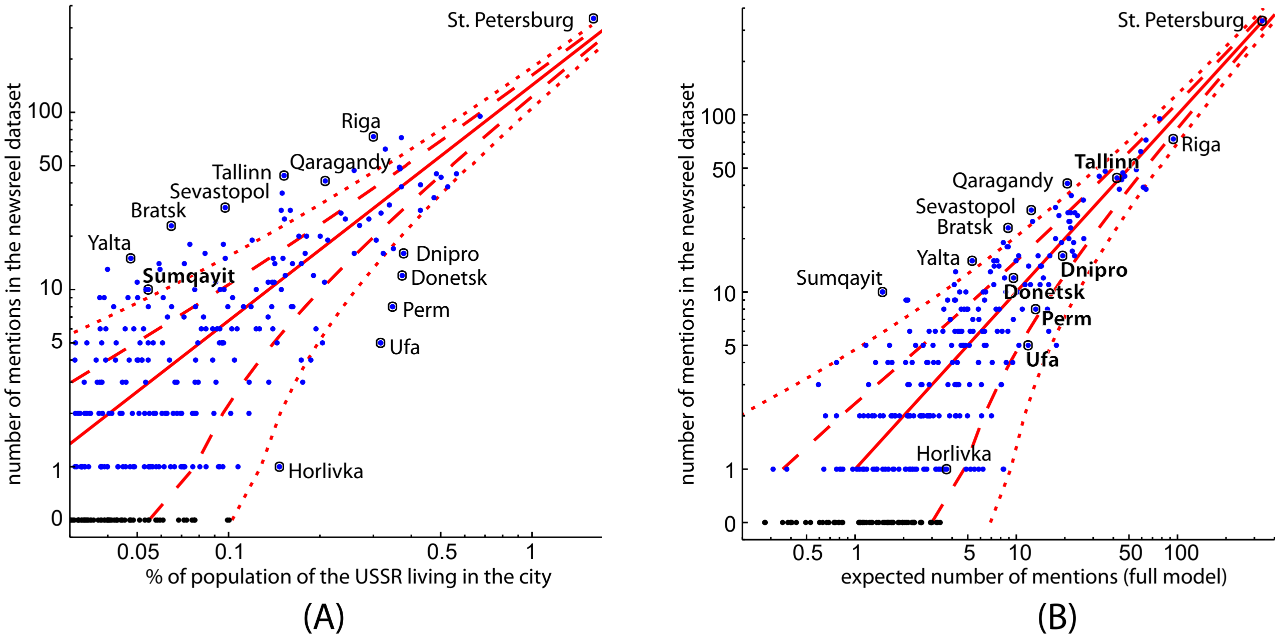

Figure 3: City mentions vs. (A) population of the cities and (B) prediction of the full model, which accounts for population, geographical regions and city specialization for all cities with population above 0.03% of the population of the USSR. Cities mentioned zero times in the dataset are shown in black, out of scale. The red straight lines correspond to ideal correspondence with model and observation (power law regression (4) in panel (A), identity in panel (B)). Dashed and dotted lines correspond to deviations with p=0.05 (dashed) and p=0.001 (dotted). Note that number of big outliers is much smaller in the full model (cf. cities outlined with black circles).

We then apply the parameter-removing procedure outlined above: starting with a given set of regions, we choose a region with smallest number of cities in it, and attempt to merge it with each of the geographically adjacent regions, and check if the condition $\Delta L < \Delta$ is satisfied. If it is not, the merger with the smallest decrease of the loss function is accepted. The procedure is continued until no further merges are possible. Fig. 4 B shows the resulting set of regions and corresponding ranges of k_α (see [48] for details).

Most over-represented regions are the vicinity of Moscow (probably due to convenience of filming there), Baltic States, South (including Southern Russia, Georgia and Crimea), North-East and Northern Kazakhstan. The over-representation of North-East may be related to the ideological importance of “stroyki kommunizma” (construction projects of communism) - big development projects often located in the far-away parts of the country. Northern Kazakhstan is the region where “osvoyenie tseliny” (reclamation of virginlands) – major political campaign of 1950s – took place. The central role this campaign played in the biography of L. Brezhnev ensured North Kazakhstan remained important for the official mythology of the later Brezhnev era. Over-representation of South and Baltics might be related to the cultural attraction of the 'Soviet West' [52, 53] or to recreational attractiveness of this regions for the film crews.

The most under-represented regions are Western Urals, Western Siberia and Russia-Ukrainian borderlands (Donbas in Ukraine and Rostov oblast in Russia). All three are industrial heartlands partly specializing in coal mining and lacking a clear ideological significance.

Specialization model. An alternative approach to understanding city representation is to study how it is correlated with the presence of some industries or administrative functions. The hypothesis in this case is that expectation (1) is

$$\log m_{III,i} = \log c + a \log P_i + \sum_\beta \log s_\beta \mathbb{I}_{i,\beta} \tag{7}$$

where index β enumerates specializations, $\mathbb{I}_{i,\beta}$ equals 1 if specialization i is present in city β and 0 otherwise (cities can have more than 1 specialization, or no specializations at all).

We started with 19 hypothetical specializations, and reduced their number, either by elimination or by merger

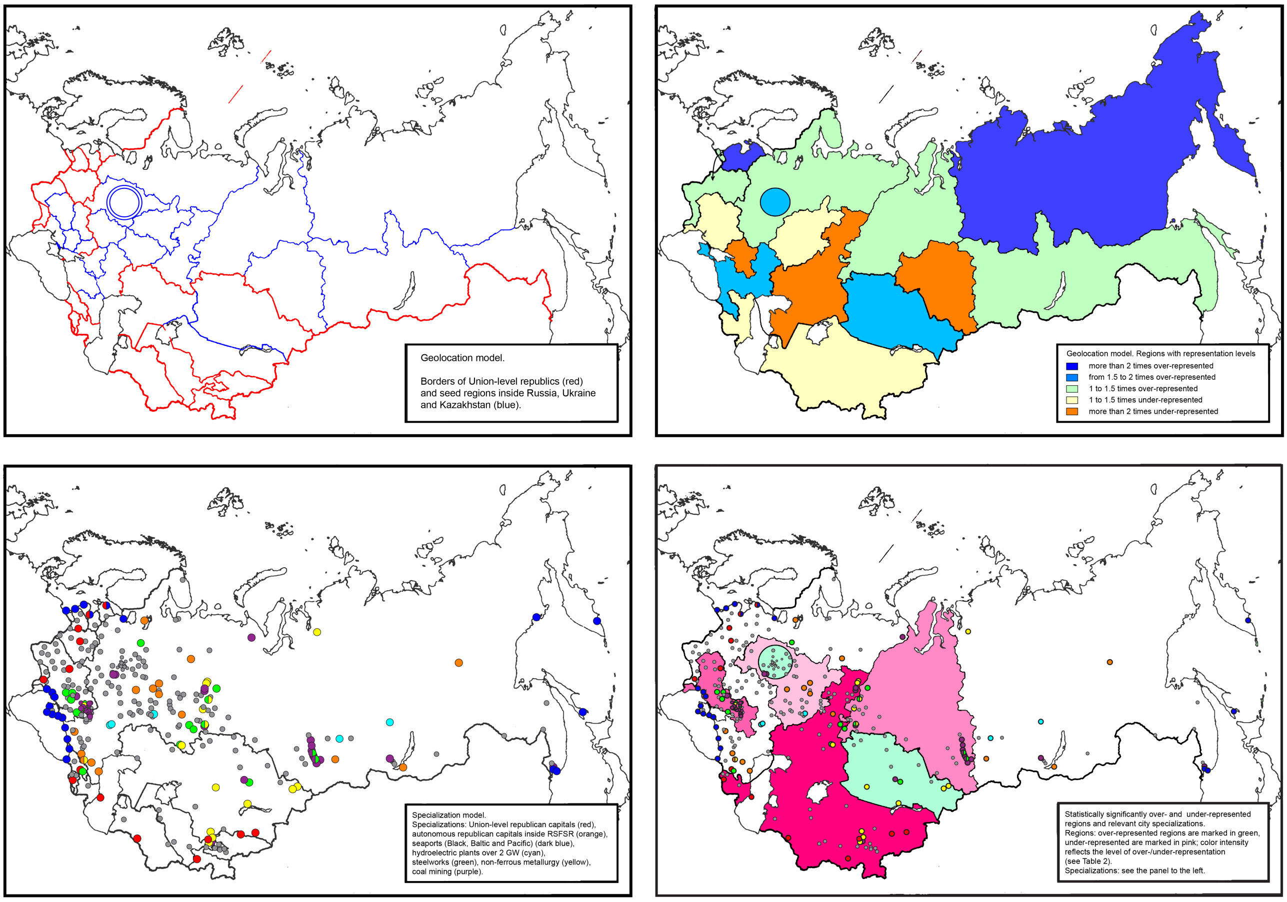

Figure 4: Overview of models explaining Soviet city representation.

(see[48]) according to the same information-theoretic rule as above. Seven out of 19 specializations turned out to be relevant (see Fig. 4 (C) and Table II).

Naturally, the administrative and symbolic value of a republican capital results in higher representation. On the contrary, the capitals of nation-based administrative-units inside the Russia proper are under-represented both with respect to centers of non-national administrative units and to cities with no administrative function. There is a significant boost for seaside cities but only for the Baltic and Black seas and the Pacific ocean, presumably due to their strategic, cultural and/or recreational importance. Strikingly, while steelworks and huge hydroelectric dams boost representation, there is no similar effect for, e.g., automobile industry.

Full model. The geolocation and specialization models give two different angles for interpretation of the representation of Soviet cities. Yet there are correlations between them: Republican capitals are concentrated along the western and southern borders, there are plenty of seaports in the Baltic and South regions, many steelworks in the Eastern Urals, etc. To study the interplay of specialization and location we introduce a combined model:

$$\log m_i = \log c + a \log P_i + \sum_{\alpha} \log k_\alpha \mathbb{I}_{i,\alpha} + \sum_{\beta} \log s_\beta \mathbb{I}_{i,\beta} \tag{8}$$

where index α enumerates geographical regions (with same seed regions and merging procedure) and β enumerates specializations (only 7 specializations which proved relevant are used). The results are summarized in Fig. 4 D and in Table II. Interplay between geographical and specialization parameters notably leads to a smaller number of relevant geographical regions.

While the Moscow region and Northern Kazakhstan retain their prominence, the significant over-representation of the Baltic region in the geolocation model is fully explained by the effects of the Baltic sea and capital status of Riga, Tallinn, and Vilnius.

Parameter	Specialization model	Full model
residual c (for the full model, the value outside of the 6 regions below)	1.42 (1.33. . . 1.57)	1.66 (1.50. . . 1.88)
scaling exponent a	1.14 (1.09. . . 1.17)	1.18 (1.13 . . . 1.22)
Boosts due to city specialization, s_β		
Union-level capital	1.65 (1.48. . . 1.81)	2.00 (1.77. . . 2.22)
Autonomy capital (RSFSR)	0.75 (0.61. . . 0.88)	0.74 (0.61. . . 0.89)
Seaside (Black, Baltic, Pacific)	2.38 (2.15. . . 2.62)	1.91 (1.68. . . 2.10)
Hydroelectricity (> 2 GW)	2.46 (2.08. . . 2.80)	2.14 (1.77. . . 2.50)
Steelworks	1.53 (1.32. . . 1.72)	1.84 (1.54. . . 2.14)
Non-ferrous metallurgy	1.50 (1.27. . . 1.79)	1.55 (1.22. . . 1.92)
Coal mining	0.53 (0.43. . . 0.65)	0.62 (0.50. . . 0.75)
Regional boosts k_α compared to the residual level		
I: up to 250 km from Moscow		1.38 (1.18. . . 1.59)
II: N Kazakhstan		1.38 (1.09 . . . 1.71)
III: Center, mid and mid-low Volga		0.78 (0.67. . . 0.87)
IV: E Urals, W Siberia		0.65 (0.55. . . 0.77)
V: Central Ukraine, S Ukraine, lower Dnipro, Donbas, Rostov		0.58 (0.50. . . 0.64)
VI: Central Asia, Armenia, Azerbaijan, W and S Kazakhstan, W Urals		0.46 (0.39 . . . 0.53)

Table II: Optimal values and 95% confidence intervals of the parameters of Specialization and Full models.

In turn, "oriental" republics of Central Asia and Transcaucasus are even more significantly under-represented after control for the republican capitals, emphasizing the Eurocentric nature of the Soviet ideological system (see also below). Also underrepresented is the part of Russia, interjacent between the European Center and the ideologically important East. Similarly, under-representation of Central and Eastern Ukraine and the Rostov region of Russia may point to an ambiguous intermediate status of Ukraine in the implicit Soviet nomenclature of ethnicities.

In Fig. 3B predictions of the full model are compared with actual mention for individual cities. Naturally, the results are still scattered around the predicted values but with a much narrower spread than in Fig. 3A. There are just 10 (3%) cities with $p < 0.001$ and 29 (9%) with $0.05 > p > 0.001$, compared with 10% and 13%, respectively, for the population only model and, on the other hand, with 0.1% and 5%, respectively, as expected if the formula for the expected values were exactly correct.

B. Cities outside the USSR

Parameter	Value
residual c (number of mentions of a city with 1 mln population)	0.14 (0.12. . . 0.20)
scaling exponent a	1.26 (1.14. . . 1.32)
Regional boosts k_α compared to residual level	
Socialist I: Czechoslovakia, Bulgaria, Mongolia, Albania[a]	64 (43. . . 82)
Socialist II: Poland, East Germany, Hungary	37 (27. . . 45)
Socialist III: Yugoslavia, Romania, Vietnam, Cuba, North Korea	16 (11. . . 21)
Capitalist I: Austria, Finland	74 (50. . . 97)
Capitalist II: the rest of Europe	4.7 (3.5. . . 5.9)
Capitalist III: USA, Canada, Australia	2.5 (1.8. . . 3.2)

[a]All recorded mentions of Tirana (Albania) are before the Soviet-Albanian split of late 1950s

Table III: Optimal values and 95% confidence intervals of the parameters of the foreign cities model.

The newsreel "Novosti Dnya" mostly specialized in the internal Soviet news. As a result, foreign cities were mentioned more rarely than Soviet ones (see Table I). However, it is possible (see [48] for full details) to construct a city-representation model in a methodologically similar way. The optimal formula for the expected number of mentions of the foreign cities is

$$\log m_{F,i} = \log c + a \left[\log P_i + \frac{\mathbb{I}_{i,cap}}{2} \log \frac{P_{c,i}}{P_i} \right] + \sum_\alpha \log k_\alpha \mathbb{I}_{i,\alpha} \tag{9}$$

where P_i is the population of the i-th city, $P_{c,i}$ is the population of the country to which it belongs, $\mathbb{I}_{i,cap}$ is the indicator function of a city being a capital, $\mathbb{I}_{i,\alpha}$ is the indicator function of belonging to geographical group, while residual c, scaling exponent a, and boost factors k_α are numerical constants. The number and composition of the geographical groups is optimized similarly to the Soviet cities case. The treatment of the capital status by replacing the city population with the geometric mean of city and country populations is a result of optimization of a more complex formula [48].

The list of relevant geographical groups, as well as optimal values of c, a, k_α are given in Table III. The inequality between geographical groups here is much stronger here than for the cities inside the USSR. There is a clear difference in representation of three groups of countries, easily identifiable with the so-called "first" (developed capitalist: Europe, USA, Canada and Australia), "second" (socialist) and "third" (developing) worlds. Interestingly, according to this dataset, Japan and China are classified in the latter group. Both developed capitalist and socialist camps split further into three groups with significantly different levels of representation.

The tiers in the socialist world can be explained by the combination of ideological conformity of corresponding regimes and the Eurocentrism of the Soviet worldview. Indeed, lower tier consists of three non-European socialist countries plus Yugoslavia and Romania, which had strained relations with the Soviet Union, while the top tier includes Mongolia, Bulgaria and Czechoslovakia, whose authorities toed the Soviet line exceptionally closely (except for several months of the Prague spring).

The tiers in the capitalist world point once again to the Eurocentrism, and to the extreme importance of neutral European countries – Finland and Austria – as the Soviet "window to the West"[54–56].

V. DISCUSSION

In this paper we analyze the representation of geographical space in historical Soviet propaganda media using a post-Stalin era corpus of the "Novosti Dnya" newsreel series. Our analysis is based on quantitative models of city mentioning and allows to elucidate and quantify biases in city representation. Full interpretation of these biases needs further qualitative analyses of the corpus, coupled with other topical historical sources. However, we observe the following important repeating motives.

Our corpus shows a clear hierarchy of representation with the Soviet Union on top, followed by the Socialist block, the developed capitalist world and, finally, the developing world. Representation of cities grows superlinearly with city population, indicating positive agglomeration effects, and is boosted by capital status (national or Soviet-Union-level republican).

Contrary to the messaging of the official Soviet ideology, which emphasized equality of nations and anticolonial movement, the silently sold Soviet worldview is heavily centered on Europe being in the role of a privileged or hierarchically higher "Other"[57]. In agreement with previous qualitative observations[32, 37, 43, 53], we find that European countries (both socialist and capitalist) are mentioned more than their counterparts elsewhere, while western regions of the USSR are mentioned much more than Central Asia and Southern Caucasus.

Some particular regions and branches of heavy industry have an outsized ideological importance. Regional examples are Northern Kazakhstan inside the USSR, the most loyal countries of the socialist block, and, most strikingly, the two neutral capitalist countries, Austria and Finland.

Seemingly, Soviet worldview deliberately avoids mixed and intermediate cases and situations: while a trait is celebrated and emphasized in its fully developed form (superlarge dams, Far East location, Union-level capital status), intermediate forms of the same trait (medium-sized dams, location in West Siberia or Urals, capital of lower-level national autonomy) are often under-represented. Possibly a similar mechanism is behind the under-representation of Eastern and Central Ukraine: while Eastern Europe, including republics of the Soviet Western frontier, is overwhelmingly important for the Soviet worldview, Eastern and Central Ukraine with its mixed Ukrainian-Russian population might seem neither fully Eastern European nor fully Russian. If true, the interplay of these two factors: over-fixation on Eastern Europe and denial of the fact that Ukraine fully belongs to it, might be instructive in understanding the worldview which led to the current Russian aggression against Ukraine.

Finally, in some cases places are overmentioned seemingly just because it is convenient (close to Moscow) or pleasant (Baltic and Black sea coasts) to film there.

While studying a particular example of a Soviet media corpus, we develop a general approach to extracting information on geographical biases from historical news corpora. The suggested procedure combines quantitative and qualitative steps into a single feedback loop, allowing to systematically refine hypotheses about relevant factors and to measure biases in robust quantitative way. The methodology developed here can be used for the analysis of multiple other datasets and hopefully will become a standard in the field. Speaking more generally, we show here how combination of relatively simple reference models routed in the complexity theory and rigorous statistical analysis of deviations from those models can be leveraged to extract significant new information in such traditionally qualitative fields as history and media studies.

Acknowledgements

This project was funded by the CUDAN ERA Chair project for Cultural Data Analytics, funded through the European Union's Horizon 2020 research and innovation program (Grant No. 810961). MT also acknowledges support from the Estonian Research Council (ETAG), Grant PRG 1059.

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[1] H.A. Makse, S. Havlin, H.E. Stanley, Modelling urban growth patterns, *Nature.* **377**, 608-612 (1995).

[2] M. Batty, Rank clocks, *Nature.* **444**, 592-596 (2006). doi:10.1038/nature05302

[3] L.M.A. Bettencourt, J. Lobo, D. Helbing, C. Kühnert, G.B. West, Growth, innovation, scaling, and the pace of life in cities, *Proc. Nat. Ac. Sci.*, **104**, 7301-7306 (2007).

[4] M. Batty, The Size, Scale, and Shape of Cities, *Science.* **319**, 769–771 (2008).

[5] M. Schich, C. Song, Y.-Y. Ahn, A. Mirsky, M. Martino et al., A network framework of cultural history, *Science.* **345**, 558-562 (2014).

[6] P.J. Taylor, Hierarchical Tendencies amongst World Cities: A Global Research Proposal, *Cities.* **14**, 323-332 (1997). https://doi.org/10.1016/S0264-2751(97)00023-1

[7] W. Wanta, G. Golan, C. Lee, Agenda Setting and International News: Media Influence on Public Perceptions of Foreign Nations, *Journalism & Mass Communication Quarterly*, **81**, 364-377 (2004). https://doi.org/10.1177/107769900408100209

[8] E. Segev, Visible and Invisible Countries: News Flow Theory Revised, *Journalism*, **16**, 412–428 (2015). https://doi.org/10.1177/1464884914521579

[9] K. Kruusmaa, K. Vanamolder, Positioning Riga in the 19th Century News Network: Tracing International News Flows in the Rigasche Zeitung Newspaper, 1802-1888. *Acta Historica Tallinnensia*, 3-34 **29** (2023). https://doi.org/10.3176/hist.2023.1.01

[10] B. Wang, B.P.Y. Loo, The Hierarchy of Cities in Internet News Media and Internet Search: Some Insights from China. *Cities*, **84** 121–33 (2019). https://doi.org/10.1016/j.cities.2018.07.013

[11] R. Sanderson, R. Franklin, D. MacKinnon, J. Matthews, Left out and Invisible? Exploring Social Media Representation of 'Left behind Places.' *GeoJournal*, **89**, 37 (2024). https://doi.org/10.1007/s10708-024-11010-z

[12] M.L. Reba, F. Reitsma, K.C. Seto, Historical Urban Population: 3700 BC - AD 2000. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC), 2018, available at https://doi.org/10.7927/H4ZG6QBX

[13] E. Buringh, European urban population, 700 - 2000, V.1, DANS Data Station Social Sciences and Humanities, 2020, available at https://doi.org/10.17026/dans-xzy-u62q

[14] D. Poumain, Scaling laws and urban systems, Working papers of the Santa Fe Institute, 2004.

[15] L.M.A, Bettencourt, J. Lobo, D. Strumsky, G.B. West, Urban Scaling and Its Deviations: Revealing the Structure of Wealth, Innovation and Crime across Cities. *PLoS ONE*, **5**, e13541 (2010). https://doi.org/10.1371/journal.pone.0013541

[16] L.M.A. Bettencourt, The Origins of Scaling in Cities, *Science*, **340**, 1438 (2013). https://doi.org/10.1126/science.1235823

[17] E. Arcaute, E. Hatna, P. Ferguson, H. Youn, A. Johansson, and M. Batty, Constructing cities, deconstructing scaling laws, *J. R. Soc. Interface*, **12**, 20140745 (2015). http://doi.org/10.1098/rsif.2014.0745

[18] M. Batty, The new science of cities. The MIT Press, 2013.

[19] M. Barthelemy, The structure and dynamics of cities. Cambridge University Press, 2016.

[20] L.M.A. Bettencourt, Introduction to Urban Science: Evidence and Theory of Cities as Complex Systems, The MIT Press, 2021.

[21] D. Rybski, E. Arcaute, M. Batty, Urban scaling laws. *Environment and Planning B: Urban Analytics and City Science*, **46**, 1605-1610. https://doi.org/10.1177/2399808319886125

[22] F.L. Ribeiro, D. Rybski, Mathematical models to explain the origin of urban scaling laws, *Physics Reports*, **1012**, 1-39 (2023). https://doi.org/10.1016/j.physrep.2023.02.002

[23] M. Oiva, K. Mukhina, V. Zemaityte, A. Karjus, M. Tamm et al., A framework for the analysis of historical newsreels. *Hum. Soc. Sci. Comm.*, **11**, 1-15 (2024).
[24] M. Bassin, C.D. Ely, M. Kirschke Stockdale, eds. Space, Place, and Power in Modern Russia: Essays in the New Spatial History. DeKalb: Northern Illinois University Press, 2010.
[25] S. Turoma, M. Waldstein, eds. Empire de/Centered: New Spatial Histories of Russia and the Soviet Union. Farnham: Ashgate, 2013.
[26] N. Baron, New Spatial Histories of 20th-Century Russia and the Soviet Union: Exploring the Terrain. *Kritika: Explorations in Russian and Eurasian History*, **9**, 433-447 (2008). https://doi.org/10.1353/kri.0.0012
[27] N. Baron, New Spatial Histories of Twentieth Century Russia and the Soviet Union: Surveying the Landscape. *Jahrbücher Für Geschichte Osteuropas*, **55**, 374-400 (2007).
[28] F.B. Schenk, 'A Sixth Part of the World': The Career of a Spatial Metaphor in Russia and the Soviet Union (1837–2021). *Kritika: Explorations in Russian and Eurasian History* **24**, 349-380 (2023).
[29] S. Turoma, Imperiia Re/Constructed: Narratives of Space and Nation in 1960s Soviet Russian Culture. In *Empire de/Centered: New Spatial Histories of Russia and the Soviet Union*, S. Turoma, M. Waldstein, eds. (Farnham: Ashgate, 2013) p. 239–256.
[30] M. Bassin. Imperial Visions: Nationalist Imagination and Geographical Expansion in the Russian Far East, 1840-1865. Cambridge Studies in Historical Geography 29. Cambridge, UK; New York: Cambridge University Press, 1999.
[31] M. Bassin, S. Glebov, M. Laruelle, eds. Between Europe & Asia: The Origins, Theories, and Legacies of Russian Eurasianism. Pitt Series in Russian and East European Studies. Pittsburgh, PA: University of Pittsburgh Press, 2015.
[32] N. Pianciola, Stalinist Spatial Hierarchies: Placing the Kazakhs and Kyrgyz in Soviet Economic Regionalization. *Central Asian Survey* **36**, 73-92 (2017). https://doi.org/10.1080/02634937.2016.1221380
[33] E. Widdis. Visions of a New Land: Soviet Film from the Revolution to the Second World War. Yale University Press, 2003.
[34] V. Papernyj. Kul'tura "Dva." Ann Arbor, Mich: Ardis, 1985.
[35] E. Dobrenko and E. Naiman, eds. The Landscape of Stalinism: the Art and Ideology of Soviet Space, University of Washington Press, 2003.
[36] E. Dobrenko. Late Stalinism: the Aesthetics of Politics. Yale University Press, 2020.
[37] E.T. Megowan, 'Writers Live Only in Moscow and Leningrad'? Navigating Soviet Spatial and Cultural Hierarchies, 1941–45. *Kritika: Explorations in Russian and Eurasian History*, **22**, 285-311 (2021). https://doi.org/10.1353/kri.2021.0015
[38] B. McNair. Glasnost, Perestroika and the Soviet Media. Routledge, 2006.
[39] K.A. Bogdanov, The USSR Instead/inside of Europe: Soviet Political Geography in the 1930s–1950s. *Studies in East European Thought* **62**, 401-412 (2010). https://doi.org/10.1007/s11212-010-9124-9
[40] E. Gilburd. To See Paris and Die. The Soviet Lives of Western Culture. Cambridge, MA: The Belknap Press of Harvard University Press, 2018.
[41] M. Oiva, H. Salmi, B. Johnson. Yves Montand in the USSR: Cultural Diplomacy and Mixed Messages. Palgrave Macmillan, 2021. https://doi.org/10.1007/978-3-030-69048-9
[42] K. Roth-Ey. Moscow Prime Time: How the Soviet Union Built the Media Empire That Lost the Cultural Cold War. Cornell University Press, 2011.
[43] P.Koivunen. "Friends, 'Potential Friends,' and Enemies: Reimagining Soviet Relations to the First, Second, and Third Worlds at the Moscow 1957 Youth Festival." In *Socialist Internationalism in the Cold War*, P. Babiracki, A. Jersild, eds. (Springer International Publishing, 2016) p. 219–247. https://doi.org/10.1007/978-3-319-32570-5_9
[44] J.C. Leitão, J.M. Miotto, M. Gerlach, E.G. Altmann, Is this scaling nonlinear? *R. Soc. Open Sci.*, **3**, 150649 (2016).
[45] O. Finance and C. Cottineau, Are the absent always wrong? Dealing with zero values in urban scaling, *Environment and Planning B: Urban Analytics and City Science*, **46**, 1663-1677 (2019). https://doi.org/10.1177/2399808318785634
[46] K.P. Burnham, D.R. Anderson, K.P. Huyvaert, AIC model selection and multimodel inference in behavioral ecology: some background, observations, and comparisons, *Behav. Ecol. Sociobiol.* **65**, 23–35 (2011). https://doi.org/10.1007/s00265-010-1029-6
[47] https://www.net-film.ru/en/
[48] M.V. Tamm, M. Oiva, K.D. Mukhina, M. Mets, M. Schich, Supplementary materials for this paper, https://github.com/thummm/soviet_newsreels/.
[49] City population according to the 1959 USSR census available at https://www.demoscope.ru/weekly/ssp/ussr59_reg2.php, https://www.demoscope.ru/weekly/ssp/rus59_reg2.php; according to the 1970 USSR census available at https://www.demoscope.ru/weekly/ssp/ussr70_reg2.php, https://www.demoscope.ru/weekly/ssp/rus70_reg2.php; according to the 1979 USSR census available at https://www.demoscope.ru/weekly/ssp/ussr79_reg2.php, https://www.demoscope.ru/weekly/ssp/rus79_reg2.php (in Russian).
[50] 2018 Revision of World Urbanization Prospects, UN Population Division, https://population.un.org/wup/
[51] M. Keuschnigg, S. Mutgan, P.Hedström, Urban scaling and the regional divide, *Science Advances.* **5** eaav0042 (2019).
[52] A. Gorsuch. All This Is Your World: Soviet Tourism at Home and Abroad after Stalin. Oxford Studies in Modern European History. Oxford University Press, 2011.
[53] J. Gronow and S. Zhuravlev. "A Window to the West and Door to the East. The Tallinn Fashion House as a Part of the Soviet Fashion Design System." In *Mood Ja Külm Sõda - Fashion and the Cold War*, (Estonia: Art Museum of Estonia - Kumu Art Museum, 2012) p. 108–137.
[54] K. Rentola. From Half-Adversary to Half-Ally: Finland in Soviet Policy, 1953-58. *Cold War History*, **1** 75–102 (2000). https://doi.org/10.1080/713999907.
[55] J. Rainio-Niemi. The Ideological Cold War: The Politics of Neutrality in Austria and Finland. New York: Routledge, 2014.

https://doi.org/10.4324/9780203379769.
[56] W. Mueller. The USSR and Permanent Neutrality in the Cold War. *Journal of Cold War Studies*, **18**, 148–179 (2016).
[57] L.E. Cahoone. Introduction, In: "From Modernism to Postmodernism: An Anthology Expanded". Wiley-Blackwell (2003).
[58] In order to avoid too small groupings, we add top 5 cities of each Union-level republics to the list, which increases the total number of cities of interest to 328.