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Hazardous digits: Telephone keypads and Russian numbers in Tbilisi, Georgia



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ABSTRACT

Why do many Georgian speakers in Tbilisi prefer a non-native language (Russian) for providing telephone numbers to their interlocutors? One of the most common explanations is that the addressee is at risk of miskeying a number if it is given in Georgian, a vigesimal system, rather than Russian, a decimal system. Rationales emphasizing the hazards of Georgian numbers in favor of the “ease” of Russian numbers provide an entrypoint to discuss the social construction of linguistic difference with respect to technological artifacts. This article investigates historical and sociotechnical dimensions contributing to ease of communication as the primary rationale for Russian language preference. The number keypad on the telephone has afforded a normative preference for Russian linguistic code.

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1. Introduction

Near the end of the much-beloved Soviet film *Mimino* (1977), there is a memorable scene in which the protagonist, a Georgian airplane pilot, places a phone call from a payphone in Berlin. *Mimino*, played by actor Vakhtang Kikabidze, attempts to make a phone call to a town in Georgia called Telavi. The telephone operator instead connects him to Tel Aviv, Israel. Coincidentally, a Georgian in Tel Aviv answers the phone. It quickly becomes clear to *Mimino* that he has not reached Telavi, but his interlocutor in Tel Aviv urges him to stay on the line. *Mimino*'s telephonic interlocutor is eager to learn if a new bridge has been built yet in Kutaisi, and then implores *Mimino* to sing together the widely known Georgian folk song “*zhuzhuna tsvima movida*.” They sing, and *Mimino*'s unknown compatriot begins to weep, nostalgic for Georgia. One of the top youtube comments on the Mosfil'm official channel, where the film can be viewed in full, remarks in Russian: “*Ia plachu kazhdyi raz kogda smotriu kak on v Tel'-aviv zvonit*” (“I cry every time when I see how he calls Tel-Aviv”). In this humorous and moving scene, human warmth is paired with the fragility of socialist-era communicative infrastructure channels.

An accidental telephonic connection resulting in a fleeting emotional encounter between two Georgians beyond the borders of Georgia is a commentary on Georgianness and nostalgia. But at a more basic level, this strange serendipity is a consequence of a telephone misdial: a chance human mistake in the use of a communicative technology. In this scene, it is not *Mimino* who has misdialed, but the telephone operator who misheard “Telavi” as “Tel Aviv.” The normally undesirable outcome of misrecording, miskeying, or mishearing a phone number is transformed into a moment of connection. The role of the telephone operator has receded in contemporary Georgia, yet certain telephone communicative practices endure because of technological and human infrastructural expectations. In this article, I examine how and why Russian remains the preferred linguistic code in which to communicate telephone numbers in contemporary Tbilisi.

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Unlike in *Mimino*, telephone misconnections and misdials are now largely attributed to user error rather than operator failure. Wrong numbers are typically regarded as hazardous frustrations to be avoided if at all possible. For this reason, one must exercise care to record new acquaintances' phone numbers correctly, to double check the sequence of digits by reading it back, and to accurately key in numbers so that future phone calls go through. At its most extreme, a miskeyed phone number can mean the loss of a contact, a failure to connect. This article takes as its focus phone number exchange in contemporary Tbilisi, Georgia. Before telephone connection can be made, phone numbers must be exchanged, verified, and saved. This happens in a manner understood as emphasizing clarity and ease above all else.

Mobile telephone number dictation is a domain in contemporary Tbilisi in which Russian numbers are highly preferred over Georgian numbers. Because of its ubiquity in urban life, mobile telephone number dictation is a compelling speech genre in which routinized patterns crosscut ethnicity, class, gender, and age categories. Additionally, number dictation is a task-directed linguistic act that is structured primarily by the technological parameters of the mobile phone itself. Mobile phone number dictation requires inscription without literacy or computation, two tasks heavily associated with numbers and technology. In terms of language attitudes, preference for Russian numbers is typically rationalized with a narrative about "ease" or "simplicity." Why for this task is a secondary, often non-native language preferred over a primary, native language? To make sense of this, we need to account for the intersection among ideologies of number, sociotechnical forms, and Russian as a language of modernity.

2. Telephone number dictation in Georgian

Georgian uses a base-twenty (vigesimal) number system for numerals 30–99, whereas Russian and English use a decimal system. Essentially, numbers from 30 to 99 are reckoned in multiples of twenty, to which the remainder (1–19) is added. So, 85 is reckoned as *otkhmotsdakhuti* (lit., "four twenties and five").

Mobile telephone numbers in Tbilisi are dictated as three single digits, followed by three double-digits. For example, my telephone number is dictated as 5-9-9-54-98-45, where the dashes separate the numbers. I will use my telephone number as an example since it contains the sort of two-digit numbers that are considered by informants to be potentially confusing for listeners. Many informants say that it is *upro advili* (easier) to list the double digit numbers in Russian so that the listener does not press the wrong number on the telephone. For example, one may prematurely press a "4" when the number turns out to be "55," which is spoken as (lit.) "two twenties plus fifteen." In an essay about the history of the Georgian language, George Hewitt noticed this preference for Russian numbers in the context of telephone numbers, and adopted the dominant narrative of his informants to explain it: that using Russian, a decimal system, is done in order to "avoid any momentary confusion" (Hewitt, 1985, p. 172).¹ Let us take a closer look at this explanation and its implications.

The most common explanation for preferring Russian numbers in telephone number dictation is that Georgian numbers potentially cause confusion for the listener, possibly resulting in a miskey. For example, in my phone number (599-54-98-45), for the number "54" there is a risk that the listener will key "4" when I say "*ormots...*" ("two twenties..."), not waiting for the completion of the number "*ormotsdatokhmet'i*" ("two twenties and fourteen"), which requires that the first keyed number be "5". The figure of the potentially misunderstanding listener is widespread as a rationale for preferring base-ten numbers. During my fieldwork, no one ever suggested that a miskeying listener was impatient or inattentive for keying a number before it had been fully uttered. As a foreign, non-native speaker, I encountered this miskey problem only once: when I paused an unnaturally long time mid-number while dictating my number to a friend with whom I planned to go on a hunting trip. I was aware that my halting foreign language production was not to be trusted as a window into this phenomenon, so I listened to native Georgian speakers dictate and record phone numbers to each other over the course of a year. I was puzzled that normal, native-speed fluent production of numbers could be considered a hazard for listeners. Dictating phone numbers in Georgian was rare. Although I heard people repeat numbers for clarity, I never witnessed a miskeying issue based on the use of Georgian. Russian numbers solve this perceived problem of decimal-keypad congruence, at least for those who know Russian numbers.

Commanding the Russian numbers does not require fluency in Russian. Additionally, Russian number use is common in other contexts in Tbilisi life, such as in shops or at the marketplace, particularly where the sellers are non-Georgian. For example, Martin Frederiksen noted that during the August 2008 war with Russia, "in the bazaars the price of 2 1/2 was still given as *dva naxevar* ('*dva*' being Russian and '*naxevar*' Georgian)" (Frederiksen, 2012, p. 133). In situations of inter-ethnic contact in Georgian, the common language historically and presently is Russian. Pro-English and pro-"Western" trends in Georgia are unlikely to alter this strong trend. Because of this, in the setting of the *bazroba* (market), one hears Russian language used as a medium of communication in transactions. Likewise, purchasing telephone numbers at the market occurs in Russian, even if the sellers are Georgian. Sellers assume that Russian numbers are intelligible to customers. Russian number use is reinforced in a fashion that positions the number as linguistically marginal, yet central to certain forms of exchange.

The enduring presence of Russian in Tbilisi assumes many forms that are not seen as direct indexes of the Soviet past, even if such forms exist because of historical circumstance. Just as backgammon players in Tbilisi name dice rolls and keep

¹ As Hewitt explains: "Another occasion when pure Russian is favoured at the expense of the vernacular is in the communication of figures, especially telephone-numbers and, almost without exception, in requests for cash on the part of sales-staff. The reason for this seems to be a practical one: Georgian's system of counting is vigesimal [...] so, in order to avoid any momentary confusion (sc. after hearing a multiple of 29, one does not automatically anticipate a figure other than one beginning with 2, 4, 6 or 8), there seems to be a universal preference for the use of Russian with its decimal system" (Hewitt, 1985: 172).

score in Persian, the boundaries of the use of Russian delimit and define its force as an often-unanalyzed fact of certain activities in Georgian life, established by ideological regimes of the past that have become anchored to certain technical practices. The historical and social values connected to Russian are crucial contingencies for understanding the particularities of contemporary practice. Russian language was bound up in the Soviet ideology of internationalization and modernization, which is one of many social valences shot through contemporary use. The connection between Russian and telephonic communication endures, even as the technical forms and speech actors involved have shifted.

3. Technology and number

As mobile phones become increasingly widespread as both mediums of interaction and objects of discussion, a host of academic approaches to their social significance has developed. Among these has been an attempt to grasp the social significance of cell phones as engendering new forms of “mediated” communication (which includes phone, email, internet, and satellite modalities) in opposition to face-to-face interaction (also called “conventional” or “traditional” communication) (Axel, 2006; Cook, 2004; Ito, 2005a, 2005b; Escobar, 1994). Cell phones have emerged as a site of anthropological interest, including their capacity to strengthen or reconfigure social networks (Goggin, 2006; Goggin and Hjorth, 2009; Horst and Miller, 2006). Cell phone communication, including specialized codes connected to SMS or text-talk, has become a site of interest for understanding language and sociality (Blommaert and Velghe, 2014). Berger and Luckmann have called knowledge about telephone use and conventions “recipe knowledge,” since it is so pragmatic and limited in scope (Berger and Luckmann, 1966, p. 42). One portion of the social life of cell phone use that bears further analysis is the exchange of numbers, usually face-to-face in culturally specific ways as a means of ensuring later contact via cell phone. I label this interactive genre “phone number dictation,” to emphasize the oral dimension of this speech practice. An ideological preference for Russian code as the normative method of giving and receiving telephone numbers in Tbilisi is a product of both the inherent constraints of the telephone keypad as well as the socially constructed associations with Russian as a lingua franca proper for technical communication.

Technical and scientific domains are ideologically positioned as maximally distant from human-ness, even as they fully derive from and define spaces, actors, and interactions. As Madeline Akrich elegantly states, “Science is taken to go beyond the social world to a reality unfettered by human contingency” (Akrich, 1992, p. 205). Numbers comprise one of the codes of this socially unfettered domain. Numbers are ideologically constructed as belonging to a neutral, apolitical, and universal domain implicitly linked to technology and futurity. David Samuels has discussed common features in the ways that the communicative possibilities afforded extraterrestrials have been imagined, in science fiction and elsewhere. Samuels points out that ambiguity in communication is treated as a central human problem, and consequently that communicative transparency emerges as the “clearest marker of technological or cultural superiority” (Samuels, 2005, p. 104). To achieve communicative transparency, one resorts to math, the “common tongue of all problem-solving species” (Samuels, 2005, p. 111). Math is expressed, in part, through numbers. Nikola Tesla, for example, stated in 1923 that he believed Martians would use numbers for communication because numbers are “universal” (Samuels, 2005, p. 109). Numbers are conceptualized as a medium for universal and logical communication, disarticulated from the social and emotional entanglements of the human. Yet as I demonstrate in this article, not all modes of naming numbers are the same. The linguistic representation of number varies significantly, and acquires different social values. Georgian numbers, for example, are viewed as a hazard for communicative transparency, whereas Russian numbers are considered less ambiguous and “easier” for transmission in talk. I explore the contours of this ideology in detail below.

Technological interfaces, such as user-input configurations, cause notions about what is “easy” or “natural” to appear as objective, self-evident qualities expressed by the technology itself. The link between numbers and technology naturalizes assessments of “ease” in number use, even though technologies must be constructed to accommodate different number systems, just as they must handle different language scripts. The default telephone keypad arrangement has the consequence of constructing a representation of number systems based on the decimal system. Telephone keypads have built in the affordance for base-10 counting systems, which has been carried over into mobile phone practices. As Ian Hutchby points out, “affordances constrain the ways that [technologies] can be read” (Hutchby, 2001, p. 21).² I discuss the oral exchange of mobile phone numbers, though landline number dictation holds the same pattern.³ The keypad, with its arrangement of digits, is identical for landline and mobile phones, and forms the central focus of the discussion of technological affordances in this article.⁴ The technological interface establishes both the possible kind of informational input that users provide to technologies, and the

² For the concept of affordances, see Gibson (1977, 1979); as well as Costall (1995), Ingold (2000); as well as Knappett (2004) for ways that affordances have been theorized in the social sciences.

³ The choice to focus on mobile phones is based on their increased prevalence and significance in contemporary life in Georgia and elsewhere. However, it should be noted that the practice of listing phone numbers in Russian applies equally to all telephone number dictation. Landlines continue to actively function in the Georgian context, and are favored for economic reasons when interlocutors call from home.

⁴ For an interesting set of explanations about why the telephone and calculator number pads are arranged differently, see <http://www.vcalc.net/Keyboard.htm> accessed 11/9/2013.

way in which that information is formatted. In turn, this has consequences for how the ideal compatibilities with technological systems are construed, as I will show in the case of Tbilisian preference for Russian numbers.⁵

We must take seriously technological interfaces – that is, the interactive displays, menus, or outward components of technical devices, intended to manage input and output with human users – as sculpting perceptions and preferences for the fit between the technological and linguistic forms. Rather than seeing technologies as the cause of some kind of macro-level social change, I point to the ways that the technological interface regiments expectations for the relationship between human language and technology.⁶ By shifting the focus to the interface with technological forms, we observe the emergence of a certain kind of relationship among technologies and language practices, made to seem natural by the parameters of the technological interface itself. Technological interfaces leave their mark upon socially grounded linguistic practices. The cell phone number pad generates expectations about what “ease” in language use means, and this in turn comes to be seen as an integral, immutable component of the cell phone itself.

The ideological status of numbers as outside of the “core” of a language treats them as shifting easily across borders, infiltrating communicative practice but remaining somehow outside of interpretive modes. Numbers preserve a veneer of neutrality or purity, as if they were divorced from the indexical entanglements, political valences, and contested histories that characterize other aspects of language. Their close attachment to computational tasks and technologies links them to narratives of efficiency, progress, and modernity. Yet even among number systems, qualifications for which systems are “more” modern, progressive, or efficient are established through links to ideological regimes of utopian or modernist social projects, such as state socialism. This linkage lives on, a ghostly vestige of modernities past, present in practices and habits, and rationalized with narratives of “ease.”

I invite us to reconsider the way that “complexity” configures understandings of language diversity, both for linguists and language users. The notion that number systems have intrinsic “ease” or “difficulty” is interesting from both a historical linguistic standpoint, as well as factors in language production and processing for users. The concept of “ease” pervades informants’ descriptions of linguistic practice, as well as linguists’ rubrics of cross-linguistic comparison. In order to make sense of informants’ evaluative comments about “ease” of Russian over Georgian, I approach them as a reflection on the force of habit in communicative expectations. “Complexity” is a contested analytic in linguistics, at times reflecting the same tacit assumptions that structure its use in folk understandings of language. In both cases, “ease” must be understood as a relational concept, in which beliefs are encoded about what constitutes the normative standards against which given languages, language-subsets, or linguistic tokens are compared.

3.1. Why study numerals?

For certain interactions, such as those that require extensive use of numbers, a specialized code (including a “foreign” language) can come to be the normative cultural modality. The use of Russian numbers in mobile phone number dictation has come to constitute a normative Georgian method, and therefore cannot be taken as a sign of cultural shift or transition. This is not a case of one language losing ground to another, in terms of having functions overtaken by foreign influence. I wish to problematize the notion that language use necessarily means acculturation, shift, or the adoption of new values. This is not to say that the use of a particular linguistic code was not initially or ongoingly motivated by social or political values. Rather, once in place as the normative practice, such social values become sedimented and are therefore not unstable, shifting, or transitory. The change, as it were, has already happened, and become sedimented in interactive patterns and expectations.⁷

One example of reading patterned switches in code as a sign of cultural change is found in Thomas Crump’s discussion of Spanish and Tzotzil. He explains that, “No part of speech is more susceptible to linguistic borrowing and cultural diffusion than numerals” (Crump, 1990, p. 34). In trade interactions, Crump interprets numerals as the primary vocabulary, and as part of a sort of outer edge of language most susceptible to borrowing. The example Crump cites in support of his claim is from a shopkeeper–customer interaction that involved monetary exchange, and in which “all the prices were stated in Spanish; the actual quantity [of good], however was stated in Tzotzil” (Crump, 1978, p. 508). Language preference in this setting is cleaved according to exchange-value (Spanish) and use-value (Tzotzil). Crump understands this as “one part of language in a state of transition,” and notes that “if Tzotzil is to lose ground to Spanish, the numbers must go first” (Crump, 1978, p. 508). Crump interprets the mixing of Spanish and Tzotzil as a sign of acculturation and shift, presumably because a move to Spanish is registered in other contexts as well. In this account, numbers are the barometer of a broader kind of language shift. Yet

⁵ The issue of how technical interfaces encode and express social values in creating standardized material regimes has been the focus of productive scholarly inquiry. Consider, for example, Paul A. David’s discussion of the QWERTY keyboard (1985), as well as the cases presented in Lampland, M. and Star, S.L., (Eds.), 2008.

⁶ Scholarly engagements with the relationship between technology and social change have varied. Among others, Langdon Winner (1986) and Leo Marx (2010) have pushed back against the move in popular and scholarly writing that describes technology as a catchall force for social change. Marx argues that scholars are responsible for exposing the hazards of viewing technology writ large as *the* agent of social change. Winner counters the related claim that certain technological forms inherently promote or arise out of social formations. Such a claim stated most strongly by Lewis Mumford (1964), who argues that technologies are agents for an expression of democratic organization.

⁷ For other uses of sedimentation as a metaphor for the accrual of linguistic (or social) practices, see Alfred Schutz (1970). Also, compare Uriel Weinreich’s fascinating formulation that “In speech, interference is like sand carried by a stream; in language, it is the sedimented sand deposited on the bottom of a lake” (Weinreich, 1964 [1953], p. 11).

mixing, particularly of number systems, can be a fixed, stable, and normative practice, rather than a sign of fragility and transition.⁸

In this approach, numbers are conceptualized as the “edge” of the lexicon, and as such are viewed as transferable, portable, and neutral, in contrast to “core” parts of the language. This ideology of number – as part of a neutral, apolitical edge – is pervasive. The notion that there is an essential core of a language is prevalent in the literature about linguistic contact as well as in folk notions about what constitutes the structure of a language. Numbers, in both cases, are treated as a distant edge of the lexicon. It is crucial to ground numbers in actual use, rather than treating them as vulnerable abstractions. To do so, taking specialized types of interaction heavy with number use (such as the shopkeeper–customer interaction above) is the proper focus. Specialized tasks, such as number dictation, do not necessarily render this part of the lexicon susceptible or vulnerable to shift. The use of Russian numerals, for example, has become normative in Georgian practice. In this case, the term code switching does not appropriately apply, as the use of Russian numerals is fully part of a Georgian way of giving phone numbers.

To put Crump’s comments about numbers as “most susceptible” components of a language in a contact situation in context, it is worth briefly reviewing approaches in linguistics that have sought to describe language mixture and susceptibility. W.D. Whitney’s “On Mixture in Language” (1881) is an early attempt to describe the possibilities and parameters of mixture and transference in languages. Whitney, and later scholars influenced by his work, segregates grammar from other domains of language. He asserts that of the elements of speech, “the grammatical apparatus merely resists intrusion most successfully, in virtue of its being the least material and the most formal part of language. In a scale of constantly increasing difficulty, it occupies the central place” (Whitney, 1881, p. 14). Much debate concerns what features, structures, or elements can be transferred between languages. Discussion of transference is often phrased in terms of susceptibility, ease, or permeability. Thomason and Kaufman address hierarchies, typologies, and predictability of contact language outcomes, contending that “any linguistic feature can be transferred from any language to any other language” (Thomason and Kaufman, 1988, p. 14). They emphasize that instead of formal linguistic elements or patterns, “the sociolinguistic history of the speakers [...] is the primary determinant of the linguistic outcome of language contact” (Thomason and Kaufman, 1988, p. 35). While language is always changing, it is meaningful to speak of outcomes that are durable or relatively widespread – telephone number dictation in Russian is one of those that have become normative and embedded into Tbilisi practice. Keeping the notion of susceptibility in focus, multiple co-existing numerical systems to which differences in transparency are ascribed demonstrate that in addition to sociolinguistic history of speakers, we must also include sociotechnical infrastructure and domains of use.

Numeral systems have a specialized status with respect to linguistic categorization and functional range. Taking Russian numerals as an example, Comrie notes that numerals “fall between” the prototypes of noun and adjective in terms of their properties (Comrie, 1989, 107).⁹ Aside from evading straightforward categorization according to linguistic category, multiple, non-overlapping numeral systems can be used for specialized functions. There are numerous documented cases of specialized counting systems, which exist alongside established numeral systems and are used for particular, socially significant counting tasks. One example is the North English “sheep-counting” numeral system, which Donald Anderson, using Bakhtin’s concepts of minor and major chronotopes, describes as serving a specialized performative function (Anderson, 2011). Further, numeral systems are inherently serial, and based on relational values. Carol Justus indicates in discussion of Indo-European that numerals were not based on abstractions, and that base is not the only consideration in thinking about the development of numeral systems.¹⁰

In some respects, telephone numbers function as address-like labels, indicating one’s fixed location like a set of non-geographic coordinates. In this capacity as a label or name, one’s identity becomes linked to a chain of numerals. Yet unlike an address, phone numbers are not understood as indicating scale or proximity, though certain numerical patterns can indicate geographic location or service provider. In Georgia, as elsewhere, one selects the service provider as well as the number itself. Cell phone numbers are not assigned without the volition of the recipient, though the field of possible cell phone numbers is not completely open. In the market, one observes kiosks plastered with available phone numbers listed on printouts with hand-scrawled additions, and purchased numbers struck through with pen or marker. Considerations emerge, then, in the selection of phone numbers as they become part of the suite of one’s personal identifying information. From my observation in Tbilisi, there are no universal qualities by which assessments of telephone numbers are made, though numbers were often informally evaluated as being “good.” Personal considerations, such as favored numbers, and repetition of digits seem to be

⁸ Another interesting example of numerical system change within a market setting is that of the Iqwaye counting system, which Jadran Mimica describes in this fashion: “The currency counting follows the traditional system, but the units are based on the decimal numerical series [...] the crucial structural relation of equivalence – that is, identity between the body and its digits – has been changed since the money denominations are grounded in an independent decimal numerical system” (Mimica, 1998, pp. 166–167). As in the case of Tzotzil and Spanish, Iqwaye counting practices have been imprinted by exchange-value, in this case, from linguistic parameters of the currency denominations.

⁹ For more on grammatical categorization of numerals in Slavonic, see Corbett (1978).

¹⁰ “Pre-decimal systems of counting, like traditional systems of weights and measures, were first based on rank-ordered, relational units. Digit number words *lethera* and *methera*, preserve pre-numerical linguistic forms for digits with meanings akin to English ‘half again as much’ and ‘next to the last’. The Celtic data of *lethera* and *methera* thus give us precious evidence as to the early relational value that, not just bases, but also digits, must have originally had” (Justus, 1999, p. 73).

the standouts in terms of what motivates the choice of one cell phone number over others.¹¹ Recently in Georgia a representative from the opposition party *kartuli otsneba* (Georgian Dream) announced that the prefix “5” would be replaced by “8” since “8” is the election number of Georgian Dream, and “5” is the election number of the Georgian National Movement.¹² An election number is a number associated with a political party, and is used on voting ballots, for example, to select the party. Thus, the first number in a cell phone number sequence has been taken to have political significance, interpreted as having links to political parties. The Georgian Dream representative conceptualizes the use of “8” as a return to pre-Georgian National Movement ways.

3.2. What is a “numeral”?

In this article, when I discuss “numbers” I am referring exclusively to integers. Numbers (integers) are a special noun class in which the members are memorized as a sequence of conceptually equally-spaced, countable digits. Yet counting is not an equivalent task to the recall/recognition use of numbers in telephone number dictation, where numbers are divested of their character as sequenced number-line positions, and are used instead as memorized blocks, much like physical addresses that are simply chunks of identifying information. In this sense, cell phone numbers are used as labels or names whose other properties (such as computational features) are secondary, if considered at all.

Bearing in mind that the central focus of this article is on the linguistic representation of number, let us take a step back for a moment to define the terms “number,” “numeral,” and “numerical,” and “number words,” as I have thusfar used them interchangeably. George Lakoff and Rafael Nuñez differentiate numbers and numerals in this fashion: “numbers [are] concepts, and numerals [are] written symbols for numbers” (Lakoff and Nuñez, 2000, p. 83). In this definition, numerals are a symbolization of numbers that must be learned. This basic division recalls Saussure’s famous description of the sign as constituted by the dichotomy of signifier//signified, in which the signifier is the (arbitrary) form of a sign, and the signified is its abstract, conceptual meaning. Thus, in this view, “number” is the signified (e.g. thirteen-ness), and “numeral” is a *written* form of the number (e.g. 13). Lakoff and Nuñez continue by making a three-way distinction, which, in brief, can be summarized as: “[a] the number (e.g., thirteen) [b] the conceptual representation of the number [c] the numeral that symbolizes the number (e.g., 13)” (Lakoff and Nuñez, 2000, 83). Thus, for Lakoff and Nuñez, “numeral” is strictly a written representation of the “number,” and “number” is a concept. For Lakoff and Nuñez, “numeral system,” refers specifically to the written system (think, for example, of the difference between Roman and Arabic numerals). To deal with the issues of differing non-numeral linguistic representations of numbers, Lakoff and Nuñez state that “[t]he decimal, binary, octal, and other base-defined notations are all built on various versions of the metaphor that numbers are sums of products of small numbers times power of some base” (Lakoff and Nuñez, 2000, p. 83). As Lakoff and Nuñez’s central focus in this text is to provide an account of the embodied basis of mathematical concepts, they do not elaborate on the many issues present with regard to linguistic representations of numbers, or numerical systems in historical perspective or contact situations.

Without tarrying in the consequences of Lakoff and Nuñez’s theoretical divisions, or offering a definitive take on “number” as a concept, in the short space allotted here I orient the discussion towards the linguistic representation of numbers. Salzmann refers to the standardized linguistic representation of numbers as the “numerical system” (1950). Additionally, the term “numerical system” calls attention to the numbers as arranged in a series. Salzmann argues that there are “three general structural patterns which underlie and determine the divergent numerical systems” (Salzmann, 1950, p. 80). These are “the *frame* pattern, (2) the *cyclic* pattern, and (3) the *operative* pattern,” each of which can coexist in a given numerical system. *Cyclic* refers to “a succession of morphemes of groups of morphemes according to which the numerical system is analyzable in terms of one or more similar or regular sets of recurring morphemes or groups of morphemes” (Salzmann, 1950, p. 80). The significant difference between Georgian and Russian is how the *cyclic* pattern functions, as Georgian uses a vigesimal system, with the *operative* pattern (in this case, addition) bound by the cycle. The purpose of discussing numerical systems in terms of frame, cycles, and operations is to make structural observations that are more broadly applicable than those possible with limited terms like “decimal” or “binary.” However, for the sake of clarity and familiarity, I will continue to use terms like “decimal” and “vigesimal” here. I use “number system” and “numerical system” interchangeably. There is necessarily some ambiguity in the term “number,” as it can refer to both the abstraction or “meaning” of a given number (e.g. thirteen-ness) as well as a particular instantiation in a word (“thirteen”). The focus for the remainder of the paper will be on standardized linguistic representations of number and their social consequences.

4. Gendered telephonic history

Historical and contemporary pragmatic precedents contribute to assessments of Russian as “easier” than Georgian for the purposes of mobile telephone dictation. The history of Russian language in Georgia, and particularly the use of Russian by telephone operators during the Soviet Union, has crystallized a form of politics in the expectations for how telephone number dictation should occur. Though the use of Russian numbers is not overtly political, the expectation that Russian numbers

¹¹ Selection criteria vary by culture. For example, in Thailand, cell phone numbers with repeated “9”s are highly sought-after, commanding top prices in auctions where they are sold to affluent buyers. The luck or beauty of repeated “9”s is connected to the significance of the number “9” in Buddhist metaphysics.

¹² <http://www.apsny.ge/2013/pol/1363316343.php> accessed 14/3/2013.

are appropriate and intelligible for any given interlocutor is a reflection of political conditions that routinized certain communicative practices, such as the use of Russian as a lingua franca. Such communicative expectations have been grafted onto the technology of the cell phone, which provides affordances and constraints that contribute to the enduring practice of Russian number preference.

The preference of Russian numbers in telephone number dictation has a historical explanation. According to my informants, women exclusively occupied the role of the *telefonistka* (telephone operator) – note the feminine gender on this term from Russian.¹³ Telephone operators had something like a headquarters, which was called *telegrafis k'orp'usi* (telegraph building). They were only involved during corporate calls, for instance, if someone was to call the ministries or any other type of official/governmental institution, where calls are transferred to specific people. Employees of the Telegraph were Russian, Georgian, and Armenian, so they used both Russian and Georgian language. An informant worked in what is called today the “Georgian Railway,” and apparently whenever they needed to get their calls transferred to other countries in the Soviet Union, there were telephone operators who performed these procedures, and did so mainly in Russian. Interestingly, this informant justified the use of Russian by explaining that back then the Georgian Railway had Russian owners, and may have even possibly been a governmental institution.

Telephone-based info-centers, which used and communicated news sources in Georgian, were another dimension of “official” telephone communication.¹⁴ Their documentation (from newspapers and television) was often in Russian. Russian was habitually used at home and in other non-official capacities, which included listing numbers in Russian. Telephone operators’ use of Russian-language in various capacities of labor and information dissemination made Russian language a strong force in this setting. An informant rationalized the continuation of the Russian number-listing practice as a form of ingrained habit, reminiscent of the “good times” during communism.

The association between Russian language use and the telephone as infrastructural channel endures, though the laboring actants have shifted from hidden female workers to the telephone keypad.¹⁵ Bruno Latour has described this remapping of role as “delegation” to non-human actors, encouraging analytical focus on the “complete chain along which competences and actions are distributed” (Latour, 1992, p. 243). In the case of telephone number dictation, the telephone keypad is a crucial link in the complete chain, through which action and ideology are channeled. A consequence of this delegation is that Russian code use, in this setting, is politically and morally neutral in its link to the infrastructure of phatic communicative technology.

5. Number use beyond telephones

I became curious if the use of Russian numbers for reasons of “ease” was present in all settings, or if it was limited in scope to certain settings or kinds of speakers. I could not register a clean-cut match between a category like age, education level, or ethnicity and this linguistic behavior, though the more nebulous category of attitude towards Russian language use, which at times – but not uniformly – can be correlated to categories mentioned above. It is my goal here to focus on the practices themselves, and the settings in which they exist, rather than starting from social categories assumed to be determinant or predictive of behavior. I will introduce two examples in which number use is very common, and for which a kind of language selection and rationalization is at play. The first is at the National Weightlifting Federation of Georgia, where barbell weights are constantly named and discussed during training. The second is in mathematics departments, where numbers and their manipulations are a deliberate focus of activity.

In the context of the National Weightlifting Federation of Georgia, it is not uncommon for weights to be named in Russian. The eldest trainer, age 75, weaves Russian and Russian-isms into his Georgian speech constantly during training sessions. This is due in no small part to the deep influence of the Soviet training system and its vocabulary on the present-day Georgian system. Many of the young weightlifters, however, do not speak Russian, so learn and rehearse the numbers through this context. This trainer exerts a strong influence on the way that his adolescent charges learn the sport of weightlifting and the discursive practices associated with it. Though other trainers use Russian less often – or mostly with Armenian, Ossertian, or other non-Georgian weightlifters – the daily presence of this elder trainer steeped in Soviet methods has profoundly shaped discursive practices in the training.¹⁶

One example of this influence on discursive practice came one day when I asked a rapidly improving teenage weightlifter from Svaneti (a mountainous region in Western Georgia) what his maximum squat was. He had just returned from several weeks at a training camp in Western Georgia. With pride in his squat record, but uncertainty in his pronunciation, he responded to my Georgian query in Russian: “*sem'desiat*” (“seventy”), he said, in a heavy Svan accent. I clarified in Georgian, the language we had henceforth used for all interactions: “*samotsdaati?*” (“seventy?”) and he confirmed, repeating

¹³ See Lipartito (1994), Green (2001), and Martin (1991) for elaboration of the gendered dimension of the development of the telephone industry. See also Fischer (1988a, 1988b, 1992), and Frissen (1995) on gendered social dimensions in telephone use.

¹⁴ Info-call centers can be reached by dialing 09 or 08, though recently the regional codes have changed so these numbers will require a three-digit code beforehand. After calling the number, an operator is assigned who will answer any question, or will transfer the call. The charge for this service is nominal, but greater than a normal cell phone call.

¹⁵ For discussion of labor, protocols, and hidden worker involved in “information internetworks,” see Downey (2001).

¹⁶ A moment that neatly captures the unchanging fixity of this trainer’s presence came on a summer day when we were the only two people in the training hall. A mailman arrived with a magazine and asked for identification in order to make the delivery. The trainer, seated barefoot on the wooden slatted bench that runs the length of the training hall along the windows, eyed the mailman in disbelief. He stated that he had no ID, but that he’d been in this training hall for decades. The mailman eventually relented and left the mail with the trainer.

“*sem’desiat*” proudly. It was common for lifters to report numbers between 100 and 199 without indicating “one hundred. . .” (“*sto. . .*” Russian, or “*asi. . .*” Georgian). Weighing around 72 kg at the time, and having trained only a year at the federation, a 170 kg squat is impressive. He continued training in the small second training hall as his brother, a rugby player, threw a tennis ball against the wall in idle distraction. Russian and Georgian numbers were used interchangeably in reporting competition results, training tonnages, and other weightlifting-related numerals. The adoption of this fluidity of numeral-language by the younger generation, even those like the young weightlifter from Svaneti who spoke no other Russian, indicates that continues to have a hold in this context.¹⁷

Another context in which number use is very common is in mathematics departments. I spoke to a professor of mathematics, and inquired why people living in Tbilisi often switch to Russian when reporting phone numbers. He shrugged and responded that it was easier. Then I inquired if Russian numbers were preferred in mathematics lectures, or in mathematics discussions. He thought for a minute and responded that numbers were simply named in Georgian, and did not see any reason to prefer Russian in the context of mathematics. Intrigued, I returned to the notion of “ease” that supposedly motivated the use of Russian for phone numbers. What, exactly, made Russian “easier” for dictating phone numbers, but not for working as a professional mathematician? My informant reluctantly posited that Russian numbers were easier than Georgian numbers because they contained fewer syllables. Yet there are many cases of the use of loanwords from Russian than have more syllables than the Georgian equivalent, as well as Russian words that are significantly shorter but are not used in place of lengthy Georgian forms (such as *tost* (toast, Russian) and *sadghegrdzelo* (toast, Georgian)). We quickly dismissed the syllable-number as simplicity hypothesis, and my informant let the topic drop as a phenomenon without a simple, generalizable explanatory principle. For dealing with numbers bare of infrastructural or technological holdings or connections, there is no reason to prefer Russian to Georgian.

6. Vigesimal systems: transparency and hazard

The Georgian numeral system has been the focus of scrutiny long before mobile phones were a force in social life. The vigesimal system has been cast as an undesirable hazard, not only in Georgia, but in other language contexts. This has extended into policy discussion, especially with respect to the use of numbers in educational settings. Hewitt mentions that the Georgian counting system has been part of long-standing debate about language reform:

Georgian, like most of the indigenous Caucasian languages, has a vigesimal system of counting (sc. from 30 to 99). In the ‘Russian-Georgian Technical Dictionary’ of 1920 it was formally proposed to introduce a decimal system for Georgian, and in their ‘Dictionary of Mathematical Terms’ (1925) Mushkhelishvili, Nik’oladze and Kharadze actually employed such a system from 30 to 99 (ibid. 135–6). In 1950 A. Shanidze, who had himself changed his mind on this issue, proposed to the Norms Commission of the time that they should officially change the counting system, but he was defeated. (Hewitt, 1989, p. 133)

Such proposals for shifting to a decimal system, though they have not gained firm ground, are based in the notion that vigesimal systems are inherently more difficult or unwieldy.

Increased dominance of a decimal-based numeral system has been presented as a consequence of the spread of global capitalism. Decimal-based numeral system spread is treated with the same ambivalence about the loss of “tradition” and increased homogeneity, familiar to the rhetoric of globalization. For example, Comrie argues that “in the modern world one basic system is rapidly taking over [. . .] This is the decimal (base ‘10’) system, with separate terms for ‘one’ to ‘ten’, and with multiplication by ‘ten’ and addition of the remainder for numbers from ‘11’ to ‘99’, although there may be some camouflage of the structure through irregular morphophonemics, portmanteau forms, and occasional expressions bearing witness to non-decimal systems” (Comrie, 1999, p. 87). He ascribes this to a consequence of “culturally dominant” languages, and notes that it is contributing to a “rapid decline in the amount of variation attested across the numerals systems of the languages of the world” (Comrie, 1999, p. 90). Brigitte Bauer (2001) details the emergence of the vigesimal system in Romance from what was originally a decimal system. Thus, a unidirectional movement towards decimal systems does not account for the appearance and enduring presence of vigesimals, or other counting systems. Comrie’s account, focused as it is on issues of language endangerment and loss of diversity, overstates the movement towards decimals as an inexorable function of modernity. Yet the pressures to introduce and accommodate decimal systems should not be overlooked. These appear as both educational and technological compatibilities for which decimal systems are viewed as fundamentally advantageous.

One common motivation for changing numeral systems has to do with seeking transparency of numeral system for educational settings, in which non-decimal systems are viewed as an impediment for mathematics learning. For example, the notorious difficulty of the Danish numeral system led to “some Danish teachers have started telling the smallest school kids

¹⁷ A humorous number-related episode in this context involved a young weightlifter, regarded by many as a troublemaker and clown, who one day spontaneously sang a modified version of the Spanish-language song “*besame mucho*”. Not knowing Spanish, he replaced the word “*besame*” “kiss me” with the Georgian word “*mesame*” (“third”), and sang “*mesame mucho*” (“third mucho”). Since the meaning of the Spanish language original was not clear to him, the phonetic similarity between Spanish “*besame*” and Georgian “*mesame*” was enough. Other lifters laughed at him, and he took the joke one step further, keying into the fact that “*mesame*” is an ordinal number, and sang “*otsdamekhute mucho*” (“25th mucho”).

the number names in Swedish to make it easier for them to understand numbers” (Vinther, 2011). Hurford reports a similar situation with respect to Modern Welsh.¹⁸ Certain number systems are seen as conferring advantage or generating disadvantage. This is especially important in the educational context. One of the most frequently referenced examples of this is the linguistic and social factors that may account for the substantial differences in the mathematical competence of North American and East Asian children which have been argued “reflect differences in the consistency and transparency of the linguistic representation of number as well as differences in parental beliefs and practices” (Miller et al., 2005, p. 176). This is based, in part, on the fact that English number names do not show a base-ten structure as consistently, transparently, or early as the Chinese number names, which leads to later acquisition and mastery of the base-ten structure for native English speakers (Miller et al., 2005, p. 170). The main concern in this study, and many of those which it cites, is to understand the effect of various linguistic system on the acquisition of mathematical competence. The practical aim is an improvement to pedagogy.¹⁹

7. Phone number dictation as a speech event

One interesting component of the phone-number dictation speech event is that the “ease” of Russian numerals instead of Georgian numerals is justified according to a listener-centric reckoning – a perception-based model of “ease” rather than one based on production. In essence, this is a folk version of what in language processing literature is referred to as “audience design” (Bell, 1984; Clark and Murphy, 1982; Kraljic and Brennan, 2004). In this section I will bring the concept of “audience design” in dialogue with models of the speech event familiar in linguistic anthropology, with the goal of finding a common way of talking about speakers’ intentions as a structuring component of the speech event. Phone number dictation, in this case, is a speech event in which audience perception is used to rationalize code choice. To work out the significance of this, I will work through Jakobson’s concept of the “set towards” (*einstellung*), as it is helpful in understanding how multiple priorities in interaction can be ordered by speaker focus. Further, I invite an updated understanding of what an addressee or audience is by emphasizing they ways that non-human actors or speech actants, in Shunsuke Nozawa’s *sense* (2013), not only influence or impinge on human interaction, but create constraints that reconfigure participant boundaries.

In his description of the speaking event, Jakobson elaborates on Saussure’s famous speaker-addressee model (or “speaking-circuit” (Saussure, 1966 [1916], p. 11) by emphasizing that the “verbal structure of a message depends primarily on the predominant function” (Jakobson, 1980 [1956], p. 113) toward which the speaker and addressee orient during interaction. Part of Jakobson’s purpose is to stress the significance of the non-referential, such as the poetic, phatic, and metalingual functions, excluded in Saussure’s model of interaction. In describing characters and characterization in Japanese society, Shunsuke Nozawa calls characters “speech actants,” which he explains “constitute an interface of objects and spaces that relays signs between other semiotic actants” (Nozawa, 2013, p. 6).²⁰ Nozawa sees characters as shape-shifting non-human entities participating in semiotic mediation. It is including speech actants into the classic speech circuit itself as fully-fledged interactional participants. Julia Elyachar, drawing together Malinowski and Karl Marx, has coined the term “phatic labor” to illuminate the production of “communicative channels that can potentially transmit not only language but also all kinds of semiotic meaning and economic value” (Elyachar, 2010, p. 453). In the case I have described here, the telephone keypad calibrates and controls the phatic dimension of communication, participating in phatic labor as a speech actant.

Audience design posits that cues are produced for, or in reaction to, the perceived needs of the addressee (Kraljic and Brennan, 2004). This has been taken as orientation for experiments in cognitive psychology as “[d]iscovering if, when, and how speakers take their addressees’ needs into account during speaking carries implications for the architecture of the language processing system, its flexibility, and its adaptability to context” (Kraljic and Brennan, 2004, p. 196). The theoretical move of *audience design* is a much-needed adjustment to models that conceptualize language processing as speaker-internal, monologic, a socially-autonomous system. Yet it has the danger of occluding the multiplicity of other orientations that comprise an interaction. *Audience design* fixates on one dimension of Jakobson’s classic description of the functions of language, the so-called “set towards the addressee.” *Audience design*, however, proposes a mechanism – attention – whereas Jakobson’s model is silent on where the “set” originates or gains force (in speakers, listeners, linguistic forms, or some dialectical process among them). Thus, I contend that *audience design* revives an older concern in models of interaction by drawing dialogism into the experimental realm. This presents an opportunity to ground observations from linguistic anthropology about the irreducibly dialogic nature of certain linguistic practices in cognitive experimental modalities by working critically with attention as a variable structuring linguistic production and reception.

¹⁸ “There is an interesting case of a whole numeral system invented all in one piece. Modern Welsh has abandoned the vigesimal system and adopted a wholly decimal system. I have not been able to discover the exact details, but from personal communications with Welsh speakers (mainly Gwen Awbery, curator of dialects at the Welsh Folk Museum, Cardiff, and John Phillips) it seems likely that the new decimal system was fairly deliberately devised specifically to facilitate arithmetic teaching in Welsh-language schools, as an alternative to the old vigesimal system which did not match up with the Arabic place-value notation” (Hurford, 1987, p. 84).

¹⁹ This is summarized with an elegant metaphor: “The coupling between concepts and ordinary language representations is, however, a loose and probabilistic one. As an analogy, consider a sidewalk that has a loose paving block [...] The linguistic representation of mathematical concepts in particular languages can present stumbling blocks for children, but ones that can be overcome with instruction aimed at making clear what language obscures” (Miller et al., 2005, p. 173).

²⁰ Nozawa states that the term “speech actant” remains to be theorized more fully. I leave that discussion aside for the moment, providing instead a tangible example of a speech actant that occupies the conceptual space that Nozawa has described.

8. Hazardous numbers

As I have indicated above, the use of Russian numerals instead of Georgian numerals in phone number dictation tasks is evaluated as a logical pursuit of “ease,” or sometimes as an indicator of laziness. One argument that I have presented is that numerals are an “edge” of the lexicon that is not imbued with emotionally charged social or political evaluations – that numerals are viewed as “empty” and functional, from a (folk) semiotic perspective. The use of Russian numerals in telephone number dictation is ubiquitous and not attached to any particular social type in Tbilisi. Only one informant indicated any sort of negative judgment about the use of Russian numerals. A linguist from the State University, she told me that her colleagues often used Russian numerals in phone number dictation, and that they should “know better” than to do this. The implication was that educated people should be in control of their linguistic production, and the use of Russian was a sign of laziness. Yet this did not indicate any kind of social danger (Douglas, 1966), as Russian numerals – in contrast to other Russian signs – have no negatively valorized social component. In other words, dictating phone numbers in Russian was not a sign of misplaced allegiances, moral failings, or indications of some kind of group membership: it was simply viewed as laziness and the pervasive force of habit. That educated people *should* produce Georgian numbers can be read as a prescriptive position. However, this position is not widely held and the moral consequences in its violation are mild.

In this article I have argued that a confluence of historical precedents and technological factors have sedimented the practice of using Russian for telephone number dictation in Tbilisi. Speakers explain that using Russian for this specialized speech genre is “easier” than using Georgian. Those who acknowledge the formal differences between Russian and Georgian make the argument that vigesimal number systems are inherently more “complicated” than decimal number systems. I have demonstrated how practices associated with or heavily involved with numbers are construed as apolitical by their ideological links to technology as a non-human, neutral domain, but are nevertheless populated with political components, some of which are sediments of the past, others of which (such as the new campaign by the Georgian opposition to change the initial digit of the phone number back to “8” from “5”) are connected to contemporary political interests. Further, I have described a shift or delegation of phatic labor from female telephonic operators during the time of the Soviet Union to present-day telephone keypads, and the attendant selective mapping of actions and assumptions about competences that have inhered in expectations for transmitting telephone numbers.

Seemingly neutral software and hardware are a way that normative patterns of language use are justified, naturalized, and replicated. Beyond cell phones, other communicative technologies like voice recognition software, and interactive voice/keypad systems (such as those used for ordering pharmaceuticals over the phone), also hold the potential to regiment and reify certain number dictation practices. In addition to encouraging the development of experimental approaches targeted at elaborating interactionally pertinent parameters undergirding speakers’ assessments of difficulty, this inquiry also opens up discussion on how technological interfaces structure patterns in number system use. Number systems are linked to suites of ascribed qualities such as modernity, European-ness, progress, and simplicity. Such ascriptions of attributes bundle together and are naturalized as components of technologies themselves.

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References

- Akrich, M., 1992. The de-scription of technical objects. In: Law, J., Bijker, W.E. (Eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change*. MIT Press, Cambridge, MA, pp. 205–224.
- Anderson, D.N., 2011. Major and minor chronotopes in a specialized counting system. *J. Ling. Anthropol.* 21 (1), 124–141.
- Axel, B.K., 2006. Anthropology and the new technologies of communication. *Cult. Anthropol.* 21 (3), 354–384.
- Bauer, B.L.M., 2001. Vigesimal numerals in romance: an Indo-European perspective. *Gen. Ling.* 1–4, 21–46.
- Bell, A., 1984. Language style as audience design. *Lang. Soc.* 13, 145–204.
- Berger, P., Luckmann, T., 1966. *The Social Construction of Reality*. Anchor Books, New York.
- Blommaert, J., Velghe, F., 2014. Learning a supervernacular: textspeak in a South African township. In: *Heteroglossia as Practice and Pedagogy*. Springer Science + Business Media, Dordrecht, Netherlands.
- Clark, H.H., Murphy, G.L., 1982. Audience design in meaning and reference. In: Le Ny, J.F., Kintsch, W. (Eds.), *Language and Comprehension*. North-Holland, Amsterdam, pp. 287–299.
- Comrie, B., 1989. *Language Universals and Linguistic Typology: Syntax and Morphology*. The University of Chicago Press, Chicago.
- Comrie, B., 1999. Haruai numerals and their implications for the history and typology of numeral systems. In: Gvozdanovic, Jadranka (Ed.), *Numeral Types and Changes Worldwide*. Mouton de Gruyter, New York, pp. 81–94.
- Cook, S.E., 2004. New technologies and language change: toward an anthropology of linguistic frontiers. *Annu. Rev. Anthropol.* 33, 103–115.
- Corbett, G.G., 1978. Numerous squishes and squishy numerals in Slavonic. *Int. Rev. Slavic Ling.* 3 (1–2), 43–73.
- Costall, A., 1995. Socializing affordances. *Theory Psychol.* 5 (4), 467–481.
- Crump, T., 1978. Money and Number: The Trojan Horse of Language. *Man.* 13 (4), 503–518.
- Crump, T., 1990. *The anthropology of numbers*. Cambridge Studies in Social Anthropology, vol. 70. Cambridge University Press, Cambridge.
- David, P.A., 1985. Clio and the economics of QWERTY. *Am. Econ. Rev.* 75 (2), 332–337.
- de Saussure, F., 1966 [1916]. *Course in General Linguistics* (W. Baskin, Trans.). McGraw-Hill, New York.
- Douglas, M., 1966. *Purity and Danger*. Routledge, New York.

- Downey, G., 2001. Virtual webs, physical technologies, and hidden workers: the spaces of labor in information internetworks. *Technol. Cult.* 42 (2), 209–235.
- Elyachar, J., 2010. Phatic Labor, infrastructure, and the question of empowerment in Cairo. *Am. Ethnol.* 37 (3), 452–464.
- Escobar, A., 1994. Welcome to Cyberia. *Curr. Anthropol.* 35 (3), 211–231.
- Fischer, C.S., 1988a. "Touch Someone": the telephone industry discovers sociability. *Technol. Cult.* 29 (1), 32–61.
- Fischer, C.S., 1988b. Gender and the residential telephone, 1890–1940: technologies of sociability. *Sociol. Forum* 3 (2), 211–233.
- Fischer, C.S., 1992. *America Calling: A Social History of the Telephone to 1940*. University of California Press, Berkeley and Los Angeles, CA.
- Frederiksen, M.D., 2012. 'A gate, but leading where?'. In search of actually existing cosmopolitanism in Post-Soviet Tbilisi. In: Humphrey, C., Skvirskaja, V. (Eds.), *Post-Cosmopolitan Cities: Explorations of Urban Coexistence*. Berghahn Books, New York, pp. 120–140.
- Frissen, V., 1995. Gender is calling: some reflections on past, present and future uses of the telephone. In: Grint, K., Gill, R. (Eds.), *The Gender-Technology Relation: Contemporary Theory and Research*. Taylor & Francis Ltd., London/Bristol, PA, pp. 79–94.
- Gibson, J.J., 1977. The theory of affordances. In: Shaw, R.E., Bransford, J. (Eds.), *Perceiving, Acting, and Knowing*. Lawrence Erlbaum Associates, Hillsdale, NJ, pp. 67–82.
- Gibson, J.J., 1979. *The Ecological Approach to Visual Perception*. Houghton Mifflin Company, Boston.
- Goggin, G., 2006. *Cell Phone Culture: Mobile Technology in Everyday Life*. Routledge, New York.
- Goggin, G., Hjorth, L., 2009. The question of mobile media. In: Goggin, G., Hjorth, L. (Eds.), *Mobile Technologies: From Telecommunication to Media*. Routledge, London, pp. 3–8.
- Green, V., 2001. *Race on the Line: Gender, Labor, and Technology in the Bell System, 1880–1980*. Duke University Press, Durham, NC.
- Hewitt, G.B., 1985. Georgian: a noble past, a secure future. In: Kreindler, I.T. (Ed.), *Sociolinguistic Perspectives on Soviet National Languages*. Mouton de Gruyter, New York, pp. 163–179.
- Hewitt, G.B., 1989. Aspects of language planning in Georgia (Georgian and Abkhaz). In: Kirkwood, Michael (Ed.), *Language Planning in the Soviet Union*. The Macmillan Press Ltd., London, pp. 123–144.
- Horst, H.A., Miller, D., 2006. *The Cell Phone: An Anthropology of Communication*. Berg Publications, New York.
- Hurford, J.R., 1987. *Language and Number*. Basil Blackwell, New York.
- Hutchby, I., 2001. *Conversation and Technology: From the Telephone to the Internet*. Polity Press, Cambridge.
- Ingold, T., 2000. *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill*. Routledge, New York.
- Ito, M., 2005a. Mobile phones, Japanese youth, and the re-placement of social contact. In: Ling, R., Pedersen, P.E. (Eds.), *Mobile Communications: Re-Negotiation of the Social Sphere*. Springer-Verlag, London, pp. 131–148.
- Ito, M., 2005b. Technosocial situations: emergent structurings of email use. In: Ito, M., Okabe, D., Matsuda, M. (Eds.), *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*. MIT Press, Cambridge, MA, pp. 1–16.
- Jakobson, R., 1980 [1956]. *Metalanguage as a linguistic problem*. In: *The Framework of Language*. Michigan Slavic Publications, Ann Arbor.
- Justus, C.F., 1999. Pre-decimal structures in counting and metrology. In: Gvozdanovic, J. (Ed.), *Numeral Types and Changes Worldwide*. Mouton de Gruyter, New York, pp. 55–79.
- Knappett, C., 2004. The affordances of things: a post-Gibsonian perspective on the relationality of the mind and matter. In: DeMarrais, E., Gosden, C., Renfrew, C. (Eds.), *Rethinking Materiality: The Engagement of Mind the Material World*. McDonald Institute for Archaeological Research, Cambridge, pp. 43–52.
- Kraljic, T., Brennan, S.E., 2004. Prosodic disambiguation of syntactic structure: for the speaker or for the addressee? *Cogn. Psychol.* 50, 194–231.
- Lakoff, G., Nuñez, R.E., 2000. *Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being*. Basic Books, New York.
- Lampland, M., Star, S.L. (Eds.), 2008. *Standards and Their Stories: How Quantifying, Classifying, and Formalizing Practices Shape Everyday Life*. Cornell University Press, Ithaca, NY.
- Latour, B., 1992. Where are the missing masses? The sociology of a few mundane artifacts. In: Law, J., Bijker, W.E. (Eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change*. MIT Press, Cambridge, MA, pp. 225–258.
- Lipartito, K., 1994. When women were switches: technology, work, and gender in the telephone industry, 1890–1920. *Am. Hist. Rev.* 99 (4), 1075–1111.
- Marx, L., 2010. Technology: the emergence of a hazardous concept. *Technol. Cult.* 51 (3), 561–577.
- Martin, M., 1991. "Hello, Central?": Gender, Technology, and Culture in the Formation of Telephone Systems. Carleton University Press, Ottawa, ON.
- Miller, K.F., Kelly, M.K., Zhou, X., 2005. Learning mathematics in China and the United States: cross-cultural insights into the nature and course of mathematical development. In: Campbell, J.J.D. (Ed.), *Handbook of Mathematical Cognition*. Psychology Press, New York, pp. 163–178.
- Mimica, J., 1998. *Intimations of Infinity: The Mythopoeia of the Iqway Counting System and Number*. Berg, Oxford/New York/Hamburg.
- Mumford, L., 1964. Authoritarian and democratic techniques. *Technol. Cult.* 5 (1–8).
- Nozawa, S., 2013. Characterization. *Semiot. Rev.* 3.
- Salzmann, Z., 1950. A method for analyzing numerical systems. *Word* 6 (1), 78–83.
- Samuels, D., 2005. Alien tongues. In: Battaglia, D. (Ed.), *E.T. Culture: Anthropology in Outerspaces*. Duke University Press, Durham, NC, pp. 94–129.
- Schutz, A., 1970. *On Phenomenology and Social Relations*. Chicago University Press, Chicago.
- Thomason, S.G., Kaufman, T., 1988. *Language Contact, Creolization, and Genetic Linguistics*. University of California Press, Berkeley.
- Vinther, D., 2011. Illogical Numbers Hurt Students in Copenhagen Post, February 4, 2011. <<http://cphpost.dk/culture/quotdanskquot/illogical-numbers-hurt-students>> (accessed 11.06.12).
- Weinreich, U., 1964 [1953]. *Languages in Contact*. Mouton & Co., The Hague.
- Whitney, W.D., 1881. On mixture in language, vol. 12. *Transactions of the American Philological Association (1869–1896)*, pp. 5–26.
- Winner, L., 1986. *The Whale and the Reactor: A Search for Limits in an Age of High Technology*. University of Chicago Press, Chicago.