

A Conceptual Application of Bakhtin's Dialogic Discourse
to Information and Interaction Design of Social Media

by

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Abstract

Background and Purpose: This research explores how humanities – Bakhtin’s dialogical discourse – offer new insights into information and interaction design providing interdisciplinary theoretical, methodological and empirical sources for understanding design research and practices. Designing for social media is chosen as an empirical object for this research because it integrates the use of a variety of design and research approaches and their immediate implementation in social interaction.

Structure: The structure of this work contains three major stages that can be described as follows: (1) Understanding Bakhtinian discourse as applied to information and interaction design. (2) Revealing and analyzing how Bakhtinian dialogic concepts contribute to design practices for social media. (3) By researching the crowd-sourced navigation social media application, Waze, we verify and validate how the Bakhtinian concept of chronotope corresponds to processing a flow of dynamic time-spatial data, to the app user experience, and to resolving the revealed problems, as well as for proposing new approaches in design practice.

Results: Our work contributes to the research as the systematic application of Bakhtin’s dialogical concepts to interactive and information technology by revealing the use of these concepts as design principles and strategies for designing for social media tools and systems. We applied Bakhtinian core concepts as one dialogic coherence emphasizing its definitive social-historic dimension. We developed and implemented our interpretation of the chronotopic data analysis to the Waze app using it as our research case study. We analyzed how multiple chronotopes are realized in Waze, and how user interaction with the app through its design and deployment decisions is connected to the society-wide patterns of social practice, and yet simultaneously, also has the potential to transform existing social practice.

Conclusion: Researching Waze’s design and user practices using Bakhtin’s dialogical discourse as an interpretive framework, we suggest a possible model for an alternate type of social interaction. A new form of performative practice that is actualized through

technologically mediated dialogue, which could be used for further rethinking of design approaches for supporting new and emerging forms of social relations.

Key words: Information and interaction design, interdisciplinary research, Bakhtin, dialogue, chronotope, carnival, designing for social media, chronotopic analysis, Waze, social interaction.

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Chapter 1: Introduction

1.1 Background and Purpose

This research explores how humanities – Bakhtin's dialogical discourse – offer new insights into information and interaction design and user research providing interdisciplinary theoretical, empirical, and methodological sources for a better understanding of design research and analysis of design practices.

This research focuses on the systematic application of Bakhtin's dialogical concepts to interactive media and information technology. By Bakhtin's dialogic discourse we mean core Bakhtinian concepts such as dialogue, polyphony, heteroglossia, addressivity, carnival, and chronotope, interpreted and applied as a coherent whole. Currently, there is rather unsystematic or even sporadic attempt to apply some of Bakhtin's ideas in this field.

Designing for social media is chosen as an empirical object for this research because it integrates the use of a variety of design and research approaches and their immediate implementation in social interaction.

The structure of this work contains three major stages that can be described in the following way:

- 1) Reviewing existing multidisciplinary research literature and using our interpretation of core Bakhtinian concepts, we expand Bakhtin's discourse as applied to information and interaction design;

- 2) Revealing and analyzing how Bakhtinian dialogic concepts contribute as design practices for social media.

- 3) By researching the crowdsourced navigation social media application, Waze, we verify and validate how the Bakhtinian concept of chronotope corresponds to the processing flow of dynamic time-spatial data, to the app user experience, and to resolving the revealed problems, as well as to proposing new approaches in design practice.

1.2 Research Questions and Specific Aim

This research intends to review and determine the validity of the following:

1. Bakhtin's ideas offer a substantial theoretical, empirical, and methodological source for design research.

Historically and chronologically the majority of Bakhtin-related research refers to the fields of knowledge traditionally associated with Bakhtinian ideas: literary theory, social linguistics, ethics, and the philosophy of language. Recently we have seen the application of Bakhtinian ideas to a broader range of disciplines (especially to different aspects of communication theory and practices) and to interdisciplinary research.

The state of information and interaction design discourse today is characterized by the articulation of dynamically designed and mediated communication and its complex collaborative genesis. The analytical exploration of interactive media and information technology as collaborative and participative can be analyzed as dialogical by systematic application of Bakhtin's dialogical concepts.

How does research and interpretation of Bakhtinian core concepts such as dialogue, polyphony, heteroglossia, addressivity, carnival, and chronotope offer new insights into information and interaction design? How valid is exploring and applying Bakhtinian ideas in these fields as theoretical, empirical, and methodological sources? Can Bakhtin's dialogic concepts be effectively used as design principles and strategies?

2. Social media with its variety of media design types and discourse modes is appropriate and effective empirical object for revealing and articulating the explanatory and interpretive potential of Bakhtin's ideas.

Exploration of Bakhtin's dialogical discourse extends our understanding of information and interaction design as a continuous dialogue which is tempered by socio-

cultural activities and conventions, and which occurs in shared social constructions. What would be the most effective context for analyzing such activities, conventions, and constructions? Does exploring social media with its variety of media design types and discourse modes provides this kind of empirical context for revealing and articulating the explanatory and interpretive potential of Bakhtin's ideas?

3. Bakhtin's dialogic concepts can be effectively used as design principles and strategies.

Social networking platforms and the concept of carnival.

The Bakhtinian concept of carnival or carnivalesque is a set of social practices that inverts or constantly attempts to undermine any form of monological (primary and overbearing) discourse in society. The concept of carnival can be applied to analyzing social media (e.g., networking platforms like Facebook) as a modern digital form of a specific way of social communication (carnival) that existed for hundreds of years. How does the information and interaction design of social media use some of the carnival strategies for its own benefits? How, based on the use of different design decisions, can social media manipulate and even lessen the creative power of carnivalization?

The concept of chronotope and social media applications.

The Bakhtinian concept of chronotope originally accounted for space and time relations in written narrative communication. How would it be valid for design research to explore a digital chronotopicity as a dynamic result of multi-accented and process-driven communications? What are the social and practical consequences of identifying

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and theorizing this form of digital chronotopicity in social media applications including
real-time spatial applications (e.g., Waze)?

A methodological perspective.

Also, from a methodological perspective, we are looking at how Bakhtinian polyphony, heteroglossia, and addressivity stand as a connection between user-centered and participatory approaches in design theory and methodology. We refer to the recent shift occurring at the collaborative edge of design research and the applied social sciences: a change of perspective from a user-centered design process to participatory design. The discursive capacities of concepts of polyphony, heteroglossia, and addressivity exemplify and articulate practical, theoretical, and methodological challenges in this perspective. In this way, we situate Bakhtinian dialogic theory into a participatory design theoretical and practical framework.

We expect that our research will contribute to the literature as the systematic application of Bakhtin's dialogical concepts to interactive and information technology by revealing the use of these concepts as design principles and strategies for designing for social media tools and systems.

Chapter 2: Literature Review and
Basis for Deploying Bakhtinian Dialogic Discourse in Design Research and Practice

2.1 Literature Review

This literature review focuses on a critical analysis of the research literature base that is historically, philosophically, and experimentally relevant to applying Bakhtin's dialogical discourse as a theoretical, empirical, and methodological source in the field of information and interaction design. We analyze how the works of Bakhtin, existing Bakhtinian and design research, and related interdisciplinary research contribute to our work.

The review starts with a summary of how Bakhtinian concepts have been used in various research fields. Next, it focuses on works that have utilized Bakhtinian concepts in the field of communication studies and draws attention to how those studied problems, ideas, and solutions work in the field of information and interaction design.

Analysis of Bakhtin's key works in Russian and English and studies of Bakhtin's work is used in our research as a theoretical framework and rationale for developing and validating interconnections between Bakhtinian ideas and design research. This review is aimed at broadening our understanding of how Bakhtinian concepts could be applied in design theory and practice.

Almost all major works of Mikhail Bakhtin (1895–1975) originally written in Russian in 1919–1975 have been translated to English in 1980–1990's (Bakhtin, 1981; Bakhtin, 1984a; Bakhtin, 1984b; Bakhtin, 1986; Bakhtin, 1990; Bakhtin, 1993), and Bakhtin's foundational ideas were immediately adopted by international academic

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community (especially in humanities and social sciences) and interpreted and applied in very different perspectives and fields. For example, the Bakhtinian concept of chronotope became a grounding contribution to the "spatial turn in the humanities" (Bertrand Westphal's and Robert Tally's theorization of geocriticism (Westphal & Tally, 2011)), and Bakhtinian theory of dialogue was essential in general dialogical "paradigm shift in the humanities" (Makhlin, 2000; Wegerif, 2007). Also, an assumption that the different "aspects that have attracted the attention of Literary Studies for centuries, such as dialogicity, explicit and implicit genre rules, pseudo- and anonymity or censorship, *return* under new circumstances in predesigned and moderated online genres" (Uffelman, 2014, p. 7, emphasis added) makes Bakhtinian ideas even more important and relevant as it applies them to the present-day and potentially the future of all social and cultural communication.

Bakhtin's most important works in English translations as they introduce his key theoretical concepts include:

- *Toward a Philosophy of the Act* (1919–1921, rescued in 1972) an unfinished philosophical essay where Bakhtin outlines his main themes studied throughout his entire life (English translation – Bakhtin, 1993);
- *Problems of Dostoyevsky's Art* (1929), a seminal work where Bakhtin introduces fundamental concepts of *unfinalizability* and *polyphony* with a later added part on the concept of *carnival* in 1963; revised and expanded edition titled *Problems of Dostoyevsky's Poetics* (English translation – Bakhtin & Emerson, 1984);

- *Rabelais and His World* (written during World War II, published in 1965), a classic of Renaissance studies, where Bakhtin's analysis is focused on *carnival* (*carnavalesque*) which is described as a social institution, and the *grotesque realism* which is defined as a literary mode (English translation – Bakhtin, 1984);
- *The Dialogic Imagination: Four Essays* (first published as a whole in 1975), the four essays ("Epic and Novel" (1941), "From the Prehistory of Novelistic Discourse" (1940), "Forms of Time and of the Chronotope in the Novel" (1937–1938), and "Discourse in the Novel" (1934–1935) study the concepts of *dialogism*, *heteroglossia*, and *chronotope* (English translation – Bakhtin & Holquist, 1981);
- *Speech Genres and Other Late Essays* (six short works written in 1970-s and published in Russian as *Esthetics of Creative Discourse* in 1979), a collection of essays that outlines Bakhtin's entire paradigm of dialogic communication and details its philosophical foundations (e.g., distinguishing between dialectic and dialogic) (English translation – Bakhtin, Holquist & Emerson, 1986).

The important fact for our work is that the first complete academic edition of Bakhtin's works was finally published in Russia. After sixteen years of work (1996–2011), for the first time, all known Bakhtin writings were rechecked, commented upon and published or republished with an extensive scientific apparatus. The result is six volumes in eight books (Бахтин, 1997–2012) which we use in our research, especially in situations where these new Russian publications of Bakhtin works are significantly different compared to the existing English translations.

Historically and chronologically the majority of Bakhtin-related research refers to the fields of knowledge traditionally associated with Bakhtinian ideas: literary theory, ethics, linguistics, and philosophy of language (e.g., Haynes, 1995; Holquist, 2002; Stam, 1989; Wood, 2004). In recent years we have seen the growing tendency of applying Bakhtinian ideas to a broader range of disciplines (especially to different aspects of communication theory and practices). Gary Kim argues that “theories of human communication through verbal dialogue or literary representations” studied by Bakhtin “will apply to virtually every academic discipline in the human sciences” (Kim, 2011, p. 54). As a result, there is an enormous and still expanding amount of literature that consistently applies Bakhtinian ideas in interdisciplinary research (e.g., Cooren & Sandler, 2014; Folch-Serra, 1990; Folch-Serra, 2012; Holloway & Kneale, 2000; Janice, 1994; Javornik, 2001; Javornik, 2012; Jordan-Haladyn, 2014; Kane, 2014; Karimova, 2012; Lawson, 2011; Mandelker, 1995; Min, 2001; Montgomery, 1993; Peeren, 2008; Soutar, 2003; Stone, 2008; Wegerif, 2007; Wegerif & De Laat, 2011). We believe the academic community is interested in interpreting Bakhtinian ideas because of their universal foundations as they could be applied to the entire social discourse and because of dialogic potential of Bakhtin's explanatory and descriptive research approaches. We address the results of this research as they correspond to our work. We point out and discuss how Bakhtinian concepts are related to other theoretical ideas and how effective their research and practical application could be.

Communication scholars mobilize Bakhtinian concepts to explore the operating of communication and social interaction in general. Following this perspective, François

Cooren and Sergey Sandler extend Bakhtinian idea of polyphony even further in order “to study the *communicative constitution of reality*: ... we mean that many different things can be identified (by the participants and the analyst) as *literally* and *figuratively* expressing themselves in any given form of communication (a text, an utterance, a dialogue, an icon, a gesture, etc.), and can thus be acknowledged as *constituting* a given situation” (Cooren & Sandler, 2014, p. 225, emphasis in original). Arguing that “the world we live in is a speaking and personified world; a world that comes to speak through us because we make it speak in a specific way” (Cooren & Sandler, 2014, p. 240), these authors started developing a new kind of *social ontology* based on ideas of Bakhtinian dialogicity.

Two different authors, Mireya Folch-Serra and James Lawson (Folch-Serra, 1990; Folch-Serra, 2012; Lawson, 2011), study Bakhtin's chronotope (space-time interconnectedness) from the same perspective: spatio-temporal as revealed in narrative, especially in the analysis of geographical narrative – “the heteroglot reality of the landscape.” Folch-Serra in her research stresses the dialogical dynamic between the world of narration and the world being narrated (Folch-Serra, 1990, p. 262). Landscapes, like narratives, also become “repositories of polyphony and heteroglossia”, and the methodological implication here is that historical geography is not compatible with the conventional scientific method that relies on stable, replicable findings. The “landscapes” and “timescapes” in historical geography cannot be studied as a monoglot text, the only approach to study it is to apply the dialogical approach of the chronotope (Folch-Serra, 1990, pp. 256–258).

Julian Holloway and James Kneale continue the direction of a dialogical study of space ("to draw out the spatial aspects of Bakhtin's work") in a methodological utilization of Bakhtin's relational dialogics, where two modes of representation can be realized together without reduction or the loss of difference: "as a working method which does not privilege discourses or fix representations, but instead depends upon a recognition of their relative weight in dialogue" (Holloway & Kneale, 2000, p. 83).

In the work titled "What does Mikhail Bakhtin have with the cybernetic subject in the era of globalization?" Miha Javornik considers Bakhtin's theory as a bridge to an understanding of interactive forms of computer communication in their connection "with the traditional patterns of thinking while treating them as a (new – uncanonized) phase in repetition or, rather, replacement of cultural psychotypes" (Javornik, 2012, p. 200). Considering that Internet interaction is based and organized on the idea of heteroglossia, modern digital communication in its "multiplicity realizes the idea of heteroglossia in practice, since it allows constant exchanges or changes of communicative situations" (Javornik, 2012, p. 209). The virtual world and social reality, the digital intertwining of virtual and real culminate in so typically Bakhtinian permanent carnivalizing ambivalence.

Gulnara Karimova comes from another perspective in communication studies and applies Bakhtinian ideas in an understanding of the marketing communication process: interactivity, as advertising practice, has been analyzed by its dialogical features using Bakhtinian concept of dialogical relationships. Author distinguishes a special "advertising chronotope" ("advertising chronotopes can be characterized as where/when

the advertising message becomes an event in the viewers' narrative and so 'materializing' the advertising message within the space/time matrix") and studies its functioning within advertising narratives using interpretative analysis of modern advertising materials (Karimova, 2012).

We want to point out one of the recent research attempts of moving away from the traditional study of Bakhtin's sources in a historical-cultural context and situate Bakhtin scholarship into previously unexplored territories. For example, we can refer to Esther Peeren and her study "Intersubjectivities and Popular Culture: Bakhtin and Beyond (Cultural Memory in the Present)" (Peeren, 2008). Peeren explores the work of Bakhtin's concepts in performance studies: including the television series *Sex and the City*, the films *Nell* and *Flawless*, the television series *Queer as Folk*, and London's annual Notting Hill Carnival. Peeren describes how Bakhtin's ideas function, extend or alter, by their interaction with particular occurrences of modern popular culture. As a result, performative arts as a part of interpersonal communication might be seen as dialogic. Peeren argues that the term "dialogism" should be reserved

for the specific form of interpersonality or interculturality that Bakhtin privileges as the most productive relationship between self and other. Not all identities are dialogic, ... they are all intersubjective. ...The other does not become an object, but is recognized as another subject. Dialogism means responding to alterity without negation or assimilation. (Peeren, 2008, pp. 17, 18)

Anna Soutar in her doctoral thesis, "The chronotope as a model for hypermedia in architectural education" (Soutar, 2003), follows Bakhtin's description of time-space as a "living, tension-filled interaction" (Bakhtin, 1981, p. 279) in applying the chronotope concept to the use of educational hypermedia. The chronotope in hypermedia ("the chronotopic click") is a model that connects temporal and spatial dimensions: "this moment of the man-machine coordinated action is the act which puts imaginative control of the learning process into the hands of the learner and thus becomes the central vehicle of knowledge delivery" (Soutar, 2003, p. 3).

Jonathan Stone, in his study "Polyphony and the atomic age: Bakhtin's assimilation of an Einsteinian universe" (Stone, 2008), provides his overview of Bakhtinian epistemology. Here we can find a clear distinction between the relativism and Bakhtinian dialogic relativity which is essential for our research as we interpret Bakhtinian carnivalization in social media design. Stone concluded his analyses of the concept of carnival with the following:

Bakhtin delighted in the ever-changing, always relativistic nature of the literature of carnival. The Einsteinian component of his understanding of relativity becomes particularly significant for carnival. *The presence of relativity, and not relativism*, shields Bakhtinian carnival from implying a shirking of moral or ethical responsibilities and shows it to be yet another manifestation of Bakhtin's celebration of modernity's shifting perspectives and unbounded subjectivity. (Stone, 2008, p. 416, emphasis added)

In Bakhtinian understanding of the literary carnival, the reader is an active participant in the carnival, in the literary world and in the story itself. Reader-participants are implicated in the carnival reversal. A world of a literary novel, the mechanics of carnival are aligned with the reader's perspective, connected to the reader's subjectivity and to the reader's point of view and perception of reality. When we know particular details about the reader, the participant, measurements are actively charged with meanings. On the contrary: "When we do not keep the reader in mind, the ambivalence and multiplicity of carnival is lost." (Stone, 2008, p. 416). This elevation of the reader to a central position is considered to be very similar to Einsteinian revolution in physics.

At this point we need to summarize and accentuate three **main directions of Bakhtinian interdisciplinary research** that have an advantageous potential for information and interaction design studies and practices in general and for our research in particular:

1. Applying Bakhtin's metalinguistics (theory of narrative and theory of novel in particular) for studying the semiotics of the globalized electronic public space.
2. Applying Bakhtinian theoretical ideas for researching cognitive processes in human-computer interaction.
3. Interpreting Bakhtin's concept of the chronotope in a vast range of scientific disciplines (e.g., time and spatial studies towards a thoroughly dialogical theory of space).

Finally, there are very few examples of the attempts of interpreting Bakhtinian concepts in the fields of communication and media design research that can be found in

the form of theses and dissertations, scholarly articles (mainly materials of science conferences dedicated to human-computer interaction and to Bakhtinian research) and several chapters in different collective works (e.g., Bannon, 2005; Bostad, 2005; Dearden, 2006; Liang, 2012; McCarthy, & Wright, 2003; McCarthy, & Wright, 2005; Spinuzzi, 1999; Spinuzzi, 2001; Trausan-Matu & Rebedea, 2009; Trausan-Matu & Stahl, 2007; Turner & Turner, 2003; Turner, Turner, & McCall, 2001; Vaagan, 2006; Wagner, Stuedahl, & Bratteteig, 2010; Wegerif, 2007; Wright & McCarthy, 2004; Wright, & McCarthy, 2005; Wright, McCarthy, & Meekison, 2018).

These attempts are rather sporadic and unsystematic as they are limited in exploring only specific Bakhtinian concepts in very particular perspectives, without taking Bakhtin's ideas as a coherent whole and often without providing necessary empirical studies for analysis and evaluation of how these concepts are applied in design practice. However, this last category of works is the object of our closest attention as they show what is already known in a specialized field and reveal the main tendencies and approaches in the current state of research.

2.1.1 General Approaches for Bringing and Investigating Bakhtin's Dialogic Theory in Design Research

Outlined below are general approaches for bringing and investigating Bakhtin's dialogic theory in design research.

1. The most common thread in the reviewed literature is characterized by referring to different aspects of Bakhtin's theory of dialogue and using them as a rhetorical framework. For example, in "A human-centered perspective on interaction

design” chapter of “Future Interaction Design” study (Bannon, 2005), Bakhtin's dialogical account of experience is investigated as the basis for exploring technology as an engaged, participatory experience where author argues for a dialogical analysis of the relationship between designer and user. A very similar in terms of defining and measuring key concepts is the approach of Rung-Huei Liang (Liang, 2012) where Bakhtin's ideas of self and other are explored as foundations in experiencing interactive processes and are used to point out that the designing of digital products must be finalized dialogically.

2. A more detailed variation of the approach observed above is using Bakhtin's analysis of narrative as theoretical and explanatory tools. For example, Phil Turner, Susan Turner, and Rod McCall argue that any collaborative virtual environment or any results or desired interactive system is the product of a socially constructed multi-voiced narrative. This kind of storytelling or narrative necessarily involves some form of compromise: the designers and the potential end-users usually have different points of view. Authors apply Bakhtin's analysis of narrative as a way to explain how a co-constructed narrative structure is an essential component of a successfully engaging collaborative virtual environments (Turner, Turner, & McCall, 2001).

A similar approach can be found in a series of the works of John McCarthy and Peter Wright (McCarthy, & Wright, 2003; McCarthy, & Wright, 2005; Wright & McCarthy, 2004; Wright, & McCarthy, 2005; Wright, McCarthy, & Meekison, 2018). These authors revise human-computer interaction theory by analyzing technology as experience. The authors argue that

Bakhtin's conception of the novel could quite literally be used as another experience design tool... it is his way of analyzing the novelistic genres as offering qualitatively different ways of seeing experience that can provide us with ways of positioning different interaction design techniques. ...

Bakhtin's analysis of the process of authoring a novel as well as his approach to analyzing the different relationships between characters, authors and plots that provides us with ideas about the relationships among interaction designers, users and designed artefacts. (Wright & McCarthy, 2005, p. 13)

As a result, McCarthy and Wright outlined their perspective of how Bakhtin's theoretical tools for dialogical analysis in literature could be applied as a framework to study the relationship between designer and user.

3. The third set of case samples refers to the application of Bakhtin's ideas for analyzing different aspects of modern online digital discourse.

Finn Bostad applies Bakhtin's dialogics to communication in the online public spaces. Modern electronic discourse explored as a meaning-producing social practice has the characteristics of Bakhtinian dialogue. The author notes "a re-mediation of discourse, with an emphasis on the added dimensions of time and space which we find in the synchronous and asynchronous potential of various ICT [Information and Communications Technology] applications" (Bostad, 2005, p. 182).

Another example is analyzing collaborative problem-solving in chats, based on the concept of polyphony (Trausan-Matu & Rebedea, 2009; Trausan-Matu & Stahl,

2007), where polyphonic structuring of chat dialogs transforms the entire interaction into a “thinking device” that can be traced and visualized using software tools.

Robert W. Vaagan explores Open Access systems (Open Access traditionally refers to online research outputs that have free access and free of many restrictions on use, e.g., certain copyright and license restrictions) in the context of Bakhtinian dialogue, polyphony, and carnival. As the author summarizes (Vaagan, 2006, p. 171), Open Access interpreted by using Bakhtinian concepts:

- a) is not only a fully sustainable but a permanent dialogic twin feature of the prevailing and still dominating asymmetrical monologue of traditional subscription-based commercial publishing;
- b) will not replace traditional subscription-based commercial publishing but will continue to challenge it and provide symmetry, as many polyphonic voices – consonant and dissonant – join in support of and in opposition to, both prevailing publishing patterns and Open Access;
- c) represents a healthy celebration of the popular, riotous and democratic carnival, in favor of freedom, in opposition to established and asymmetrical commercial power structures.

Another collective work, “Exploring digital design: multi-disciplinary design practices” (Wagner, Stuedahl, & Bratteteig, 2010), is important for our research. This study deserves a special attention because – even in an abridged form of two pages section (Wagner, Stuedahl, & Bratteteig, 2010, p. 74-76) – its authors finally attempted to take into account all main Bakhtin's concepts intertwined in their dialogic whole and sketch the areas of effective connections between Bakhtinian ideas and design research and practice. The “Polyvocality and Addressivity” section from the beginning points to

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considering Bakhtin's dialogic discourse as a substantial source for design research in general:

Bakhtin argued that we also consider communication as only ever partial and always unfinished. This notion of the dialogical resonates with some current concerns in digital design research, such as in electronic installation works and online discourse, where dialogue is realized only online and in the time of its telling. (Wagner, Stuedahl, & Bratteteig, 2010, p. 74)

And then continues with the suggestion that in analytical perspective:

... explorations in the 'dialogical' may be extended into interaction and communication design as part of seeing design as multiply made, that is with a variety of media types and discourse modes. It is the interplay of unfolding digital textual materialities and artefactual mediations that challenge our interpretative and explanatory frames, such as in the shared constructions and interpersonal activities of online gaming that are only possible because of their underlying digitally conceived and afforded communication design. (Wagner, Stuedahl, & Bratteteig, 2010, p. 75)

Outlining how Bakhtinian concepts work in modern design, we see that polyvocality was instrumental in "...a central shift from notions of primary and overbearing authorship – here the romantic lone designer – to meaning that is collectively created through a medley of speaking positions" (Wagner, Stuedahl, & Bratteteig, 2010, p. 75). Bakhtin's utterance is a response to previous utterances and is expected to produce a response from another speaking position. The level of the utterance is essential for

interpersonal communication and for designing for communication. Responding to different utterances gives design necessary social charge: following Bakhtin, utterance refers to socially situated and articulated “speech” and not to language rules in general.

We agree that “[t]his is a level of articulation is still very much under-theorized in design research ... polyvocality is in the process of being realized through a range of media types, co-occurring in websites and increasingly present on mobile devices and in public spaces”, and

[b]y placing communication at the centre of a socio-cultural perspective, digital design research is able to connect information systems and application design and their affordances with the shaping and multimediational character of digital utterances in, as and through, design artefacts and discourses.” (Wagner, Stuedahl, & Bratteteig, 2010, p. 75)

So Bakhtinian polyvocality is addressed as a tool for the mapping of intersecting and interacting activity systems where the design objects (participants, processes, products) are themselves parts of a constant synthetic restructuring in connection to other systems.

The concept of the chronotope is shortly mentioned by Wagner, Stuedahl, and Bratteteig in the context of studying digital genres as a mix of multiple online and media types, the features and functionalities of simulated online environments, and, most importantly, concerning space-time relations in designing real-time spatial applications.

We conclude that Wagner, Stuedahl, and Bratteteig approach to bringing Bakhtin's ideas into design discourse works as a very condensed outline of possible

directions of how Bakhtinian ideas could be methodologically and empirically used in different fields of design. Considering this approach and adding our interpretation of Bakhtin's core concepts, our work aims for a deeper deployment of Bakhtinian dialogics in the design field and their practical application in the analysis of contemporary social media applications.

Very close to Wagner, Stuedahl, and Bratteteig's view of chronotope as a connectedness of multiple space-time modalities is Rupert Wegerif's attempt of conceptualizing of emerging "internet chronotope" (Wegerif, 2007). Following Bakhtin's note that literature chronotope can consist of many chronotopes in dialogic relationships with each other and with the "outside" chronotope of the reader (Bakhtin, 1981, p. 252), Wegerif finds that "The Internet also generates its own sense of space very different from the three dimensions of objective space. ... the 'chronotope' of the Internet is different from that of physical space-time", where "different interface designs and ... 'information architectures', produce different experiences of space and time" (Wegerif, 2007, p. 6).

Where Wegerif only drafts the concept of "internet chronotope," another researcher, James Gourley, moves further in outlining the details of this concept. Using Bakhtin's original application of chronotope to literature genres field, Gourley's work, "Terrorism and Temporality in the Works of Thomas Pynchon and Don DeLillo" (Gourley, 2013), outlines emerging tendencies in time-space relations. "[T]he internet signifies the boundless time of this new form of information exchange. Through this technology, previous conceptualizations of time are superseded, and past, present, and future coalesce" (Gourley, 2013, p. 170). Or, in other words, the "emerging internet motif

is reliant, once again, on the metaphor of time as able to merge, or for multiple times to bleed into each other" (Gourley, 2013, p. 168). The result is that time in the "internet chronotope" gets new characteristics as ambivalent in its manifestations, becomes "dimensional but diffuse: past, present, and future exist all on one plane, different times bleeding into each other rather than the delineated linear conception of temporality" (Gourley, 2013, p. 170).

Design research literature is an essential contribution to our work as it provides different perspectives on how these studies relate to and advance theory and practices, and indicate areas needing more research. As we can see, the use of Bakhtin's discourse in design research explores only some of his main concepts or their most common interpretations without establishing a coherent approach and generally follows a limited number of well-established patterns that came from other disciplines or from interdisciplinary research. These research patterns usually repeat already existing theoretical framework and do not provide extensive support by data specifically related to information and interaction design.

In order to provide a practical connection between Bakhtin's dialogical discourse and information and interaction design, we analyze it in the empirical context of social media design. Modern social media is an integral part of our research as it provides pertinent research data in such a vast array of interrelated design tools, user interactions, and different discourse modes.

2.1.2 Waze-related Research Literature

We will look at Bakhtinian concepts in social media by examining the social navigation application Waze. There has been very little academic research about Waze since the application was launched in Israel in 2006-2008 until recently. ResearchGate (researchgate.net) shows quickly growing interest in research involving Waze starting in 2018. Including the latest research papers (from 2018), we can classify the most representative works in the following groups.

The majority of papers is concentrated on exploring different aspects of crowdsourcing for the collection of traffic information (e.g., Morschheuser, Hamari, & Maedche, 2018; Tiziana, & Steffen, 2018; Upadhyay, Khan & Kumar, 2018).

The second group of papers is dedicated to evaluating the reliability, quality and potential outcomes of using the app's dynamic traffic reports (e.g., Amin-Naseri, Chakraborty, Sharma, Gilbert, & Hong, 2018; Fire, Kagan, Puzis, Rokach & Elovici, 2012; Hughes, 2016; Jeske, 2013; Katta, Ghag, Hira, Keslassy, Bergman, & Barefoot, 2017; Yamsaengsung & Papasratorn, 2017).

The third group of researchers studies more specific aspects of Waze: assessing the accessibility of the app from the privacy viewpoint abiding by W3C (Chicanelli, Souza, & Borges, 2018), comparing detection and disclosure of traffic incidents on Twitter and Waze (Vallejos, Caimmi, Alonso, Berdun, & Soria, 2018), studying new digitally mediated spatial practices performed and embodied by users as they relate to architectural and urban space (Ramos, 2016; Ramos, 2017), looking at mobility practices occurring between commerce and community in the public space (Van der Graaf &

Ballon, 2018), or investigating how Waze as a social navigation platform changes the perspective of the automotive industry on automated driving technology (Hind & Gekker, 2014).

In summary, existing Waze-related research provides detailed insights on how the app is functioning in the social environment (crowdsourcing for data generation).

However, there is less attention paid to exactly how Waze can dynamically combine and process time-spatial characteristics from a development and design perspective. Also, existing Waze research is more based and concentrated on directly studying empirical examples of the app's use rather than on developing adequate methodologies that should align different research tasks and approaches. Additionally, as with mobile navigation app research in general, current Waze research is mostly focused on *quantitative* analysis exploring how the app performs as a system, but there is a gap in research that is oriented on adding and using *qualitative* analysis data. We believe our research of the Waze app using chronotopic analysis should start to fill this gap.

Also, generally speaking about designing for social media applications, we agree with Regner Ramos that in this field,

[i]t is evident ... that apps are made at a fast pace aimed at increasing their commercial value, but their *development, design, and research currently lacks critical study into apps' implications regarding the social reconfiguration ...*, as well as the formation of new forms of embodiments and identities. (Ramos, 2017, p. 2, emphasis added)

So, in our work, we continuously aim to study designing for social media according to its practical implications to a broad socio-cultural perspective.

2.1.3 Reasons for Bringing Bakhtinian ideas into Information and Interaction

Design Discourse

Based on the state of information and interaction design discourse today and the main tendencies in exploring Bakhtin's theory found in the multidisciplinary research literature, we can summarize the following reasons for drawing on Bakhtinian ideas.

2.1.3.1 Bakhtinian dialogical discourse as an articulation of dynamically designed and mediated communication and its complex collaborative genesis.

All Bakhtinian concepts are integrated by what has come to be labeled as the *dialogical*:

Dialogic relationships are a much broader phenomenon than mere rejoinders in a dialogue laid out compositionally in the text; they are an almost universal phenomenon, permeating all human speech and all relationships and manifestations of human life – in general, everything that has meaning and significance. (Bakhtin, 1984, p. 40).

According to Bakhtin, all communication is enacted, occurs in dialogue, but is articulated only in context and tempered by social and cultural discourse conventions. "... *Any true understanding is dialogic in nature*. Understanding is to utterance as one line of dialogue is to the next" (Voloshinov, 1973, p.102, emphasis in original). The specific "social language" of different conventions is based on what Bakhtin called *speech genres*. Speech genres accentuate the social and cultural basis of all communication.

Communication is mediated through language and other socio-cultural modes of exchange and expression.

In this context, one of the common threads in incorporating different aspects of Bakhtin's theory is to use the dialogical account of experience as the basis for exploring technology as an engaged participatory experience (Bannon, 2005). Similarly, Bakhtin's concepts of *self* and *other* are used to point out that the creative understanding in the design of digital products must be accomplished and finalized dialogically (Liang, 2012). Bakhtinian analysis of narrative is used as an argument that any produced or desired interactive system is the product of a socially constructed multi-voiced narrative (Turner, Turner, & McCall, 2001). Consequently, there is an approach of building a dialogical analysis of the relationships between designer and user (McCarthy, & Wright, 2003; Wright, & McCarthy, 2005).

Another example in this perspective is the analysis of collaborative problem-solving practices in online chats based on the Bakhtinian concept of *polyphony*. Polyphonic structuring of chat dialogs transforms the entire interaction into a "thinking device" that can be traced and visualized using software tools (Trausan-Matu & Rebedea, 2009; Trausan-Matu & Stahl, 2007). By embedding a dialogical approach as an interpretive and explanatory framework, design research provides a connection between information systems and application design. Where it is multi mediational in form and character, digital utterances connect different design artefacts and discourses.

2.1.3.2 Dialogue in online discourse. The notion of the dialogical directly applies to current concerns in information and interaction design, such as designing for online

discourse, designing for the latest social media technologies where communication is realized only online and in the time of its happening, and where discursive constructs are part of the information exchanges and as well as being in flux.

The essential characteristic of dialogic for Bakhtin is that communication is only ever partial and always unfinished. "The semantic structure of an internally persuasive discourse is not *finite*, it is *open*; in each of the new contexts that dialogize it, this discourse is able to reveal ever new *ways to mean*" (Bakhtin, 1981, p. 346, emphasis in original). As a result, Bakhtinian unfinalizability/inconclusiveness/open-endedness means that "the resonance or oscillation of possible meanings within [...] is not only not resolved, but must increase in complexity as it continues to live" (Bakhtin, 1981, p. 426). Online spaces integrate enormous groups involved in dialogic expression creating a new kind of the "unfinalizable" web or a presence of the "unfinalizable" online audience echoed in continuing, never-ending chains of responses.

2.1.3.3 Polyphony as a tool for mapping intersecting activity systems. Bakhtin's notion of *polyphony* (polyvocality) extends dialogical relations to the mapping of intersecting activity systems. When we understand the design process as a part of different intersecting activity systems, its object (product, process) is itself part of a synthetic dialogical reframing in coordination with other systems.

Bakhtin emphasizes this kind of intersecting activity in verbal material, when we see utterances as signs with their social and cultural importance: "images of language are inseparable from images of various world views and from the living beings who are their agents-people who think, talk, and act in a setting that is social and historically concrete"

(Bakhtin, 1981, pp. 45-46). Methodologically and technically this understanding of design is realized in recent developments in social network applications (tumblr or flickr), and especially in wikis. A wiki is usually a web application, which allows collaborative designing (creating, modification, extension, or deletion) of its content and structure. Typically, a wiki is written using a simplified markup language (special “wiki markup” language) that is easy for potential users. In wiki design principles this is a universal principle: “Universal – The mechanisms of editing and organizing are the same as those of writing, so that any writer is automatically an editor and organizer” (Wiki Design Principles, n.d.). Technically a wiki is still a type of content management system; however, wiki's content is created without any particular leader or owner.

For example, for Wikipedia, “**No one**, no matter how skilled, or of how high standing in the community, has the right to act as though he or she is the owner of a particular page. ... **Work submitted to Wikipedia can be edited, used, and redistributed – by anyone**” (Wikipedia: Ownership of articles, 2015, emphasis in original). Wiki design structure is not strictly predefined or limited, allowing the structure to be extended or developed following particular needs of the wiki's users so that different modes and mediations can be communicatively and creatively connected.

2.1.3.3 Information overflow, binary control choices and Bakhtin's concept of polyphony. With increases of information flows especially on social media platforms, user experience has become fragmented, discordant, and often overwhelming. Usually, design decisions are based on exploration of traditional binary options (on/off, follow/unfollow, subscribe/unsubscribe, friend/unfriend or view/hide) of controlling and

rendering information flows. This way current binary options usually become static configurations and social tools lose their engagement and adequate flexibility to follow a broader range of possible communication scenarios.

Polyphony in social media environments means intentional threading of multiple voices across contexts and in real time. Polyphony incorporates different voices without the presence of a dominative, authoritative voice. According to Bakhtin, "the essence of polyphony lies precisely in the fact that the voices remain independent and, as such, are combined in unity of a higher order than in homophony" (Bakhtin & Emerson, 1984, p. 21). Social media platforms are polyphonic because their content typically expands beyond a normative homophonic or monologic unity. Therefore, in order to be able to actively participate in the dynamic creation or modulation of own experience, a user should have more options in social media interfaces than the current binary control choices.

Sengers and Gaver (2006) argue for a reflective understanding of designing and using of design objects, where a single preferred or authoritative interpretation of a given interactive system is deliberately avoided in order to acknowledge the coexistence and legitimacy of multiple, even potentially competing interpretations. For Bakhtin, there are always arguments for this kind of potentially competing interpretations because there is no objective unity (Bakhtin, 1993, p. 331; Holquist, 2010, p. 25); objects or systems should not be unified as linear or unidirectional. Designing with polyphony as a guiding principle can support multiple unspecified outcomes enabling users to construct and manage a content stream that is more nuanced and adapted for personal needs.

2.1.3.4 The concept of the chronotope and multimodal data. Following Bakhtin's

ideas, the chronotope is the activity of knotting together/untying a narrative:

What is the significance of all these chronotopes? What is more obvious is their meaning for narrative. They are the organizing centers for the fundamental narrative events of the novel. The chronotope is the place where the knots of narrative are tied and untied. It can be said without qualification that to them belongs the meaning that shapes narrative.

(Bakhtin 1981, p. 250)

Bakhtin introduces chronotope, a critical and heuristic unit of linguistic analysis for studying discourse "according to the ratio and nature of the temporal and spatial categories represented" (Bakhtin, 1981, p. 425). These specific temporal-spatial patterns characterize certain generic literature types as chronotopes combine specific senses of time and place characteristic to each particular genre; then each genre serves as a foundation for different strategies in producing narratives.

Taking further the initial idea that the chronotope displays that time cannot be interpreted without a spatial dimension, Emerson and Holquist accentuate that "the distinctiveness of this concept as opposed to most other uses of time and space in literary analysis lies in the fact that neither category is privileged; they are utterly interdependent" (Bakhtin, 1981, p. 425). For Bakhtin, chronotope connects, represents and embodies multiple time-spatial dimensions without privileging the temporal or the spatial aspect.

Bakhtin stresses out that the various literature chronotopes stand for “[t]he process of assimilating *real historical* time and space in literature” (Bakhtin, 1981, p. 84, emphasis added). So chronotopes are not merely artistic and genre conventions but rather is the ontological perspective for larger “generic techniques” for “reflecting and artistically processing such appropriated aspects of reality” (Bakhtin, 1981, p. 84). Also, there is important for our research historical and social dimension of the chronotope concept: as Morson and Emerson describe it, “Bakhtin’s crucial point is that time and space vary in qualities; different social activities and representations of those activities presume different kinds of time and space.” (Morson & Emerson, 1990, p. 367).

The dialogic interconnectedness to socio-material, sociocultural here-and-now, and to representational dimensions (abstract, fictional, hypothetical) renders chronotope as a theoretical construct for understanding and representing artifacts with different modes of activity or occurrence, digital design artifacts in particular, and multimodal data in general. For design research the chronotope “allows us to move analytically within emerging practices of digital communication design and their enactment” (Wagner, Stuedahl, & Bratteteig, 2010, p. 76). The concept of the chronotope is applied in the context of studying digital genres as a mix of multiple online and media types including:

- Crowd-sourced resources as wikis (Allan, 1994; Holquist, 2010), Q&A platforms (e.g., Quora, reddit), online forums and blogs with user interaction;
- Open Access systems (Spinuzzi & Zachry, 2000; Vaagan, 2006);

- Real-time spatial applications based on an exchange of social information (e.g., Waze (Brynjolfsson & McAfee, 2014), Localscope, Mobli or Trapster) and collaborative geo mapping platforms (e.g., OpenStreetMap);
- Synchronous online technologies such as Google Drive (formerly Google Docs) that transform the time-space continuum of the collaborative process (Bankard, 2015);
- Historical visualizations in Geographic Information Sciences (GIS) and the emerging Spatial Humanities field (e.g., constructing spatio-discursive visualizations from the Bakhtinian chronotope perspective – “Bakhtinian GIS” (Travis, 2015, p. 49) – to model shared perspectives of linear and cyclical time-spaces);
- The features and functionalities of simulated online environments (e.g., Second Life, – a three dimensional, multi user, object-based, virtual environment where all users can create their own cultural experiences, and where time/space inseparability intensifies a non-linearity of the temporal and spatial aspects of interaction (Nocchi & Blin, 2013) in virtual worlds) and digital communities like MUDs (Multi-User Dungeons);
- Recent media practices (e.g., user-generated content (Lewis, 2012), transmedia and media convergence) that created an environment for indicating new types of chronotopes:
 - A special semiotic “multimedia chronotope” (Lemke) that
transverse mode, time and space as formed by “the culturally

typical movements from place to place, each with its own

characteristic timing and pacing” (Lemke, 2005, p. 184);

- Conceptualizations of emerging “internet chronotope” (Gourley, 2013; Wegerif, 2007), or – as a variation – the “Internet-news chronotope” (Рабкина, 2015);
- A special interactive “advertising chronotope” (Karimova, 2012).
- We believe Google’s Ngram project, (Google Books Ngram Viewer, n.d.) which traces trends in word use in millions of published books could potentially have more explicit chronotopic perspective in uncovering large shifts in language use as they are interconnected with time, place, and space data;
- Applying the idea of chronotope in software development (Hannan, 2011) as the hybridization of the time-space contexts, and in computer programming (e.g., assessing software run-time as an enacted chronotopic adventure time (Ørstavik, 2005);
- Concerning space-time relations in interface design (e.g., Wegerif, 2007) in general.

2.1.3.5 Heteroglossia and empirical data modeling. The quintessential characteristic of Bakhtin’s linguistic theory is that his language concepts are empirically-based rather than being prescriptive or primarily predictive systems. Language and language discourse for Bakhtin is not a predefined structure, it is the changing medium, where “discourse lives on the boundary between its own context and another, alien, context” (Bakhtin, 1981, p.

673). The same principle can be recognized in semantic data modeling, in open-world format metadata models, for example, in the Resource Description Framework (RDF).

Following W3C semantic web standards, RDF's abilities for empirical modeling are based on the fact that "RDF has features that facilitate data merging even if the underlying schemas differ, and it specifically supports the evolution of schemas over time without requiring all the data consumers to be changed" (Resource Description Framework (RDF): Semantic Web Standards, 2014). Compared to many different ways of working with relational data and using web semantics for linking data, the RDF model provides more opportunities for storing abstract or different kinds concepts.

Bakhtinian heteroglossia directly maps with principle RDF's "Anyone can say anything about anything" (Resource Description Framework (RDF): Concepts and Abstract Data Model, 2002) in terms of organizing and maintaining data. Heteroglossia is defined as a variety and diversity of speech types and is characterized by "the totality of the world of objects and ideas [...] by means of the social diversity of speech types and differing individual voices that flourish under such conditions" (Bakhtin, 1981, p. 263). Due to the characteristics and capabilities of RDF's data model, it is not assumed that all information about any topic is available, and "RDF cannot prevent anyone from making nonsensical or inconsistent assertions. Applications that build upon RDF must find ways to deal with conflicting sources of information" (Resource Description Framework (RDF): Concepts and Abstract Data Model, 2002). Heteroglossia reveals the multiplicity of voices enclosed within discourse without pointing to any dominating or authoritative voice or restricting any voices.

Similarly, RDF doesn't have constraints restricting the data allowed in the system and here RDF "departs from the XML approach to data representation, which is generally quite prescriptive and aims to present an application with information that is well-formed and complete for the application's needs" (Resource Description Framework (RDF): Concepts and Abstract Data Model, 2002).

2.1.4 Conclusion

Analysis of the research literature is an essential contribution to our work as it provides different perspectives on how existing designs and their critical studies relate to and advance theory and practices as well as indicate areas needing additional research. As we can see, at this moment the use of Bakhtin's discourse in design theory and practice explores only some of his main concepts following their most common interpretations without establishing a coherent discourse approach, and generally follows the limited number of well-established patterns that came from other disciplines or from interdisciplinary research. These research patterns usually repeat an already existing theoretical framework and do not provide extensive empirical support by analyzing data specifically related to information and interaction design.

Understanding and application of Bakhtinian concepts as a dialogic coherent whole is crucial for our work because, as this literature review confirms, currently there is rather unsystematic or even sporadic attempt to apply some of Bakhtin's ideas in the field of information and interaction design. For example, massive research related to different applications of the chronotope is often mechanically connecting time and space indicators missing a real reference to the original foundational ideas of the Bakhtinian view of the

chronotope. For example, two most significant related issues with chronotope application research are the following:

- A suggested research framework ignores the *unified* spatio-temporal structure of the chronotope – the “intrinsic connectedness of temporal and spatial relationships” (Bakhtin, 1994, p.84) – giving preferences to examining space or to examining time contributions and without exploring chronotopes on a larger socio-historical perspective. So, an analytic approach that incorporates the “intrinsic connectedness” between time and space still remains largely underdeveloped.
- As a result, chronotope is removed from the core or from the foundation of dialogical interaction. As Ritella emphasizes, our aim should be that in chronotope time and space are not given but *dialogically negotiated* (Ritella, Ligorio, & Hakkarainen, 2016, pp. 50-51).

In order to provide a practical connection between Bakhtin's dialogical discourse and information and interaction design, we are planning to analyze it in the empirical context of social media design that provides pertinent research data in a vast array of interrelated design tools, user interactions, immediate feedback related to user experience, and different discourse modes.

Summarizing results of our literature review and especially considering the potential of existing Bakhtinian research in the interdisciplinary field, in the next section, we outline a basis for expanding Bakhtin's discourse from the perspective of information and interaction design.

2.2 Basis for Deploying Bakhtinian Dialogic Discourse

in Design Research and Practice

2.2.1 Bakhtin's Dialogic Discourse as a Theoretical and Empirical Source

The state of information and interaction design discourse today is characterized by the articulation of dynamically designed and mediated communication and its complex collaborative genesis. The analytical exploration of interactive media and information technology as collaborative and participative can be analyzed as dialogical by systematic application of Bakhtin's dialogical concepts. Researching and interpretation of Bakhtinian core concepts such as dialogue, polyphony, heteroglossia, addressivity, carnival, and chronotope offer new insights into information and interaction design. In this section, we argue the validity of exploring and applying Bakhtinian ideas in these fields as theoretical, empirical, and methodological sources and give examples of how Bakhtin's dialogic concepts can be effectively used as design principles and strategies.

We focus on how humanities, Bakhtin's dialogical discourse, in particular, offer new insights into information and interaction design and user research providing interdisciplinary theoretical, empirical, and methodological sources for understanding design research and practices. By Bakhtin's dialogic discourse we mean core Bakhtinian concepts such as dialogue, chronotope, polyphony, heteroglossia, addressivity, carnival (carnivalization, carnivalesque), and utterance. We understand and apply all these key Bakhtinian concepts as one dialogic whole that has a definite social-historic dimension.

We see their coherence as the following. *Utterances* always “come from somewhere” – from historically configured social positions (*polyphony* as simultaneity of viewpoints and voices). Because utterances are “outwardly actualized” (Bakhtin/Voloshinov), they are always social actions. Utterances are based on differences in discursive context (*heteroglossia*) and respond to particular points in this context (*addressivity*), transforming existing meanings or adding new ones (continuous dialogic relations – the Bakhtinian famous *unfinalizability* of any meaning) in different ways (*carnivalization* – “a world upside-down” or “inside out”) as a possible revision of any dominant structure in a discourse. Utterances are filled with social-historic meanings from all parts of the spectrum as well as dynamics structures which can activate specific configurations of time and space (chronotopes). *Chronotopes* receive their central role in the Bakhtinian dialogic ontology as they are represented and embodied: represented in language and discourse, able to be traced in the literature (as literature genres), and embodied as actual time-space constructs in the history of society. For example, in a narrative a reader is situated within at least two chronotropic dimensions: the fictional world of a novel (a representational chronotope), and the experiential here-and-now (an embodied chronotope). Or, accentuating a coherence of the chronotropic thinking, we agree that

[i]t would be best to say that Bakhtin came to view all chronotopes as embodied-representational – with concrete time-place-events deeply furrowed with, and constructed through, representations and with representations always deeply rooted in chains of concrete historical

events. Certainly, Bakhtin did not conceptualize chronotopes as some abstract, decontextualized Cartesian time-space coordinates, but as human(ized) worlds filled with historical and social significance... (Prior & Shipka, 2003, p. 186)

Describing our understanding of Bakhtinian concepts as a dialogic coherent whole is crucial for our work because, in our opinion, currently there are rather unsystematic attempts to apply some of Bakhtin's ideas in the field of information and interaction design. Our approach is based on an idea of interpreting and applying Bakhtinian theoretical ideas as coherent and continuous, and we accentuate a socio-historical dimension of all Bakhtinian concepts as we study their importance in the social practice of design.

2.2.2 Social Media as Empirical Context for Articulating Explanatory and Interpretive Potential of Bakhtin's Ideas

Exploration of Bakhtin's dialogical discourse extends our understanding of information and interaction design as a continuous dialogue which is tempered by socio-cultural activities and conventions, and which occurs in shared social constructions. We believe modern social media is the most effective context for analyzing such activities, conventions, and constructions because exploring social media with its variety of media design types and discourse modes provides an empirical technological and social context for revealing and articulating the explanatory and interpretive potential of Bakhtinian ideas.

From this perspective, designing for social media integrates the use of a variety of design and research approaches and their immediate implementation in social interaction provides pertinent research data in a vast array of interrelated tools and systems. Social media provides almost unlimited possibilities for user participating and engagement. Modern social media applications work as a digitally mediated environment that dynamically represents the majority of cultural constructs and discursive exchanges. These very different constructs and exchanges are revealed digitally, but they are socially and culturally rooted, and are interpersonal and collaborative.

Designing for social media in order to support interpersonal communication directly relates to Bakhtin's communication theory. For Bakhtin, any mode of communication, whether it is a written narrative or a different form of socio-cultural encounter, is addressed to a potential hearer and respondent, and extended to the broader structure of related and antecedent discourse.

From this perspective, any designs for digital media environments are also discursive constructs themselves. These constructs are in permanent interpersonal, cultural, and collaborative exchange, an exchange that is always in flux. Social media exist as shared constructions for online interpersonal activities that are possible because of their "underlying digitally conceived and afforded communication design" (Wagner, Bratteteig & Stuedahl, 2010, p. 75). This kind of underlying design decision is a powerful and very influential way of predefining possible characteristics and actual user practices in social media communication.

2.2.2.1 Dialogization and monologization of social media environment.

An important question that arises in social media discourse is the issue of how different voices interact, and if there is a predefined, predesigned positioning for dominant voices. Groups or users who have access to and control of generic design conventions or of enabling/disabling particular features for the specific media platform, have an authoritative influence on possible discourses and also have more chances of controlling the actions of other users. Different social media tools vary in how much they permit or support conversation, in how responsive they are to user's voices. Here responsiveness is a prerequisite for multi-voicedness or polyphony in Bakhtinian understanding. The specific construction of power relations through different voices produces a possible effect in *dialogization or monologization* of the social media environment.

In this context dialogizing in social media means a built-in possibility for conversation (multiple authors), a possibility for discussion and commenting. Also, we need to articulate that dialogization in any form can be realized only in a process, e.g.: "polyvocality is in the process of being realized through a range of media types, co-occurring in websites" (Wagner, Bratteteig & Stuedahl, 2010, p. 75).

Monologizing means one dominant voice (user, author, corporation), who is allowed to choose which user voices will appear in communications, to inhibit some users from posting, to delete comments or not to respond to comments. For corporate social media pages or profiles, monologizing would mean discussing only specific topics (e.g., offerings or competitions) and avoiding any topics that could be viewed negatively.

One of the trending ways of providing users with more collaborative opportunities is user-generated content. User-generated content (UGC) is usually defined as "any form of content such as blogs, wikis, discussion forums, posts, chats, tweets, podcasting, pins, digital images, video, audio files, and other forms of media that was created by users of an online system or service, often made available via social media websites" (Moens, Juanzi & Chua, 2014, p. 7). However, we cannot say that the massive presence of user-generated content works as dialogization or changes the construction of power distribution on social media platforms or any "content-based" sharing sites. In a case when participants are allowed to create and share their own media content, two main issues, empowerment and exploitation, should be critically viewed:

Much of contemporary discourse on user-generated content (UGC) situates it within a framework of either exploitation or empowerment. To some, the new media promises a reallocation of power between producers and consumers [...] Others, taking a more critical stance, have emphasized the labor consumers perform as part of their integration into media production processes. (Duffy, 2010, p. 27)

The entire new (and very profitable) business models have been created when different media companies (e.g., YouTube, Facebook, Vine, Instagram, or Second Life) quickly realized that they could make use of user-generated content by only providing a technological "playground" for the users rather than producing material for them to consume. "To this end, consumer-participants have recently been conceptualized as free workers in a knowledge based economy [...] and even as exploited consumers whose

labor is expropriated under the logic of marketing” (Duffy, 2010, p. 27). For this perspective user-generated content is only an allocation of labor rather than an allocation of power. Media companies still have the dominant voice, and still have dominant control of the entire design structure and functionality of their environments.

2.2.2.2 Intertextuality as a foundation for modern social media.

The concept of *intertextuality* as an integral part of Bakhtinian dialogic discourse, refers to various connections in meaning, form, and content between different narratives.

Intertextuality links any narrative or text to other texts creating an interrelationship between all texts. Each text exists or generates its meaning only in relation to other texts. Following Julia Kristeva's interpretation of Bakhtin's theory, there are two axes in any narrative: one is a “horizontal axis” that connects a creator and a reader, second is a “vertical axis” that connects the text to other texts (Kristeva, 1980, p. 69). These two axes are linked through shared codes represented by chronotopes. Every text and every possible meaning depends on preexisting codes. This intertextual perspective is essential for an understanding of how modern social media represent multiple voices that are generated by our preconceptions of other voices. In this perspective, intertextuality is exactly what makes the modern social media definitely modern and definitely social.

In the current context of globalization, media is embedded in all discourses, and constant advances in technology development only speed up an even greater and more nuanced mediatization process. For example, digitally mediated communication is distinguished by conditions like the permanent remixing and manipulation (e.g., very

popular mashing, memeing, and modding) or just a reuse of materials without changing texts or images created by others.

2.2.2.3 Heteroglossic memeing and meme chronotope.

Memeing (meme-ing) can be analyzed just as thoroughly as a discursive construct due to its significant cultural role and unique genre. Memeing, as a cultural construct that is transmitted by repetition and replication, is inherently heteroglossic because users connect meanings from multiple contexts. The meaning of meme derives from dialogic relations of two discursive constructs: one construct is imposed upon another construct and the result is not just a sum of their existing socio-cultural codes. The result is new ambiguous information.

For Bakhtin, any “utterance is filled with dialogic overtones... [o]ur thought itself – philosophical, scientific, artistic – is born and shaped in the process of interaction and struggle with others’ thought” (Bakhtin, 1986, p. 92). Memeing happens as a dialogue between two different cultural contexts. Visuals used for memeing, often in the form of mashups (image-text combinations), respond to both contexts at once. In this perspective, memeing demonstrates that any interpretive activity is always in progress and always open ended: “even past meanings, that is those born in the dialogue of past centuries, can never be stable (finalized, ended once and for all) – they will always change” (Bakhtin, 1986, p. 170). Viewers can reimagine the meanings and topics of older memes by imposing newer aspects from newer memes onto previous ones. Bakhtinian utterance, then, can be analyzed and connected to another, previous utterance. Utterances are not “self-sufficient,” they rely on intertextuality in order to deliver their meanings:

The very boundaries of the utterance are determined by a change of speech subjects... Every utterance must be regarded as primarily a response to preceding utterances of the given sphere (we understand the word 'response' here in the broadest sense). Each utterance refutes, affirms, supplements, and relies upon the others, presupposes them to be known, and somehow takes them into account. (Bakhtin, 1986, p. 106)

Remembering that the chronotope is "the intrinsic connectedness of space and time" and "in which time, as it were, thickens, takes on flesh, becomes artistically visible; likewise, space becomes charged and responsive to the movements of time, plot, and history" (Bakhtin, 1986, p. 84), we can see that the meme chronotope has its own specific characteristics. Space in the meme chronotope matters only because it provides a framework for the construction of the meme.

Also, the meme chronotope possesses its own "interchangeability of space": "only a few objects are essential to meme recognition, a quality that encourages the participatory remixes endemic to the genre" (Lewis, 2012, p. 110). The most viewed and remixed on the Web memes often repeatedly use the same set of visuals, particular elements of the meme repeatedly appear in remixes while others elements can be replaced. As is the Bakhtinian depiction of the chronotope of Greek novel,

[T]his most abstract of all chronotopes is also the most static. In such a chronotope the world and the individual are finished items, absolutely immobile. ...What we get is a mere affirmation of the identity between

what had been at the beginning and what is at the end. (Bakhtin, 1981, p. 110).

The main characters within memes are stable and inflexible, they are fixed both in and outside of time (Lewis, 2012, p. 111). However, exactly this fixity of recognizable characters along with static placement in space and time capture the attention of viewers and creators, and establish an opportunity for participatory remixing. Thus, the participatory remixing as collaborative performance is based on recognition and intertextuality.

2.2.3 Carnivalization as Interconnectedness of Opposing Categories

Making use of pre-existing socio-cultural codes can not only be effectively explored using intertextuality but also reveals many connections with Bakhtin's concept of the carnival. Double-voicedness (or co-positioning of opposing categories) of any carnival discourse is based specifically on the use and reuse of pre-existing socio-cultural codes and demonstrates that any possible social or cultural meaning is always ambivalent. Bakhtinian ambivalence means that oppositions are brought together, positive and negative interpretations are interconnected:

Other's utterances can be repeated with varying degrees of reinterpretation. They can be referred to as though the interlocutor were already aware of them; they can be silently presupposed; or one's responsive reaction to them can be reflected only in the expression of one's own speech. (Bakhtin, 1986, p. 106).

Bakhtin's understanding of carnivalization is based on the idea of the interconnectedness of opposing categories. These opposing categories are also in the process of constant replacement. Following this reasoning, Bakhtinian carnival is the manifestation of constant dynamics in the unity of diametrical opposites.

2.2.3.1 Carnivalizing language of modern social media.

The language used in modern social media, even a written language, is often characterized by a use of Bakhtinian carnivalesque features. New language norms and conventions emerge as a result of collaborative playing with language: new creative orthographic forms, new words, new abbreviations, new “funky” spellings. For example, Seargeant and Tagg summarize the various orthographic variations for the very conventional and iterative “Happy Birthday” wish posted on one of Facebook pages where “happy” has 17 and “birthday” has 22 different spellings. “[T]hey are meaningful on two different levels: wishing a friend *happy birthday* on Facebook is as much an important social ritual as it is an opportunity to publicly display one's linguistic creativity and originality” (Seargeant & Tagg, 2014, pp. 35-36). Engaged in this “linguistic clownery” (Bakhtin, 1984, p. 472) users have a choice of creating or conforming. Some of the social media profiles are framed as a carnivalesque form of self-presentation. Carnavalesque self-framing can be continued in postings when they are norm-breaking or ignore any implicit traditional social framing (e.g., postings or re-postings with ridiculing and mocking photomontage, including themselves in self-mockery). Carnavalesque playfulness as a feature of digital interaction allows user to position himself as a certain kind of person who accepts carnivalistic variability and changeability as a genre, who is

“not only as someone who is fun, playful and creative, but also as someone who is familiar with the genre and the potential freedoms such informal spaces can offer to the expression of the self” (Sergeant & Tagg, 2014, p. 42).

2.2.3.2 Digital scholarship as carnivalistic practice. There is a very interesting research idea to explore emerging digital scholarship that is causing disturbances to traditional academic publishing practices using key theoretical concepts from the work of Bakhtin. Authors refer to the concept of carnival “to understand the current changes we are seeing in the ways in which scholars are using the web” because “[o]pen publication practices arguably represent a ‘carnival’ in academia, one that facilitates new knowledge, networks, and voices across a variety of topics” (Cooper & Condie, 2016). Following the Bakhtinian aim for “unfinalized” social science, authors see these recent tendencies as a positive movement. They describe how new publishing practices support the “unfinalized social science research” that corresponds to the dialogical, unfinalized nature of any social knowledge. So, new forms of scholarly work as open publishing and self-publishing have “more potential to be dialogical, participatory, and polyphonic in online spaces” and “could enable best practice guidance to be generated in an iterative and collaborative way for a sustained ‘carnival’.” (Cooper & Condie, 2016).

2.2.3.3 Blogging as Carnivalistic Practice. One more example of how Bakhtinian concepts of heteroglossia and carnival work in the modern social environment is blogging, political blogging in particular. Social networking such as blogging (including Twitter and Facebook) have become a part of a participatory culture where bloggers exhibit many Bakhtinian carnivalesque features like parody, irony, the use of political

masks or imaginary images (avatars), even assuming various personae, providing free and familiar contact between bloggers and their readers, and ridiculing those in power.

As a result “the contemporary carnival can be performed daily in a public venue”

(McLean & Wallace, 2013, p. 1530). In the current socio-political environment, the possible selection of various digital masks and intertwining of opposing discourses is characteristic for both bloggers and their readers.

The navigation application Waze is using avatars differently, but still with a very Bakhtinian chronotopic meaning. This app's interface maps all Waze drivers, connecting personal avatars of its drivers-users with their time-space positions. One of the results is that “through Waze's avatars, users construct a sense of embodied self-awareness and a social understanding of their immediate context by being able to visually position themselves within an expansive network of others” (Ramos, 2017, pp. 3-5). Waze provides each user with a digital representation in the form of an avatar. Based on their user ranking, Wazers select different avatars, each avatar depicting different personalities – or in Waze's playful terminology – “moods” (Waze Moods, n.d.).

2.2.4 Hashtags as Technological Support and Visualization of Polyphony

One of the technological and even visual ways that support intertextuality in social media are hashtags. Twitter's hashtag, the # symbol, marks a keyword to a Tweet in the form of a metadata reference to the topic of the message as specified by the user. Then users can selectively examine hashtags and include them in their own Tweets. Very interesting is the fact that Twitter acknowledges user's participation in designing hashtags, “[i]t was created organically by Twitter users as a way to categorize messages”

(How to use hashtags, 2014). Attaching hashtags is a participatory activity because “tags are created by Twitter members (rather than constructed as pre-selected options authorized by the site), and may be of various kinds, ranging from tags which categorize the subject matter of the tweet... to idiosyncratic examples which function as expression punctuation” (Page, 2012, p. 184). In line with the Bakhtinian view of intertextuality, the “tag as type” relationship “assumes that other users will also adopt this hashtag and use it as keyword for a Tweet on the same topic” (Zappavigna, 2012, p. 87). Also, we see a real work of heteroglossia in the use of hashtags because particular hashtag can be equally adopted by all interested users. These users may or may not agree with some interpretations of topic marked with the hashtag but they still equally use it in their multi-voiced communication for delivering very different content.

Hashtagging polyphony is characterized by and based on using unique searchable marks (“searchable language”) that create communicative connections identified through linguistic alignment while still providing possibilities for debate and difference. Tweets are dialogic because they are interconnected, unlike, for example, Facebook status updates, because each Tweet can be categorized and aggregated through its evaluative and ideational language (Zappavigna, 2011).

Recent developments in communication technologies for social media radically change the traditional organization of the online social environment enabling more opportunities for dialog, multi-voicedness, and co-creation. Consequently, these changes require even more critical examination and analysis of whether the new discursive practices of media interaction can be described as dialogical or make a genuine dialogue

possible. Created long before the Internet age, Bakhtinian dialogical concepts such as intertextuality, heteroglossia, chronotope, and carnival can be appropriately applied and used as analytical tools for the critical exploration of modern social media. This analysis works at different levels: from exploring general dialogic framework to researching and analyzing some particular recent trends like memeing, hashtagging, or utilizing norm-breaking language.

2.2.5 Design Case Study: Facebook and Concept of Carnival

We already approached the Bakhtinian concept of the carnival in previous sections, and now we can explore the design of Facebook as a case study to evaluate the effectiveness of this Bakhtinian concept in design research and study possible social effects of Facebook design decisions from carnivalistic perspective.

The Bakhtinian concept of carnival is a set of social practices that inverts or constantly attempts to undermine any form of monological (primary and overbearing) discourse in society. The concept of carnival can be applied to analyzing social media (e.g., networking platforms like Facebook) as a modern digital form of a specific way of social communication (carnival) that has existed for hundreds of years. This question is twofold. First, we need to explore how the design of social media use some of the carnival strategies for its own benefits such as user engagement. Second, based on the use of different design decisions, the methods by which social media platform owners can manipulate and even decrease the creative power of carnivalization. Our analytical framework is based on Bakhtin's concept of carnival as an integral part of his dialogic discourse. Our theoretical perspective for analyzing Facebook as a social media

environment is based on its technologically mediated potential for carnivalization or for monologization.

Drawing on his socio-cultural research of the historic Middle Ages and Renaissance carnival practices, Bakhtin constructs a theoretical concept with important social meaning. Bakhtin describes carnivalization as a very specific social and cultural construction, an “immaterial force” that subverts the assumptions of the dominant (authoritative) style and undermines any form of monological discourse in society. In this perspective we see monologization as an attempt to prevent heteroglossia with possible predefined inequality in the level of participation as well as other limitations, – for example, limitations for reflecting on the possibilities of change. Avoiding multiple voices, monologizing, can be realized by limiting the visibility of certain postings or in the avoidance of certain topics. Carnivalization can be seen in the simultaneous presence of opposites, making possible an examination of existing power relations, and the reversal of control hierarchies and speaker roles (enabling the possibility of change). We believe these ideas can be viewed as essential communication strategies in social media design and on modern social network platforms. The most popular of them, Facebook employ this social function of the carnival.

According to Bakhtin, carnival establishes the context in which distinct individual voices are heard and the way in which they interact together. Originally the concept of the carnival was developed by Bakhtin as a way of describing Dostoevsky's polyphonic literary style. In Dostoevsky's novels each individual character is distinctly defined, and at the same time, each character has a critical influence upon the other characters. This

way the voices of others are heard by each individual character, and each renders the voice of the other. Bakhtin frames the carnivalesque as a transformative and transgressive experience:

...medieval man in a way led two lives: one official, monolithically serious and somber; beholden to strict hierarchical order, filled with fear, dogmatism devotion and piety; the other, of carnival and the public place, free; full of ambivalent laughter, sacrileges, profanations of all things sacred, disparagement and unseemly behavior, familiar contact with everybody and everything. (Bakhtin, 1984, p. 173)

Carnival here works as the "threshold" situation where regular norms are reversed or broken and genuine dialogue becomes possible. The carnival, therefore, provides "a place for working out, [...] a new mode of interrelationship between individuals. ... [D]uring carnival there is a temporary suspension of all hierarchical distinctions and barriers so that 'all were considered equal'" (Bakhtin, 1984, p. 123). Historically and culturally carnival was not just a socially appropriate way to ridicule the existing social environment. It was a way to unleash what Bakhtin saw as the people's ability to renew and regenerate the entire social system in the radical inversions of social and conceptual hierarchies. Thus, there are two perspectives on Bakhtinian concepts of the carnival: "carnival is both the name of a specific kind of historically instanced thing – the popular social institution ... – and an immaterial force which such particular instances characteristically embody" (Holquist, 1994, p. 89). With the advent of the digital era when technology overtakes the organic, there is still the ability to carnivalize. By its

primary design purpose as a social network platform, Facebook has a potential for dialogue, multi-voicedness, and carnivalization as we see them as integral parts in Bakhtin's discourse.

Facebook gives a two-fold perspective on the festive-carnival ability in a Bakhtinian sense. On one hand, Facebook effectively uses or channels some of the carnival strategies for its own benefits in order to become something bigger than just a social media platform. Because of user engagement, a specific new form of social communication has been created. On the other hand, we can see how the design of Facebook can manipulate and even lessen the creative power of carnivalization with specific controls and limitations of interactivity.

Our analysis is based on comparing Facebook's design features and Bakhtin's characteristics of the carnival. Below is a table that outlines the main positions for this comparison.

Table 1. A Comparative Table of Bakhtin's Characteristics of Carnival and Facebook's Corresponding Design Features

Bakhtin's characteristics of carnival	Facebook's design features
Carnival (public) square. Carnival culture of the open "marketplace". <i>Free and familiar contact among people.</i> "Carnival is not a spectacle seen by the people; they live in it, and everyone participates because its very idea embraces all the people" (Bakhtin, 1984, p. 7).	<i>Free service</i> Facebook gives free access to its system and free accounts.
Carnival <i>role</i> : dressing up, role playing, role reversal.	<i>Social profile</i> Facebook's detailed profile and Timeline.

	“... like a performer who chooses a stage name, participants in digital exchanges perform themselves, [...] by constructing a specific persona” (Deumert, 2014, p. 37).
<i>Carnival Openness</i> as temporary suspended social distance	<i>Social Openness and Interactivity</i>
“It is the people as a whole, but organized in their own way ... it is outside of all socioeconomic and political organization, which is suspended for the time of the festivity” (Bakhtin, 1984, p. 154).	Facebook's Wall, Pokes, Timeline, Photos, status and a multitude of additional applications to provide and support interaction. Familiarity in conversation. Explicitly in connecting Facebook profiles (e.g., “A and B are now friends”). Sharing information: allows personal profiles to be shared and cross-cut with other profiles.
Carnival participants, carnival voices.	Threads (Facebook is the platform consisting of individual, or at least separate, threads); multiple users/voices.
Symbolic (non-verbal) highly visual language of carnival.	Use of imagery (like emoticons), picture-based communication
Carnival <i>mask</i> , “[T]he mask is the very image of ambiguity, the variety and flux of identities that otherwise, unmasked, are conceived as single and fixed” (Clark & Holquist, 1984, p. 304). The carnival self is transgressed through masking. Doubled carnival identity.	Profile pictures (<i>avatars</i>). Changing of profile pictures (temporary images reflective of the moment). “The profile picture becomes the most important because that image is repeated in the News Feed whenever an action is taken; it functions as a visual symbol of your online life” (Wittkower, 2010, p. 55).
Carnival imagery, eccentricity, carnival grotesque realism, <i>grotesque body</i> (biological profanity and excess, sexuality, the exaggeration of bodily parts).	Facebook's imagery (manipulated, photoshopped). Remixed media. Memes.
Carnival's own language practices (medieval dialogues, parodies and travesties, curses, billingsgate, oaths).	Utilizing a norm-breaking language, creating new orthographic forms, creating numerous laughing acronyms in digital writing, modifying existing texts.

Interactivity on Facebook as seen from the perspective of carnival openness and transgressivity is very controversial. From one side, Facebook has a number of default interactive features for its users: Wall/Timeline (a space on every user's profile page to allow friends to post messages for the user), Pokes (a virtual notification to let users know that they have been poked), Photos (uploading photos/albums), Status (information about user whereabouts and actions). Also, there is a multitude of additional Facebook applications to provide and support interaction. Conversely, Facebook has a lot of tools for controlling and limiting all user's interactions. Facebook profile's privacy settings enable users to choose who can see specific parts of their profile. Only a user's name and profile picture (if applicable) are required to be accessible by everyone.

Facebook users can choose who has access to information they have shared, as well as who can find them in searches. For example, Facebook decides which posts to allow on their Page's Timeline and reviews posts by other people before they are shown. By contrast, on Twitter the default account setting for Tweets is public, so typically there is no need to ask for permission to follow or to retweet/quote someone, it is automatic with no approval needed from the creator of original Tweet. As a result, Facebook's interaction part is "static". "For the most part [...], we monitor our own profile, which contains items in which we are directly implicated" (Wittkower, 2010, p. 72). Most Facebook users are passive participants because they check the site when they get a note, a friend invite, or when they want to check the Status of other people or update their own Status.

Modern digitally mediated communication is characterized by specifically carnivalistic conditions like the remix and manipulation of existing media objects (video, music, images, and texts, alone or in combination with each other). This media manipulation is connected with carnivalization as a way of enabling a free creative approach to the official or dominant intercourse, and a play or transgression of its media language. Thus, a carnivalesque self-presentation in social media profile (e.g., constructing a specific persona that becomes a virtual mask) or living the carnival by exercising in a norm-breaking language (e.g., using vernacular speech interactions) utilize carnival and carnivalistic features. This way carnival is utilized "... in its capacity to illuminate potentially transgressive elements within popular social and cultural practices" (Webb, 2005, p.121) in order to create new meanings out of pre-existing voices or objects.

The built-in possibility for dialogic conversation is based on enabling different modes of responsivity. Users look to express a wide range of emotions in digital public environments. Laughter is the simplest example. Laughter as a way to show different nuances is essential in everyday communication, and this is the main reason why there are numerous laughing acronyms in digital writing. Only one of the most popular laughter acronyms, LOL (Laugh(ing) Out Loud), can have up to 35 variations in meaning (Milazzo, October 21, 2014). The nuances of laughing acronyms used to communicate laughter and amusement are so different and multi-layered that require special research (e.g., an analysis of laughing acronyms as discourse markers in Deumert (2006)).

From the perspective of responsivity with the aim of allowing users to express a broader range of emotions, one of the Facebook's best-known design features, the "Like" button, is very representative of Facebook's general design strategy and has been criticized extensively. Users are adapted to the "Like" button as the quickest way to share content. A click on the Like button will "like" content on the web and share it on Facebook. However, our possible actions should not be limited to just "like/share". Facebook doesn't provide its users with an opposite "dislike" button or ways to show more nuanced feedback to pieces of content on the web. For example, Facebook users cannot express more appropriate emotions for "sad moments". The first question Facebook's Mark Zuckerberg was asked at the Company Q&A in December 2014 was whether Facebook ever considered adding a "dislike" button. This is a fundamental question because it shows that social designs such as Facebook not only represent changing practices of media communication but also address user's expectations of how they can participate in public discussions and how users are able to reflect on design practices. Following Zuckerberg's response, Facebook has no plans to introduce a "Dislike" button: "Some people have asked for a dislike button because they want to say, 'That thing isn't good.' And that's not something that we think is good for the world. So we're not going to build that." (Oremus, December 15, 2014).

Zuckerberg's response directly addresses our questions of monologization and dialogization/carnivalization in a technology-mediated social environment. The possibilities for expressing negative sentiments, conflict, and disagreement, are needed for creating a real multi-voicedness. Facebook has an absolute dominance as the leading

driver of social referrals (overall visits) to sites across the Web. This means that Facebook has the authoritative voice in managing online traffic to news, opinion sites, and to almost any content around the Web. According to shareaholic.com, even after 2016 US election year and all criticism Facebook received for its role, Facebook is still a dominating social media platform. According to the share of visits by social media network, in the second half of 2017 Facebook had 18.16% of visits (30.90% in the first half of 2016). In the same second half of 2017 Pinterest had 7.53%, and Twitter had only 0.74% (Zevin, February 22, 2018).

Facebook's "Like" button significantly influences the distribution of content. In this way Facebook's algorithms became influential in determining what content users actually see or do not see:

No media entity is ignorant of the fact that headlines conducive to Facebook sharing are likely to help its bottom line. ... It's part of the reason that, at a time when Twitter was ablaze with debates about race, the use of force, the militarization of the police, and the rights of protesters in a democracy, Facebook was drowning in ice bucket challenges. (Oremus, December 15, 2014)

With the limitation to only the "Like" button there is no possibility for the presence of multiple voices that can create alternative meaning or can question/reverse existing discursive dominants. Also, Twitter with its different design architecture (e.g., creating new or using already existing hashtags that are transgressive and aren't organized by "like"-relation) looks like a more suitable platform for dialogic

communication. From this perspective, Facebook's design architecture is mainly oriented towards supporting and reproducing the dominant values of any social discourse, especially with the addition of the Trending topics feature (January 16th, 2015) that is designed to surface "like"-relevant conversations. As a result, even if initially

Facebook was designed to facilitate information flow in social networks, ... it quenches sites of dissent and publicly-held discussion ... So you actually would want to design away sites of public exchange of opinion. It is not about discourse as such, but rather the diffusion of non-publicly actionable signals. (Wagner, Bratteteig & Stuedahl, 2010, p. 242)

Facebook's architecture is linear in terms of positioning multiple voices (posts). Online communication is more often asynchronous, and usually, there is a lag in between when a new post is made, and when other users see that post. Predictably, the more Facebook friends a user has, and the more active those friends are, the more quickly any post will get shifted down in the scrolling line and displaced by newer posts. For the most part, users monitor only the currently visible portion of the page (or news feed), which contains the most recent posts. Older posts or items from the bottom of the feed most likely don't receive immediate attention and are even missed altogether. The most recent posts at the top of the feed have more chances for feedback and exchange. Using tags on Facebook doesn't really solve the linear positioning issue. Facebook has its own tagging feature, but those tags are very limited in terms of how they can mark content. Facebook tags create a link to someone's profile. The tagged post may also be added to someone's Timeline. Using hashtags with their carnivalistic transgressiveness on Facebook is fairly

new and is not as effective as on Twitter or Instagram. When Facebook first used hashtags in 2013, posts with hashtags had only 0.80% median viral reach per fan, and posts without hashtags had 1.30% median viral reach per fan (Ayres, n.d.).

The spread of locative media applications (location-aware interactive technologies) created a new layer of digital information exchange that augments physical infrastructure in real-time. Socially mediated interactions in locative media mix physical and digital environments creating one of the best examples of hybrid spaces. However, locative geoweb social media tools (e.g., Facebook status update feature updated to a new location every time users check in and "Nearby Friends" with opt-in real-time location sharing) actively record, collect, use, and even disclose to third parties significant amounts of information about everyday user actions and detailed patterns of activities. In this way locative media can encourage users to maintain their routines, and support patterns of activity, and, as a result, disallow the carnivalesque transgression of everyday rules, practices, or recognized patterns.

By its design, Facebook provides users with the inherent possibilities for dialogue in the social environment. Also, there are carnivalistic features that affect user/participant roles and possible power distribution. Both polyphonic and monologizing discursive dynamics are present. The polyphonic dynamics include the built-in possibility for conversation and multi-voicedness. The monologizing dynamics includes limitations on the visibility of specific postings that can result in deemphasizing or excluding certain topics. Certain carnivalistic features (e.g., simultaneous presence of opposites as a transgression of the traditional binary system, reversing traditional speaker roles,

familiarity in conversation) are also present, but “since the dominant ideology seeks to author the social order as a unified text, fixed, complete, and forever, carnival is a threat” (Clark & Holquist, 1984, p. 301). Often these carnivalistic features are counteracted by Facebook's universal design conventions and practical features, which are very effective in avoiding multiple voices in communication and in allowing inequalities in participation by enabling/disabling particular features of the platform.

There is no design mechanism for content mediating and distribution based directly on user participation or user feedback that could potentially prevent disinformation spread or social bots from distorting activities in the way Facebook was used to affect results of the 2016 United States presidential election (e.g., Bessi & Ferrara, 2016; Persily, 2017). We believe this is one of the main reasons for current concerns about Facebook's role in future political campaigns. Also, these political implications of social media design and deployment point to recent attempts in increasing a level of government involvement in controlling internet use (e.g., Armstrong, May 12, 2017) as it relates to techniques for managing the flow of online information and especially to the ways to control it in the changing political environment. From this perspective, we share the concern about Facebook as an influential “universal standard”. “[A] design like Facebook will tend to either fall by the wayside or become a universal standard, and if it's a universal standard, it becomes harder to unseat than a government” (Lanier, n.d.). This tendency towards “universalism” and homogenization is in direct contradiction with Bakhtin's understanding of the dialogue and carnival as a kind of existential heteroglossia with an inversion of social and conceptual hierarchies.

Acknowledgment and awareness of the carnivalistic frame as design strategy contributes as an essential verification condition in making a genuine dialogue possible in the social media environment.

2.2.6 The Concept of Chronotope and Time-spatial Social Media Apps

Bakhtin's concept of chronotope, originally accounting for space and time relations in written narrative, gives us a possibility to identify and theorize about a digital chronotopicity which is a dynamic result of multi-accented, data- and process-driven communications in social media applications including blogs and wikis, real-time spatial applications (e.g., Waze or Google Maps), or simulated online environments (e.g., Second Life).

In this section, we introduce the concept of chronotope as it relates to designing for social media. Our next chapter is specifically dedicated to researching Waze's design and user experience using explanatory chronotopic analysis.

Bakhtin positions time-space as a foundational element in his philosophy of dialog. The chronotope is an epistemological category defined by Bakhtin as "the intrinsic connectedness of temporal and spatial relationships that are artistically expressed in literature" (Bakhtin & Holquist, 1981, p. 84). In "The Dialogic Imagination," Bakhtin defines the chronotope:

We will give the name *chronotope* (literally, "time space") to the intrinsic connectedness of temporal and spatial relationships that are artistically expressed in literature. ... What counts for us is the fact that it expresses the inseparability of space and time (time as the fourth dimension of

space). ... spatial and temporal indicators are fused into one carefully thought-out, concrete whole. Time, as it were, thickens, takes on flesh, becomes artistically visible; likewise, space becomes charged and responsive to the movements of time, plot and history. This intersection of axes and fusion of indicators characterizes the artistic chronotope. ... The image of man is always intrinsically chronotopic. (Bakhtin, 1981, pp. 84-85, emphasis in original)

Following Kant, young Bakhtin starts his carrier by accepting the destruction of objective unity (Bakhtin, 1993, p. 331) and with an attempting his own interpretation of Kantian epistemological separations (e.g., between mind and world, between perception and self-knowledge, between intellectual and sensible). From this perspective Bakhtin “militantly insists on the foundational importance of a divided subject” (Holquist, 2010, p. 25) and concentrates his attention on questions concerning the “spatial form of the hero” and the “temporal form of the hero” (Bakhtin, 1990, pp. 22-52, 99-138).

Also, in his early works of the 1920s Bakhtin introduces one of his most famous time-space visual metaphors defining the necessity of the other (other person, other voice) in an understanding of the self. This is what Bakhtin calls the “excess of seeing” or the surplus of seeing: a phenomenological analysis of two persons looking at each other becomes a way for Bakhtin to illustrate and define the bifurcated self.

When I contemplate a whole human being who is situated outside and over against me, our concrete, actually experienced horizons do not coincide. For at each given moment, regardless of the position and the

proximity to me of this other human being whom I am contemplating, I shall always see and know something that he, from his place outside and over against me, cannot see himself: parts of his body that are inaccessible to his own gaze (his head, his face and its expression), the world behind his back, and a whole series of objects and relations, which in any of our mutual relations are accessible to me but not to him. As we gaze at each other, two different worlds are reflected in the pupils of our eyes...

(Bakhtin, 1990, p. 23)

Spatial ("our concrete, actually experienced horizons do not coincide") and temporal ("at each given moment") constitute our understanding and measure all aspects of human existence, most importantly, the identity of self, the distinction between I and the other, the work of I and the other in dialog. Time-space is foundational in establishing the possibility and continuity of Bakhtinian dialogue:

My temporal and spatial boundaries are not given for me, but the other is entirely given. I enter into the spatial world, but the other has already resided in it. The difference between space and time of *I* and the *other*.

(Bakhtin, 1986, p. 147, emphasis in original)

Thus, Bakhtinian dialogue is not just a relation, and time and space are not boundaries, because chronotope transgresses them as boundaries. Boundaries can be overcome through interaction: time and space interact in chronotope, interact in experience. This is the way that the concept of chronotope can be used as a "unit for analysis [...] according to the ratio and nature of the temporal and spatial categories

represented" (Bakhtin & Holquist, 1981, p. 425). And, as we see, "The distinctiveness of this concept as opposed to most other uses of time and space in literary analysis lies in the fact that neither category is privileged; they utterly interdependent" (Bakhtin & Holquist, 1981, p. 425). For Bakhtin language as "the most immediate reality" establishes the effectiveness of chronotopes in the socio-cultural environment. "In our daily use of chronotopes the abstractness of time-space is domesticated when we deploy them in speech" (Holquist, 2010, p. 31).

Language makes possible for our "I" to be filled with different meanings and in this way to be the point of reference for all spatial and temporal processes:

[T]he first person pronoun, coupled with indicatives such as "then", "now" and "here", "there" serve to calibrate positions in abstract space and time that are always conditioned ("thickened") in the event by the specific values that society attached to them in any particular time and place.

(Holquist, 2010, p. 32)

"Now" and "here" marker the proximity of the speaker's horizon, "then" and "there" marker the distance of the other. Self's need of the other through different chronotopes creates a possibility for dialogue.

As we can see, these dialogic descriptions are concerned primarily with the time, sequence and environment, and their functionality evolves through the spatial dynamics in which the dialogue takes place. As the chronotope "allows us to move analytically within emerging practices of digital communication design and their enactment" (Wagner, Bratteteig & Stuedahl, 2010, p. 75), the concept is already used in researching

different digital genres, such as online blogs, virtual portfolios with their mix of online mediation and media types, and the features and functionalities of simulated online environments such as Second Life.

There is an impressive array of real-time spatial or locative applications and, in particular, navigation applications that involve social activities. Concentrating our analysis on apps like Waze, Google Maps and Apple Maps provides us with an effective practical example of using the dialogic approach in designing for social media. The connected moment and situation (chronotope) indicate a dialogue that is a dynamic result of combining different streams of digital information. The concept of chronotope as an analytical category is at the center of such analysis, “[t]he chronotope, functioning as the primary means for materializing time in space, emerges as the center for concretizing representation” (Bakhtin & Holquist, 1981, p. 250). Thus, focusing on the temporal and spatial information flows within application brings the necessity of such a digital chronotopicity that should ground both data flows and represent the practical functionality of modern real-time navigation social media.

We can say that, in very different ways, as shown in the next chapter, Waze and Google Maps found the most appropriate chronotope for driver's needs. These apps position the driver (I, self) relative to other drivers (the other(s)). The best route for me can be obtained only by integrating my time-space into time-spaces of other drivers where other cars (other voices) are communicating how fast and in which direction they are moving. For example, the uniqueness of Waze and its “software's genius is to turn all the smartphones running it into sensors that upload constantly to the company's servers

their location and speed information” (Brynjolfsson & McAfee, 2014, p. 60). As a result, Waze and Google Maps create the *digital polyphony* of different voices where multi-voicedness is based on running applications on users’ mobile devices. Multiple voices (multiple sensors) are participate equally in such a dynamic digital chronotopicity. We are using time-space data from others around us, and, from this perspective, all of them are communicate equally: either by actively submitting user driving reports or just by driving with applications open.

The result is that instead of traditional static maps and static routes we see dynamic dialogization of maps and routes because the app's algorithms are oriented on working with the simultaneous presence of alternative routes: because of current updates on traffic conditions maps are active and actionable for local decision-making purposes. Such dialogization of maps is the result of users’ interactivity based on submitting their road reports on traffic jams, accidents, police traps, closures, or any other hazards along the way. Even visually Waze’s main map window is an example of the use of Bakhtinian “excess of seeing,” or even is a sum of multiple “excess’ of seeing” because the user views his own car-icon and, sees other Wazers around himself and uses data from multiple cars/Wazers around him. According to Bakhtin,

As we gaze at each other, two different worlds are reflected in the pupils of our eyes. It is possible, upon assuming an appropriate position, to reduce this difference of horizons to a minimum, but in order to annihilate this difference completely, it would be necessary to merge into one, to become one and the same person. (Bakhtin, 1990, p. 23)

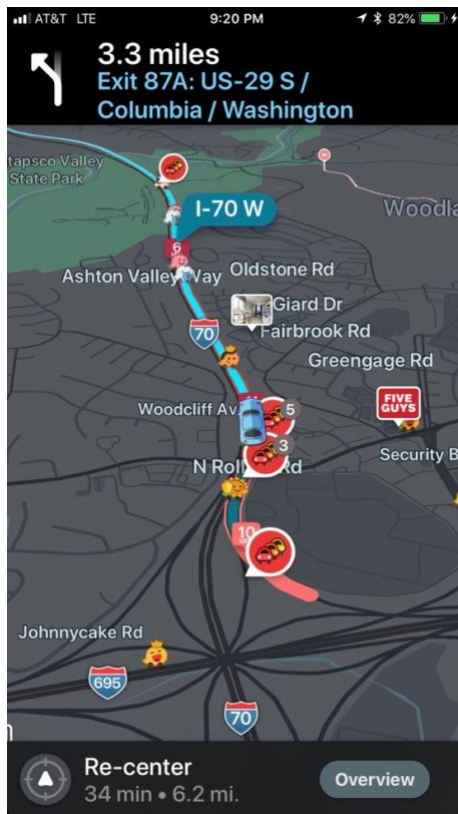


Figure 1. Screenshot of the Waze mobile app interface on iOS device.

Wazers nearby as “excess of seeing.” At least seven Wazers are visible on a less than three miles long segment of Route I-70 at 9:20 PM (Baltimore County, MD).

Map data ©2018 Waze. (Screenshot by author)

As we are able to see all Wazers around us (Figure 1), two different things happen with Bakhtinian “excess of seeing” in Waze. First, “different worlds” are multiplied by a number of Wazers who are “gazing” and driving around. Second, knowing that our route is based on integrated data from multiple Wazers (on what different Wazers reflect), we can say that Waze merged “this difference of horizons”.

There is also a very interesting example of *carnivalization* using Waze’s pre-build design options. All Wazers can submit road report tagging the exact location of police

vehicles on a map and label them with a distinction as "visible" or "hidden" to other drivers. Then, other Waze users see a police icon on maps. Here is user's feedback about making this kind of report:

I know for a fact that it works and updates fast. While sitting at a traffic light, I updated the app for the officer sitting in his car waiting for red light runners. When I looked over at the officer, he had both hands up in the air, like "..."! We both started laughing. (Definitely not hiding..., August, 2018).

Police officers in the US know about their presence on Waze. Based on feedback from a person who identified himself as the police officer, "I'm sure that not only are highway patrol officers aware of it but most, if not almost all police officers are. In fact, I use it intentionally when I'm on duty to see when I've been spotted." (Conner, December 13, 2017). Miami police took it further and decided to extend and employ a carnivalistic approach here:

Hundreds of Miami cops have reportedly downloaded the app just to falsely report their own locations. By flooding Waze with misinformation, the officers hope to trick drivers who use the app to avoid law enforcement when driving recklessly. (Plaugic, February 12, 2015)

As an open-ended system, Waze is open for carnivalization. These "false" actions (historically the central ritual of the carnival is often the false coronation/deposition of the carnival king) are exactly a Bakhtinian carnivalistic reversal of existing (power and

social) relations and participants (user) roles that Waze perfectly supports because of its real digital multivoicedness.

Here is another interesting example of how police officers use Waze (Figure 2). One of the Wazers took a screenshot capturing messages from the police officer whose location was displayed on the app's interface and was marked as "hidden."

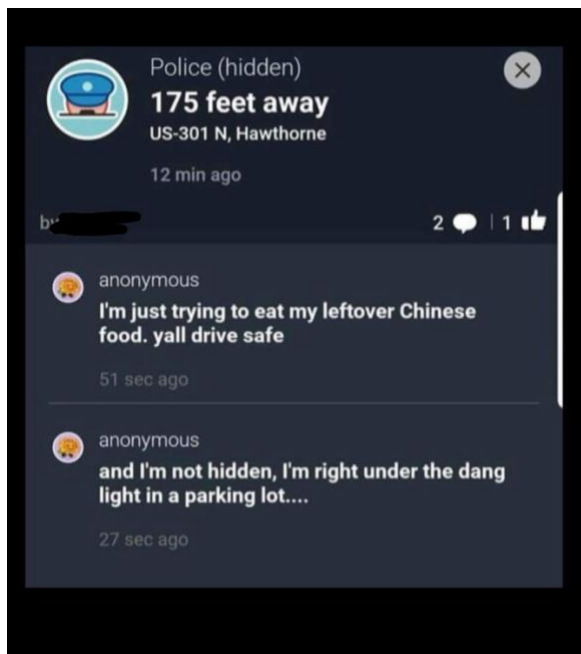


Figure 2. Screenshot of the Waze mobile app interface. "Police (hidden)" info and chat window: (most likely) the police officer whose location is displayed responds with two text messages. (Definitely not hiding..., August, 2018).

Here is an explanation from the user who took the screenshot, "the anonymous commenter IS the cop. He was marked as hidden when in reality he was just eating his dinner in a parking lot and not even pulling people over." (Definitely not hiding..., August, 2018). Many users confirm that a lot of police officers behave the same way: "We have a cop in NH that does this too. He's just there to make sure people drive safe",

“A cop said ... that he would mark his own location on Waze so he wouldn't have to pull a bunch of people over lol”, “My friends cousin is a cop and he uses Waze, saw someone report him in real time and commented almost the exact same thing”, and, finally, “I'm a cop, when I run traffic I use Waze. When someone spots me on the app I give them a thumbs up and move. No use whining about it like I've heard some other cops do. People who are smart about speeding should get an advantage.” (Definitely not hiding..., August, 2018).

Another user experience cases of the unconventional approach in using Waze are about neighborhood communities in different parts of the US providing intentionally false data to the app (e.g., Bliss, April 29, 2015; Descant, April 24, 2018; Hendrix, June 5, 2016; Marshall, July 5, 2016). We will use a geographically close example from Takoma Park, Maryland. At some point, a lot of cars suddenly filled this quiet Washington, DC suburb. “The suburbanites retaliated by firing up Waze, the navigation app they blamed for routing the unwanted burst of traffic their way.” (Marshall, July 5, 2016). Based on the Washington Post report, one of the neighbors

became a Waze impostor. Every rush hour, he went on the Google-owned social-media app and posted false reports of a wreck, speed trap or other blockage on his street, hoping to deflect some of the flow. He continued his guerrilla counterattack for two weeks before the app booted him off, apparently detecting a saboteur in its ranks. (Hendrix, June 5, 2016)

One of the users described a similar case about reporting false data: “[S]treet racing around your neighborhood at night? Go on Waze and report a police officer in

your street.” or “Report an accident on Waze and viola, no cacophony of honking while I eat my supper.” (ULPT, 2018, February).

Waze technically limits such activities by not counting provided data if a driver is not actually in motion. Most importantly, the app constantly self-corrects, based on combining road data from other Wazers and reports confirmation results from the app's vote/upvote feature. However, based on user comments, there are cases when the Waze vote/upvote report feature could be compromised. We already studied how police officers are creative in their adaptation of Waze. “Further up a cop says he goes into a hide spot, waits till he gets pinged and then upvotes the location and moves spots. So they are even sneakier and take advantage of the upvote system.” (Definitely not hiding..., August, 2018).

All these cases of unconventional use of Waze by regular users, officials like the police officers, specific groups like neighborhood communities show that the app is open by its design to very different approaches. We believe this is one of the main reasons for Waze's success and popularity: users feel and explore the app's gamified features that are still connected to the real time-space environment. Here we refer again to Bakhtinian understanding of carnival as “the playful element of life,” the necessary element that corresponds to human history and cultural traditions:

The mask is connected with the joy of change and reincarnation, with gay relativity and with the merry negation of uniformity and similarity; it rejects conformity to oneself. The mask is related to transition, metamorphoses, the violation of natural boundaries, to mockery and

familiar nicknames. It contains the playful element of life; it is based on a peculiar interrelation of reality and image, characteristic of the most ancient rituals and spectacles. (Bakhtin, 1984b, p. 40)

Waze's design phenomenon is based on using multiple streams of information. We can see it as a *polyphony* of data streams: digitized street maps, map edits from the online community, GPS location information, sensor data (location coordinates for cars/drivers broadcasted by the application), social data, user-generated data – real-time road reports submitted by users (Brynjolfsson & McAfee, 2014, pp. 60, 61, 69). This way Waze creates a dialogic data-driven process where the time-place of every event is recognized or can be concluded from time-spaces of other events. These highly detailed time-space constructs configure the environment that corresponds to Bakhtin's understanding of the “chronotope of the road” or how time and space form a road:

On the road the spatial and temporal series ... combine with one another in distinctive ways, even as they become more complex and more concrete by the collapse of social distances. ... Time, as it were, fuses together with space and flows in it (forming the road). (Bakhtin, 1990, p. 243)

In this representational perspective, the situated, dynamic processes develop through the interaction and chronotopes work as practical defining features as they can inform and affect our design choices for particular uses. For example, in Spring 2015 Waze added a new “Time in Traffic Bar” feature (Waze - Official Blog, April 01, 2015), which appears on the left side of the interface and provides time-space information related to the current traffic jam. We can see that the “minor” chronotope of the traffic

jam is incorporated in “main” user's chronotope-route. One simple “Time in Traffic Bar” (Figure 3) feature combines information about how long user's traffic jam is expected to last (time) and visually showing user's progress in moving through traffic line (space).

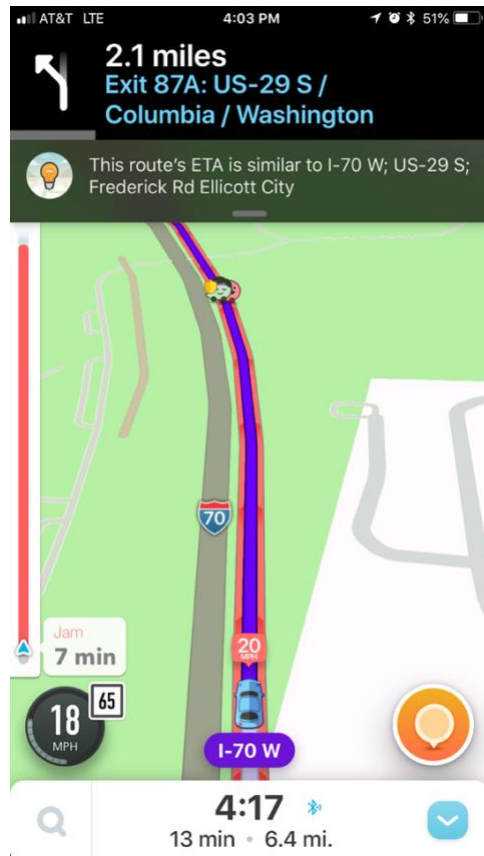


Figure 3. Screenshot of the Waze mobile app interface on iOS device.

Waze's “Time in Traffic” Bar.

Map data ©2018 Waze. (Screenshot by author)

Waze achieves temporal and spatial coherence bringing multiple streams of information together and presenting them to users in the form of dynamic chronotopes each with its own characteristic timing and pacing: unique route(s) calculated for each unique user at unique moments in time. Such uniqueness follows the specifics of understanding of Bakhtinian chronotope: “It must be a chronotope of someone for

someone about someone. It is ineluctably tied to someone who is in a situation” (Holquist 1994, p. 151). The chronotopes are formed by patterns of constant changes in the continuity of an ongoing collaborative activity (multidirectional user-generated and sensor data) with occasional spatio-temporal intensifications (e.g., traffic jam). What is also important is that all these information streams are digitized or are originally digital: it means that traditional boundaries in connecting different types of information (like time vs. space as flows of different kind of data) are already almost removed owing to digitization that makes it easier to produce one result (one route) out of different streams. Multiple layers and even different generations of digitized data are combined and recombined by Waze. All different streams of information mentioned above existed for a long while before Waze application was designed. What Waze does so successfully is a recombination of the social network, data transmission devices, sensor data, and GPS: a recombinant process whereby all these different information flows are constantly dialogized and dynamically produce routes-chronotopes.

We explored that as a system Waze is based on the dialogical recombination of a dynamic time-spatial data received through user participation. Now, taking into account the Bakhtinian concept of the chronotope, we can research Waze using our interpretation of the exploratory chronotopic data analysis.

3.1 Methods and Techniques for Data Analysis

This chapter outlines our methodology for researching constantly evolving social media platforms using key theoretical concepts from the work of Bakhtin. We started by connecting Bakhtinian ideas to the design of different social media applications in the previous chapter. Our main research chapter is dedicated to applying the chronotopic analyses that is based on our interpretation of the Bakhtinian concept of chronotope as an experiential and critical approach to the design and user experience of Waze, a crowd-sourcing navigation application.

We started with a qualitative analysis of Bakhtin's works and studies of Bakhtinian theory from the perspective of information and interaction design. We used an extensive case sampling of modern social media applications with their variety of media design types and discourse modes as an empirical context to develop, describe and demonstrate our initial hypotheses about interconnections between Bakhtinian ideas and design research and practice. Then, in correspondence with our research questions, these theoretical and empirical findings were summarized as a foundation for a detailed chronotopic data analysis using Waze.

Using Waze as a case study, we explore user experience and user feedback to research how the app enables new digitally mediated time and spatial practices to be realized and embodied by users. We are framing our research within the theoretical framework of participatory design. We apply the Bakhtinian concept of chronotope as a

foundation for his theory of dialogue and as one of the means for participatory design theory and practices.

We are addressing the design and time-spatial properties of Waze – in particular, its data sources, routing algorithms and program interface – while using the chronotopic analyses as a critical study of the development and design of the app. We are collecting our data by examining an expansive complex of online materials which includes different platforms for acquiring user feedback: user discussion forums, author blogs, help or wiki resources with user posts, comments, and other additions. Because Waze (and Google Maps, its main competitor) has a mobile app component, we explored user reviews posted on the App Store and the Google Play online store sites. Regarding the use of App Store or Google Play user app reviews, we agree, that “[t]he key, in terms of user research, is to focus on the substance of what the user is saying, as opposed to the rating (i.e., one star to five stars)” (Peterson, 2017, May 02). When the user is excited about some app features or asked about missing features we were looking for practical data points or reasons behind such aspects of the app using experience.

All these online platforms are open for public discussion. Diverse groups of users with very different evaluations interact to discuss specific topics related explicitly to Waze, Google's package of geo software, Apple Maps, MapQuest, and similar social media applications. We refer not only to product-specific industrial sites supported by Waze or Google but also to a growing body of multi-topic forums (like Quora, Mac Rumors, Ars Technica, or Reddit), and to open-source software development platforms (e.g., GitHub) that can be searched for product-specific or feature-specific threads. For

example, based on our experience with Quora, we agree that “Quora offers an almost scholarly approach to the format, with many users possessing strong subject matter credentials to validate their expertise” (Peterson, 2017, May 02). At the beginning of fall 2018, Quora had 26.2k users following different Waze-related topics (Waze – Quora, n.d.). Also, online communication platforms like Quora provide important feedback from discussion participants such as Waze product engineers (e.g., Antokolsky, 2018, January 6) or police officers using Waze (e.g., two participants identified themselves as US police officers responding in the “Are highway patrol officers aware of the Waze app?” thread (Conner, December 13, 2017)).

We aim at detailed and comprehensive descriptions of design and user experience using qualitative research as an exploration within the dynamic contexts of reality. We share the same approach with Dan Lockton when he points out the importance of the qualitative method in design research:

Much of how we construct meaning in the real world is qualitative rather than quantitative. We think and act in response to, and in dialogue with, *qualities* of phenomena, and relationships between them. Yet, quantification has become a default mode for information display, and for interfaces supporting decision-making and behavior change.

There are more opportunities within design and human-computer interaction for *qualitative* displays and interfaces, for information presentation, and an aid to help people explore their own thinking and

relationships with ideas. (Lockton, Ricketts, Chowdhury, & Lee, May 6, 2017, emphasis in original)

Analysis of qualitative data often allows studying challenges that are rarely explored with quantitative data, as we interpret wide-ranging feedback from many different users and understand complex situations. We believe Bakhtinian understanding of dialogue is closely connected to the way in which qualitative data represent the user's subjectivity and aim for consistency in data analysis. We share the following understanding and application of qualitative methods and qualitative data:

Qualitative methods do not aim to eliminate subjectivity – instead, they accept that subjectivity is inherent to process of interpreting qualitative data, and they strive to show that interpretations are developed methodically to be consistent with all available data, and representative of multiple perspectives. (Lazar, Feng, Heidi, & Hochheiser, 2017)

Seeing this way, qualitative research as dialogic exploration is very appropriate for studying Bakhtinian dialogic theory in the context of the social media applications that display interlaying flows of dynamic data.

We follow the research strategies, practical guidelines and techniques on using online materials as a qualitative research method as discussed below. These methods and methodology are based on a critical exploration of:

- an increasing amount of online research in general (Bhattacharya, 2017; Hand & Hillyard, 2014; Hine, 2005; Marotzki, Holze, & Verständig, 2014; Media Data Collection, 2017);

- online discussion sites, forums, communication platforms, and blogs as one of the most frequently used and effective qualitative research methods (Giles, 2017; Guest, Namey, & Mitchell, 2013; Holtz, Kronberger, & Wagner, 2012; Hookway, 2017; Hutchinson, 2014; Im & Chee, 2012; Peterson, 2017, May 02); and
- exploring wider opportunities for qualitative data analysis within information and interaction design research in particular (Bilić, 2018; Lazar, et al., 2017; Morse, 2009; Mortensen, September 27, 2018; Lockton, et al., May 6, 2017).

We use the following data analysis methodology and techniques in a coordination outlined below.

Table 2. A Coordination of Data Analysis Methodology and Techniques

1	A fit with research purpose and research questions
2.	Research logistics. Quality and credibility of user data
3	Using the structure and functionality of online forums
4	Analyzing qualitative data
a)	Thematic content analysis
b)	Content coding concepts and content categories: text-reducing and text-enhancing methods
c)	Online participants observation
d)	Dialogical qualitative data analysis
e)	Exploratory chronotopic data analysis
5.	Different perspectives for analysis and interdisciplinary approach

1. A fit with research purpose and research questions.

Online discussion sites provide us with a large amount of easily accessible and searchable data organized in relation to specific topics. Online discussion forums give access, in a fairly 'straightforward' way, to people's views and experiences around a topic of interest, ... give 'fly-on-the-wall' access to data not impacted on by the researcher ... they offer exciting examples of communities interacting, exhibiting all the complex negotiations between individuals and groups that social psychologists have been desperately trying to recreate in the laboratory for decades. (Giles, 2017, pp. 193, 194)

Online forums users are characterized as a specific category or group of discussion participants. The research project determines the selection of a certain user group (online community) and content specificity. This involves "collecting potentially relevant websites and then checking whether the forums are amenable to analysis in terms of quantity" (Holtz et al., 2012, p. 8). Then we select appropriate online forums and sites as research data sources; these sites should be typical and representative for the discourse within this group and contain the data most relevant to the topic in question.

One of the "unique characteristics of online forums could be natural selection of specific participants" (Im & Chee, 2012), so, we can expect the discussed data to be unbiased. All of the participants are familiar with an application or its particular features, or they are experts, – apps owners/creators providing support information. We believe that content and thematic analysis of online forums dedicated to navigation apps and

modern social media related to time-space constructs is essential to achieve our research purposes and to address our research questions.

2. Research logistics. Quality and credibility of user data.

We understand blogs and similar online sites as modern forms of generating social communication data. This is multimodal and multimedia data: textual, audio, visual (including interface design) and interactive as it describes user actions. These various types and modes of data are connected by the fact that they provide first-person accounts for understanding and experiencing different aspects of everyday life as they relate to the use of social media.

We use the online discussion forums as a qualitative component of our study because we are looking for a wide range of discourses to receive an adequate amount of user feedback about Waze and similar apps. The navigation apps users geographically resided in widely dispersed areas and their number is different from area to area (e.g., number of Wazers is essential for the app's quality and in larger cities we usually have more users). While selecting and defining appropriate forums, we "extend the corpus until saturation of perspectives is reached" (Holtz et al., 2012, p. 8). By switching/comparing multiple online forums dedicated to different (or competing) apps we have more justification for the quality and credibility of the feedback data expressed.

3. Using the structure and functionality of online forums.

Regarding the structure and functionality of online forums and similar sites, we share the understanding that "[t]aken together, the hierarchical structure of forums informed by a previous content analytic structuring of the corpus makes internet forums a

rich source for in-depth qualitative research” (Holtz et al., 2012, p. 12). Participants could post messages, or initiate discussion about topics of interest in any form (e.g., app use practical examples, opinions, or responses to other users questions). Participants could comment on official app guidelines or instructions. In cases when an app provides its official help or instructional resources, we expect some degree of monitoring/steering of online discussion from app owners/makers.

4. Analyzing qualitative data.

All messages posted on the discussion forum could be explored as the content data for *discourse analysis* and the interactions among the users could also be used as the *participant observation* data. We use online communication platforms as a data collection and analysis method to critically generate descriptive data on the specific research topics rather than just an observation of a data collection environment.

a) Thematic content analysis. We started with *thematic content analysis* as an approach to systematically identifying specified characteristics of the main data patterns across different forums to explore their broad content as the dataset examining regularity and variability in the data.

We then used *text-reducing* as well as *text-enhancing* “in-depth” content analysis methods (Holtz et al., 2012, p. 10-11). Then, if our research logic required, we “quantified” some of our qualitative data results agreeing that “[a]lthough many people think content analysis is a qualitative research method, both quantitative and qualitative techniques can be used in the process of content analysis” (Lazar, et al., 2017).

b) Content coding concepts and content categories. We used the *text-reducing method* to outline main themes and overlapping contents within an extensive amount of textual material from online discussion sites and to compare different user feedback. Interacting with data content, we developed a set of relevant *content coding concepts and content categories* that correspond to our research questions and to the chronotopic analysis of Waze and Google Maps apps as we often compare these two applications.

Our process was to derive concepts that are supported by identified patterns in our content data, then develop those concepts in terms of their characteristics and according to our research questions. For example, to define and validate differences in Waze and Google Maps routing algorithms, we compared opinions expressed by individual users within different sites and platforms, then we processed this data as connected to our content categories, and classified possible views as they relate to different perspectives on this topic. As a result, we reduced the amount and characteristics of these user opinions to reference the most common, well-reasoned and practice-based user opinions. Later we used the same content coding categories for laying out a text structure of our analysis, for describing the data relationships and for summarizing and grounding our findings.

We used *text-enhancing method* when we needed to analyze the contexts of online discourses. "In-depth" contextualizing provides a better understanding and interpretation of certain postings as they are related to context and to any other background information on the forum or particular online user group, or to earlier research on the topic or content in question. For example, when we're defining and comparing the chronotopic nature of

time with the nature of space and place in Waze and Google Maps in correspondence with the Bakhtinian literary theory of chronotope, we used a more *linguistic orientation to discourse analysis* and put an additional emphasis on the style of communication about time-space constructs, including the use of metaphors and other language practices for expressing a range of emotional references in user forum postings. For example, from this perspective “the metaphor illuminates the fact that the ‘assembly’ of an account involves choice or selection from a number of different possibilities” (Gill, 2000, p. 177). Use and selection of a particular metaphor usually strongly corresponds to the point of view of the discourse participant.

c) Online participants observation. We also gather our research data by continuously observing (Bhattacharya, 2017, pp. 51-52, 140-145; Guest, Namey, & Mitchell, 2013, pp. 75-112) digital environments such as online forums and other types of virtual worlds looking for the main trends in discussion topics, monitoring participants' experiences in the online spaces (e.g., patterns of interest, how many participants are interested in the topic, how and when certain terms are used, what kind of questions and how often asked, and what kind of responses received), analyzing users feedback for specific app features or users feedback for particular events. For example, Waze was bought and now is owned by Google even though there is a Google-native Google Maps application very similar to Waze; so discussions about the future of Waze as Google-owned product provide us with a lot of information about the uniqueness of Waze and possible future developments as it will become more coordinated with the rest of the Google products.

Regarding observing and analyzing the nuances in subjectivities, online participants observation is closely related to the dialogical qualitative data analysis approach discussed below.

d) Dialogical qualitative data analysis. It is important for us to refer to the methodological approach in qualitative data analysis, that is, trying to establish a dialogical approach based on Bakhtinian theory of dialog. We refer to Paul Sullivan's work "Qualitative Data Analysis: Using a Dialogical Approach" (Sullivan, 2012) where the author outlines a distinctiveness of a dialogical approach in the qualitative analysis as an important tool to view discourse as the language in action. Applying a dialogical view of subjectivity in qualitative data analysis, Sullivan argues for the development of "dialogical subjectivity" and provides the methodological analysis of subjectivity as changing and responsive to others because dialogic discourse has "potential to shape selves and look at how selves can respond, in different ways, to this shaping" (Sullivan, 2012, p. 43). Similarly to our use of qualitative data analysis, Sullivan notes a perspective for further extending dialogical approach into online-based qualitative research.

While classifying and selecting user forum data for content analysis, we used the dialogical approach to preserve original dialogic relations in forum threads, approaching every participant as a "conscious, feeling subject" (Sullivan, 2012, p. 41) and analyzing how user feedback may subsequently be affected by the usual multivoicedness and language expressivity of online communication.

e) Exploratory chronotopic data analysis. Finally, we use the exploratory chronotopic data analysis that is directly related to research. We draw on the

methodological idea of the exploratory chronotopic data analysis introduced by Adams and Gahegan (Adams & Gahegan, 2016). Coming from a perspective of the historical geographic information field, these authors “processed the English Wikipedia text to find all co-occurrences of named places and dates and discovered that times are linked to places in a large majority of cases” and “suggest that chronotopic data analysis will lead to the development of new data models and methods for geographic information science and related fields, such as digital humanities” (Adams & Gahegan, 2016, p. 243). Using existing open source tools and custom analytic scripts, Adams and Gahegan added temporal and placed tagging to a large corpus of unstructured wiki text collections and were able to find and start analyzing time-space narrative co-references. As they conclude,

[i]n this paper we carve off a preliminary slice of this research”, and one of the biggest challenges for exploratory chronotopic data analysis is formalizing complex spatial and temporal references. For example, “What kinds of query operators and interfaces are needed? How do we extend the current formal models of topology and spatial relations to address these more complex, multi-space, multi-time objects? (Adams & Gahegan, 2016, p. 257)

We believe that there is a significant research potential in applying the idea of exploratory chronotopic data analysis to Waze and Google Maps apps as they provide effective interfaces and dynamic data models for integrating spatio-temporal elements. So, from the perspective of our work, our chronotopic analysis is two-fold. First, we

analyze how social media navigation apps in their information and interaction design connect time, place, and space. And, second, how user experience data from large, crowdsourced online resources is referencing these spatial and temporal connections. More details about our interpretation of the chronotopic data analysis as related to information and interaction design in general, and to researching social media navigation apps in particular, are provided in the introductory part of the next chapter.

In general, the process of our research on online communication sites, our research concepts and findings confirm that they, “[a]lthough time-consuming, ... offer the possibility of immersion in the community under consideration, providing rich context that might enable deep understanding” (Lazar, et al., 2017).

5) Different perspectives for analysis and interdisciplinary approach.

As we are bringing Bakhtinian concepts from literature studies to a field of information and interaction design, a careful exploration of discussion data pointing to interdisciplinary connections is essential for our work.

A wide range of different explanations and arguments on online forums allow us to discover many important interdisciplinary connections (e.g., how Waze could potentially be used for SAS (Statistical Analysis System)) in automatic routing around locked datasets (Hughes, 2016); an open-source code to add layers to the Waze Map Editor to display additional GIS data (GitHub – WazeDev/WME-GIS-Layers, 2018); or how navigation media correspond with the newest trends in GIS (Geographic Information System) and the Spatial Humanities (Travis, 2015)).

We believe that the diversity and multivoicedness of online forum resources specifically correspond with a Bakhtinian understanding of social communication as a continuous dialogical practice for collective meaning-making. We agree that, “[t]his refers to his [Bakhtin’s] assertion that all communication is enacted, it occurs in dialogue but [is] enunciated in contexts and tempered by conventions” (Wagner, Bratteteig, & Stuedahl, 2010, p. 76). Using user forums as a substantial resource for our research, we believe such platforms could be seen and explored as dialogical because they provide expression and exchange of different positions based on different aspects of the user experience (“enunciated in contexts”), and usually user forum’s communication aims for creating and validating shared (“tempered by conventions”) meaning as a collective response to discussed issues. This experience of meaning-making is usually qualitative rather than quantitative. Also, Bakhtin’s notion that any socio-cultural communication is ever partial and always unfinished directly resonates with mechanics of user or help forums: for example, the same topic reappears infinitely under different circumstances, and any application update creates a new layer of lamination in online discourse.

We’re collecting research data from a series of specific communications with people who are using different generations of different types of geolocating software. Personally, I have more than 15 years hands-on experience using GPS, mapping and navigation applications. I’ve personally used Waze over the last seven years. I was always fascinated by its design decisions and wanted to explore them critically.

In addition, digital news outlets could provide information that displays the main trends in navigation applications or give examples of user experiences with specific data

and even the very unusual perspective of practical implications of some of apps features.

For example, news post about the unconventional use of Waze by police officers

(Conner, December 13, 2017; Plausic, February 12, 2015) or by neighborhood

communities (Bliss, April 29, 2015; Descant, April 24, 2018; Hendrix, June 5, 2016;

Marshall, July 5, 2016) provided us with valuable insights about positive and negative

aspects of Waze app design as a tool for social communication.

3.2 Bakhtinian Dialogic Theory and Participatory Design Methodology

As we integrate Bakhtinian dialogic theory and a participatory design framework,

we have to discuss how we see their connection: how polyphony, heteroglossia, and

addressivity are connected with user-centered and participatory approaches in a

theoretical and practical design framework.

The recent shift occurring at the collaborative edge of design research and the applied social sciences is a change of perspective from a user-centered design process to participatory design. The discursive capacities of concepts of polyphony, heteroglossia, and addressivity articulate practical, theoretical, and methodological challenges in this perspective. We explore how we can generate an analytical workflow to connect user-centered and participatory approaches and encourage a focus on designing customizable and configurable systems by using these Bakhtinian concepts.

With the emergence of a more participatory, collaboratively produced online discourse and an increasing share of user-generated content, current social media require design research to analytically connect how to simultaneously design for participation and research for participation. Research for participation means to investigate the user

experience and articulate the dynamic relations of user activities. The way to do this is to design in advance for user involvement, for further user contributions and collaboration in digital environments, and in digital discourse in general.

We refer to a shift in perspective from a user-centered design process to participatory experiences: “from designing **for** users to one of designing **with** users. ... Participatory experience ... is a belief that all people have something to offer to the design process ... when given appropriate tools with which to express themselves” (Sanders, 2002, p. 1, emphasis in original). According to Bakhtin, those who know how to think participatively, “know how not to detach their performed act from its product, ... rather how to relate both of them to the unitary and unique context of life and seek to determine them in that context as an indivisible unity” (Bakhtin, 1993, p.19). Thus, Bakhtin's theory of dialogue recognizes every thought to be an act, where the content of thought cannot be separated from the content of the act of doing, and there is no separation between the product and the act of making it. From this perspective we explore Bakhtinian concepts of *polyphony*, *heteroglossia*, and *addressivity* as analytical tools for dynamic investigation and articulation of users' experience.

Embedded in a flow of spontaneously responsive activity such users' experience is always unique (“once-occurrent events of Being” by Bakhtin) and is internally structured as an inseparable whole. A whole that cannot be explored from the outside by traditional abstract-systematic analytical frameworks. “Once-occurrent uniqueness or singularity cannot be thought of, it can only be participatively experienced or lived through” (Bakhtin, 1993, p. 13). Discursive capacities of concepts of polyphony,

heteroglossia, and addressivity, in our opinion, can be effectively applied in design research in order to explore practical, theoretical, and methodological challenges in the analytical workflow that connects user-centered and participatory approaches in design.

The concept of *addressivity* is based on the understanding that “[e]very word is directed towards an answer and cannot escape the profound influence of the answering word that it anticipates” (Bakhtin, 1981, p. 279). All possible means of communication are being necessarily addressed to a potential respondent, and, in general, are addressed to the responsive continuity of precedent, present and subsequent discourse. “Responsive understanding is a fundamental force, one that anticipates in the foundation of discourse, and it is moreover an active understanding, one that discourse senses as resistance or support enriching the discourse.” (Bakhtin, 1981, p. 279). The basis of this understanding is that a dialogue is never a neutral exchange. A dialogue exists as responsively-expectant relations:

The word in language is half someone else's. It becomes ‘one's own’ only when the speaker populates it with his own intentions, his own accent ...

Prior to this moment of appropriation, the word does not exist in a neutral or impersonal language ... but rather exists in other people's mouths, in other people's concrete contexts, serving other people's intentions.

(Bakhtin, 1981, pp. 293-294)

Following this reasoning, we comprehend the expressions of these other people, others and otherness, not as passive and neutral objects, but as responsive presences, presences related to us, toward which we act in accordance with our own “evaluative

attitude” (Bakhtin, 1986, p.84). Thus, applying this relational-responsive understanding to design research, we can say that all digital designs, all communicative digital artifacts can be explored as active socio-cultural discursive exchanges and constructs. Following Bakhtin's ideas, in the participatory design process, participants relate the performed act and its product to the unity and singularity of one's actual experience.

The next step in looking at design communication from the perspective of Bakhtinian addressivity requires the understanding of such concept as *utterance*. Utterance is a main, active unit of meaning, constituted by a speaker's relation to others (other voices, other utterances) in a continuity of ongoing discourse. Utterance is not a conventional unit in a syntactical sense, like the sentence. Utterance is a real communicative unit: Bakhtinian utterance is fundamentally linked to or positioned in relation to a response. Utterance is active in the sense that utterance actively relates to other utterances and in this way positions the dialog between different voices: “[t]he entire utterance is constructed, as it were, in anticipation of encountering ... response” (Bakhtin, 1986, p. 94). Discourse then is created by following responsive patterns of utterances that are positioned within time and space and are inseparable from time and space.

Addressivity and utterance are interconnected. Utterance is itself a response to other utterances. Utterance develops as “a link in very complexly organized chain” (Bakhtin, 1986, p. 69), the link that provides the potential for others to respond. The response is the act accomplished by the speaker (or user) in communicating a specific meaning. “The word lives, as it were, on the boundary between its own context and

another, alien, context" (Bakhtin, 1981, p. 284), so utterance is a response to previous utterances and is also expected to produce a response. Utterance is situated through its use and the use of other utterances, and always exists in a simultaneous state of being addressed and in the process of being answered. Thus, utterance is distinctive by its addressivity and answerability: utterance is addressed to someone and anticipates an answer. Following its meaning utterance potentially generates a response. Therefore, for Bakhtin, addressivity is a constitutive factor of every utterance:

Any concrete utterance is a link in the chain of speech communication...

Utterances are not indifferent to one another, and are not self-sufficient; they are aware of and mutually reflect one another... Each utterance refutes, affirms, supplements, and relies upon the others, presupposes them to be known, and somehow takes them into account... Therefore, each kind of utterance is filled with various kinds of responsive reactions to other utterances... (Bakhtin, 1986, p. 91)

The specific meaning of utterance is charged with the general condition of each speaker's addressivity. Addressivity here involves personal responsibility for creating a meaning, then meaning creates a context of meaningful dialogic patterns, and multiple meaningful patterns establish a possibility of discourse. As we can see, Bakhtinian utterance doesn't refer to language rules in general and is not speakers'/users' own product. Utterance contains explicit and implicit elements from a communicative context, as it traces other utterances or other voices. Utterance is socially situated and realizes dialogue at the level of articulation.

The level of articulation is specifically important for design research because there is a current demand for theorizing the move from traditional design artifacts to modern digital artifacts which are more focused on the real-time user experience. For traditional design artifacts we follow the understanding of "the thing being designed (e.g., the object, communication, space, interface, service, etc.), looking for ways to ensure that it meets the needs of the user" (Sanders, 2002, p. 1). That is the main characteristic of the user-centered design process. In its own turn, emerging digital design artifacts, like all kinds of digital utterances, are generated by users themselves and therefore establish new and different way of social and cultural communication. The attention shifts from a precise concept of design product's expected use to the context and actual users' practices of use as they occur in social media.

From this perspective, we see that the Bakhtinian concept of *heteroglossia* is instrumental in focusing on articulating users' situated experiences. Heteroglossia is "the base condition governing the operation of meaning in any utterance" (Bakhtin & Holquist, 1981, p. 428). According to Bakhtin, heteroglossia assures the primacy of context over narrative. Any context that is given as a set of sociocultural conditions ensures that "a word uttered in that place and at that time will have a meaning different than it would have under any other conditions" (Bakhtin & Holquist, 1981, p. 428). All utterances are heteroglossic as they are addressed to specific patterns of meaning in context. When understanding design communication as heteroglossic, "attention to the level of the utterance is essential" (Wagner, Bratteteig & Stuedahl, 2010, p. 75), if we want to support and facilitate the responsive addressivity.

One more concept, *polyphony*, is also instrumental in connection to addressivity and utterance. The term polyphony usually refers to particular voices or utterances. When more multilayered socio-cultural contexts are explored as different discourses, Bakhtin preferred a broader concept than polyphony, the concept is *heteroglossia*, the other(s)' voice. Bakhtin argued that language is a "heteroglot representing the co-existence of socio-ideological contradictions" (Bakhtin & Holquist, 1981, p. 291). For example, heteroglossia can refer to the conflict between official and unofficial, centripetal and centrifugal discourses within the same language environment. What is happening in such an environment is a very complex interplay of both centripetal and centrifugal tendencies. The centripetal tendency is directed toward inside order and unity at the center (usually representing already existing official discourse), and the centrifugal tendency is directed toward outside diversity and difference on the borders or margins (usually representing unofficial or an emerging discourse). The centripetal tendency is *monological* (monoglossic) as it directs towards a unitary meaning, while heteroglossia is centrifugal, expands into many meanings, and potentially develops *dialogical* environment.

Of course, any communication contains multiple personal voices and utterances (polyphony) and multiple social discourses (heteroglossia). From this perspective, we need to compare and articulate how polyphony and heteroglossia work in order to apply them to the user-centered and the participatory design frameworks. Basically, polyphony is more related to the user-centered framework, as the design development of the artifact is based on the linear data flow between the designer and the user. Heteroglossia, as a dynamic including of otherness, better explains the participatory design frameworks with

its needs for nonlinear communications. For example, the participative design is context-based: users experience design artifacts by communicating with them in different environments. In different environments and in different contexts design deliverables have different meanings for users and users can generate different content. Also, the participative design is an ongoing process. Changes are continuously made and changes are continuously experienced. Exploring digital utterances as integral relational parts of the participatory design process, we understand that:

The processes of centralization and decentralization, of unification and disunification, intersect in the utterance; ... The authentic environment of an utterance, the environment in which it lives and takes shape, is dialogized heteroglossia ... simultaneously concrete, filled with specific content and accented as an individual utterance. (Bakhtin, 1981, p. 272)

Thus heteroglossia, as the continual intersection of changing user perspectives with specific content and their resonances, constitutes an explanatory framework for the non-linear ongoing design process where users can participate in constructing and enhancing each other's experience.

Both polyphony and heteroglossia, at their levels, do not simply imply the inclusion of multiple utterances into communication. For designing for social media, we must not forget that some utterances may be also excluded from discursive exchanges by specific design decisions or conventions. Thus, in social perspective, "[t]he commitment of Participatory Design (PD) to enhancing users' autonomy implies the responsibility to design in ways that enables people to understand the systems they are part of, and puts an

emphasis on transparency and critique as parts of digital design” (Wagner, Bratteteig & Stuedahl, 2010, p. 6). In practice, such users’ responsibility to design is often blocked or lessened by the "authoritative discourse" or unconditional type of discourse that is supported by social power relations and/or social media design. Bakhtin identifies the "authoritative discourse" as the specific type of discourse, which, following socio-cultural context, has hierarchical superiority. The authoritative word (the authoritative monoglossia) is anticipated to be hierarchically or historically, socially or culturally more “legitimate” because it derives from different power centers and adheres to various factors of authority. “The authoritative word demands that we acknowledge it, that we make it our own; it binds us, quite independent of any power it might have to persuade us internally” (Bakhtin, 1981, p. 342). Examples of "authoritative discourse" might range from religious dogma, or scientific theory, to, in our case, a popular influential (e.g., Facebook) design and social practice. Such superiority demands the listener or user to assimilate the "authoritative discourse" as "unconditional allegiance" rather than accept and allow interpretation.

Taken together, the Bakhtinian concepts of addressivity, heteroglossia and polyphony provide a fundamental shift from an assumption of primary and overbearing authorship. This shift allows us to see differently the roles of designers, researchers, and users in user-centered and participatory approaches in the design process. In the user-centered design process “[t]he social scientist/researcher serves as the interface between the user and designer. ... The user is not really a part of the team, but is spoken for by the researcher” (Sanders, 2002, p. 1). The researcher and designer are interdependent but

distinct. The researcher collects data to explore user needs and interprets information in the form of design criteria. The designer interprets these criteria and develops the product. In a participatory culture “the roles of the designer and the researcher blur and the user becomes a critical component of the process” (Sanders, 2002, p. 2). In participatory experiences, systems and tools that involve active social exchange should not have the primacy of the designer or the researcher. Ideally, the design of these systems should be responsive enough to – using Bakhtinian language – support collaborative creation of discursive meanings through a medley of speaking positions. These discursive meanings address the direct and proactive participation of users in the design development process.

This is the quintessential part of the understanding of the design process as a part in the continuity of multiple intersecting activity systems, where the designer, user, or product are themselves parts of a constant dialogical reframing. We already mentioned that methodologically and technically this understanding of design is realized in recent developments in social media applications (Tumblr or Flickr), and especially in Wikis. Wiki with its design structure that is not strictly predefined or limited, and open to being developed following the needs of its users, is an excellent example of bottom-up participative design. Here discursive capacities and the communicative importance of the application are established and articulated collectively. Here we explore the real emergent character of the design process: it is – simultaneously – contextualized and in the process of being developed.

Bakhtinian relationally-responsive dialogue contrasts with the traditional representational-referential analytical understanding of communication. From this perspective, exploration of relational-responsive dialogical processes provides an essential interpretive and explanatory framework for supporting and facilitating a participatory approach in designing for social media. The participative approach in design can be effectively explored as a connection between the design process and its active relation to socio-cultural discourse in general. The character of this discourse is multidimensional in form and constantly growing in the number of digital utterances. The spread of social media demands establishing practices in design research for investigating the user experience, articulating dynamic participants' relations, researching possibilities for participation, and designing for participation. From a Bakhtinian perspective, design environments should trace and allow wider fields of social participation, and should be centered on the acceptance of user participation in a variety of ways. The pre-building possibilities for such responsivity (addressivity and answerability) should allow users more choices in how they contribute.

Chapter 4: Chronotopic Analyses of Waze Application

In this chapter, we research the results of applying the chronotopic analyses on a specific practical example of designing for social media applications – the Waze navigation application. Applying chronotopic analyses to Waze as an interpretative and explanatory frame, we move analytically within the app, exploring and critically addressing its unique features and the emerging practices of its design construct. We examine the existing and potential implications of the chronotope concepts as they are explored in user experience, design and functioning of Waze. We demonstrate how chronotopic analyses could also be used for finding and producing new or alternative design approaches.

We believe Waze is a strong and very representative case study for research on applying Bakhtinian concepts in general and the chronotopic analyses in particular for the following reasons:

- app popularity among a gigantic group of users
 - As of March 2018, there were 100 million active Waze users who spend an average of 11 hours per month in the app, “that gives it [Waze mobile app] engagement parity with Instagram and more than Snapchat” (Sterling, March 28, 2018);
 - As of April 2018, 25.6 million monthly users accessed the Waze app in the United States (Most popular mapping apps in the United States as of April 2018, by monthly users (in millions), 2018);

- Active online communities of the app enthusiasts continuously provide a large amount of feedback about their user experience;
 - For example, as of Fall 2016, Waze had more than 420,000 highly-involved volunteer Waze map editors (Hall-Geisler, 2016);
- The app's navigation purpose brings us into a time-space design theorization and immediate practices;
- The app's socially based functioning (user-generated data flow, user reporting, user map editing). In addition, the transactional and performative collaborations among Waze users addresses not just one of the main focuses of our research, but also provides a unique perspective as "Waze fosters previously unseen socio-spatial constructs and modes of embodiment that question the traditional take on "community"." (Ramos, 2017, p. 10), and could provide more ground to the dialogic rethinking of the forms of sociability, interaction, and identity in design practice.

Through studying user experiences of Waze, our practical research task is to explore methods, according to which a chronotopic application can be developed, validate these methods from a user perspective, and find alternatives and further implications. Our approach to this task is structured in the following ways:

- Time-space frame and the chronotopic concepts as revealed in the overall design system;
- The way in which the chronotopic analyses can be implemented in design;

- The way in which chronotopes are actualized in Waze and how users can enact and practice them.

4.1 Basis of Researching Waze as Chronotopic Application

Even so, the concept of chronotope was initially developed by Bakhtin for analyzing literary texts – “what the literary text represents within its fictional worlds”. Since chronotope integrates the space-time continuum, we believe, this concept is appropriate for the analysis of traffic and navigation applications.

Additionally, as some of the Bakhtinian researchers point out, there is a second, broader definition of the chronotope that is based on social communication and social history in general. For example, Wall and Thomson point to Bakhtin's notebooks of 1970-1971, "From Notes Made in 1970-1971" in “Speech Genres and Other Late Essays” (Bakhtin, 1986, pp. 132-158). These authors point out that “The chronotope is no longer entirely understood in the context of what is represented in the literary text. Now the chronotope can also be fruitfully extended to the realm of those persons or voices who do the representing” (Wall and Thomson, 1994, p. 73). So in this larger perspective “chronotopes and chronotopic relations are big issues connecting situated moments of interaction to the very large patterns of social order” (Blommaert, March 18, 2018). We believe this broader conceptualization of the chronotope already existed in the main Bakhtin's chronotope study, “Forms of Time and of the Chronotope in the Novel”, with a very explicit and important subtitle, “Notes toward a Historical Poetics” (originally written in 1934, first published in Russian in 1975, English translation in 1981). For

example, Bakhtin explains how literary chronotope is inseparable from history and society and is actually based on the continuity of socio-historical developments:

The work and the world represented in it enter the real world and enrich it, and the real world enters the work and its world as part of the process of its creation, as well as part of its subsequent life, in a continual renewing of the work through the creative perception of listeners and readers. Of course this process of exchange is itself chronotopic: it occurs first in and foremost in the historically developing social world... (Bakhtin, 1981, p. 254)

This way we research Waze as a social media platform that represents a specific chronotope, as a specific time-spatial continuum that corresponds to and is based on a particular period in the technological and social history of society. From a perspective of information and interaction design, we explore chronotopes as configurations of situated moments of user interaction. These moments as we research them in user experience are directly connected to design and deployment decisions and potentially connected to the existing or future society-wide patterns of social practice and social organization in general.

An additional theoretical approach for researching Waze as a chronotopic application is also based on the general Bakhtinian interpretation of the methodology of human sciences. Specifically, we refer to his last essay entitled "Toward a Methodology for the Human Sciences" (Bakhtin, 1986, pp. 159-176), where Bakhtin discusses the difference between the monological form of knowledge in natural sciences (with their

traditional tendency to finalize and objectivize knowledge) versus the dialogical form of knowledge characteristic for human or social sciences.

The exact sciences constitute a monologic form of knowledge: the intellect contemplates a *thing* and expounds upon it. There is only one subject here – cognizing (contemplating) and speaking (expounding). In opposition to the subject there is only a *voiceless thing*. [...] But a subject as such cannot be perceived and studied as a thing, for as a subject it cannot, while remaining a subject, become voiceless, and, consequently, cognition of it can only be *dialogic*. (Bakhtin, 1986, p. 161, emphasis in original)

The consequence of this approach is Bakhtin's view of natural sciences as oriented on "accurate" knowledge: "The limit of accuracy in the natural sciences is identification ($a=a$)" (Bakhtin, 1986, p. 161). On the other hand, social sciences focused on understanding, on active and dialogical understanding of "[t]he complex interrelations of the understood and the understanding subjects, of the created and understanding, and of the creatively rejuvenating chronotopes" (Bakhtin, 1986, p. 168). Following Bakhtin's further description of this understanding as the "setting in relation with other texts and as reinterpretation in a new context", where "[t]rue understanding ... is always historical and personal" (Bakhtin, 1986, p. 161), we can justify exploring the concept of the chronotope in the complex relations between time and space and users as we analyze the Waze application. Consequently, we research Waze, a crowd-sourcing navigation application, as a case study to examine how the app enables digitally mediated temporal and spatial practices through the user experience.

We discuss and apply the chronotope as an interconnected time-space continuum with definite and unique manifestations, "intrinsic connectedness of temporal and spatial relationships" (Bakhtin, 1994, p.84). Waze's design is chronotopic in the sense that the application is based on finding and using specific space-time interconnections as they are presented and embodied by the app users. Following Wazeopedia's introduction, "When using the Waze application, Waze servers use routing algorithms to determine the best path for a given route at that particular time." (Routing server, n.d.). These interconnections include discovering and processing data patterns in roadmaps and moving objects (drivers/cars) such as route clusters and user/driver behavioral rules.

As for any similar navigation application, their information architecture requires processing the raw mobility data (user/driver data) to discover patterns of the space-time paths of the mobile objects (cars). Waze becomes different from the way in which this data is structured and which methods are developed and used for processing these patterns most efficiently. We refer here to particular data acquisition and data management designs and functional mobile object indexing methods.

We research Waze's algorithms as closely connected to humanities and specifically to Bakhtinian ideas as originated in literary studies. Every Waze's routing calculation is user-centric and unique, completed for a specific driver. Waze is based on client routing. "While the client device app has a routing algorithm included, this is not used unless there is no connection to the Waze server." (Routing server, n.d.). If there is a connection to the Waze server, the app calculates a client-specific route. Waze minimizes the use of predetermined routing calculations (the client device's app routing algorithm).

It means that most of the times a route is calculated when a specific user sends a routing request, and "that route is then transmitted back to your client device and displayed" (Routing server, n.d.).

This allows every voice (every driver) in Waze be heard in the dialogic sense: every user or client is heard as a requester of a route and as a data provider for the rest of the driving community. Waze establishes and supports a new level of social spatiality with time sensitivity. First, "[t]his idea of users working together to outsmart traffic brings about a notion of community but one that is transactional and detached. The drivers do not know each other; they appear as small avatars zooming through a digital map, but they often feel a sense of responsibility to the app to provide data to help other users." (Ramos, 2016, p. 139). Then "[t]he act of driving, when coupled with Waze, takes on a complex role enabling new spatial relations and subjectivities" (Ramos, 2016, p. 139). From this perspective, Waze's user community-based routing algorithms make Waze more human-oriented in its field compared to other similar applications or even compared to the majority of modern social media applications in general.

Also, Waze is almost using a literature analysis technique — and very Bakhtinian technique — a space-time association. A literature analysis' space-time association is based on how time and space are represented in language and discourse. Waze's space-time association is based on how configurations of time and space are represented in driving habits. In Waze, data is recorded to describe how objects move from segment to segment of space over time creating different space-time sequences. From a software development perspective, one of the Waze's foundational components is routing flowlet

or flowlet-switching. Waze segments car data flow into more traceable and predictable flowlets:

[s]ince Waze needs to be able to load-balance ongoing flows ..., it divides these flows into flowlets, i.e., tiny groups of packets in a flow separated by a sufficient idle gap. It can then independently pick a new path for each new flowlet [keeping each flowlet necessarily] fine-grained, congestion-aware, and reactive to network dynamics. (Katta, Hira, Keslassy, Bergman, & Barefoot, 2017, pp. 2-4, 12)

Waze's sequence searching techniques and load-balancing algorithms establish and realize the basis for Waze's unique, client-based routing patterns.

4.2 Main Characteristics of Bakhtinian Chronotope as Revealed in Waze Design

We construct our chronotopic analysis on the following characteristics discussed below. According to Bakhtin, the exploration of forms of chronotope in literary texts is identified by the following main characteristics:

- 1) The *ratio and nature of spatial characteristics* represented in a text;
- 2) The *ratio and nature of temporal characteristics* represented in a text;
- 3) Resulting in *how particular spatial and temporal characteristics create the meaning of the narrative*.

We share the ontological understanding of narrative not as “simply an externalized discursive form, but a mode of inner understanding that is basic to our ontological grounding in the world, to making sense of the flow of experience” (Prior, 1998, p. 248). Seen from such a perspective, any contextualized experience is always

chronotopic. This understanding suggests how "the intrinsic connectedness of temporal and spatial relationships" (Bakhtin, 1981, p. 84) constitutes the structure of narrative events, or how chronotope could be seen as the organizing center of narrative events. So, according to Bakhtin, chronotopes are

the organizing centers for the fundamental narrative events of the novel.

The chronotope is the place where the knots of narrative are tied and untied. It can be said without qualification that to them belongs the meaning that shapes narrative. (Bakhtin, 1981, p. 86)

Following this logic, we can identify Waze's functioning as creating narrative: the main meaning of Waze as a narrative producing application is "the best path for a given route at that particular time". This "best path" could be seen as a chronotope, as the organizing center to arrange the different patterns of events in their "proper" narrative order and to create meaning. Also, we can describe the chronotope of Waze as a dialogical chronotope. Waze's narrative is constructed as a network of complex situations and interchanges that communicate with each other in time and space to produce a meaning — the best route for a community of drivers.

Chronotope is constitutive even if the relationships between time and space are not always "symmetrical" – as Bakhtin shows in the "Forms of time and of the chronotope in the novel" (Bakhtin, 1981). In some chronotopes their temporal part is more important, in others place and space could be more significant for structuring the narrative. This notion is important for applying chronotope analysis to any space-time-

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based media. Chronotope is not a formal construction, rather it is event-related as it
"produces" possible narratives.

Very different events or even "distorted" (as traffic or congestion) patterns of road events establish a combination of many chronotopes. This is what Bakhtin describes as an interaction of chronotopes in an artistic text. "Within the limits of a single work and within the total literary output of a single author, we may notice a number of different chronotopes and complex interactions among them" (Bakhtin, 1981, p. 222). Next, we apply Bakhtin's specifications and analyze the corresponding types of chronotopes in Waze's design.

4.3 Bakhtinian Levels and Types of Chronotopes as Applied to Waze Design

Bakhtin describes major and minor, fused, chronotopes, "the major chronotopes, those that are most fundamental and wide-ranging ... each such chronotope can include within it an unlimited number of minor chronotopes" (Bakhtin, 1981, p. 252), and specifies the following dimensional *levels of chronotopes* in an artistic text and language communication.

1) On the first level are *general* or "the major chronotopes, those that are most fundamental and wide-ranging" (Bakhtin, 1981, p. 222). The "chronotope of whole genre" is the chronotope that defines the text's literary genre and exposes the type of time and space reflection attributed to a particular historical period. Bakhtin argues that

[t]he process of assimilating real historical time and space in literature has a complicated and erratic history, as does the articulation of actual historical persons in such a time and space. Isolated aspects of time and

space, however – those available in a given historical stage of human development – have been assimilated, and corresponding generic techniques have been assimilated, and corresponding generic techniques have been devised for reflecting and artistically processing such appropriated aspects of reality. (Bakhtin, 1991, p. 84)

In terms of Waze, we can see this fundamental chronotope as the chronotope of the whole application – "corresponding generic techniques" – that assimilate its design and development, functioning and operating as they are reflecting and processing "such appropriated aspects of reality."

2) On the second level are *minor* or different *situational* chronotopes that Bakhtin also names "motifs". Each major chronotope "can include within it an unlimited number of minor chronotopes... [i]n fact ... any motif may have a specific chronotope of its own" (Bakhtin, 1981, p. 222). Examples of this kind of "motivic chronotopes" in Bakhtin's analysis are the chronotope of the road, the chronotope of the meeting, the chronotope of the threshold and the chronotope of the public square. "Such motifs enter as constituent elements into plots" (Bakhtin, 1981, p. 97). These "motifs" trigger events and allow chronotopes to be dialogically opened and responsive for accounting incidental or local situations.

For Waze "motifs" are all typical events that could change routes and make it different from the beginning or during the process of driving: e.g., a map issue, a traffic jam, a road closure, or a hazard on the road. All of them "enter as constituent elements" into the fundamental Waze app chronotope. The majority of these Waze events are

reported events, events reported by active Wazers and shared with the rest of the app drivers.

3) Bakhtinian scholars usually specify only two levels or two types of chronotopes. They investigate "major" and "minor" chronotopes, "representational" and "embodied" chronotopes, "chronotope of the whole genre" and "chronotopic motifs" (or "generic" and "motivic" chronotopes), "adjacent", "incidental", and "local" chronotopes without specifying any additional levels. We believe there is an additional level that corresponds to the potential result of communication especially when we apply chronotope to modern social media applications.

We can approach the Waze user and his personal time-space experience exactly at this level. Waze functions because of the direct participation of the user. Here "the act of physical driving alongside digital guiding, ... capitalizes on the hybridity between person, space, and machine (referring both to the vehicle and the app)" (Ramos, 2016, p. 139). As a result of driving and communicating with Waze inside this hybrid environment which connects very different types and levels of utterances, the user interacts with the large combined system of chronotopes: "major" Waze's chronotope and extended "minor" event chronotopes.

We believe the *additional* chronotope level is established when a user responds to the above mentioned "major" and "minor" chronotopes and connects them with his own individual situation, combining them with his own chronotopicity. Bakhtin suggests here that, in addition to the chronotopic space that the work organizes, there is a chronotope within which this very organization *occurs*. We can describe this chronotope as a

chronotope of a user/driver and ascribe to an author and reader equal relations in representing reality and creating meaning. The author is producing a text, and the reader is actively renewing the same text. According to Bakhtin,

We may call this world the world that creates the text, for all its aspects – the reality reflected in the text, the authors creating the text, the performers of the text (if they exist) and finally the listeners or readers who recreate and in so doing renew the text – participate equally in the creation of the represented world in the text. (Bakhtin, 1981, p. 253)

What is important and different is that there are many situations when our user/driver becomes the author. For example, user reports and map editing could be qualified as an author's activities. So, we can position our Wazer as the author and the reader at the same time because of the different ways of interacting with the Waze app and Waze's openness in taking into account different chronotopes. We see the same interactions in the Bakhtinian description of many dimensions in the chronotopic organization:

A point of view is chronotopic, that is, it includes both the spatial and temporal aspects. Directly related to this is the valorized (hierarchical) viewpoint (relationship to high and low). The chronotope of the depicted event, the chronotope of the narrator, and the chronotope of the author... (Bakhtin, 1986, p. 134)

So, projecting this Bakhtin's suggestion on Waze and the Wazer, we see again how three main chronotopes interact: the chronotopic space that the app organizes, a chronotope within which this app's functioning occurs, and author/user chronotope.

This third, level of chronotope, *user chronotope*, should connect the physicality of the immediate individual time/space environment and the rest of the discussed types of chronotopes. This is where the chronotope of the Wazer is mixed with the chronotopes of the application and its possible situational chronotopes. A user's activities and their consequences fuse all chronotopes and create a unique spatiotemporal experience where our user is directly present with all its first-hand subjectivity.

4.4 Structuring and Realizing Chronotopes in Waze

Let's see how chronotopes are structured and realized in the Waze app and our use of it. According to Bakhtin, chronotope is always producing the meaning of any narrative. In our interaction with Waze we are concentrated on the meaning of different spatiotemporal constructs: route sequences, road events, basic activities (e.g., make a turn) as they provide possible route scenarios, time continuity (stretching and compressing), speed (acceleration and deacceleration), mapping (layout, errors, and corrections), an order described in directions and a mapping interface resulting in the driving process.

The last part, the mapping interface part is only "informatic" at the moment (we see only a fragment, a phase that is "in the frame" on our screen) and doesn't necessarily provides a clear connection to the next time-spatial fragment. For example, if we are in traffic, Waze can provide us with an estimated time in traffic, but we still do not know what the cause of the traffic is. Sometimes we need to zoom in or use route overview to see where traffic ends in an actual space and then re-center the app to get to the current route phase (Figure 4).

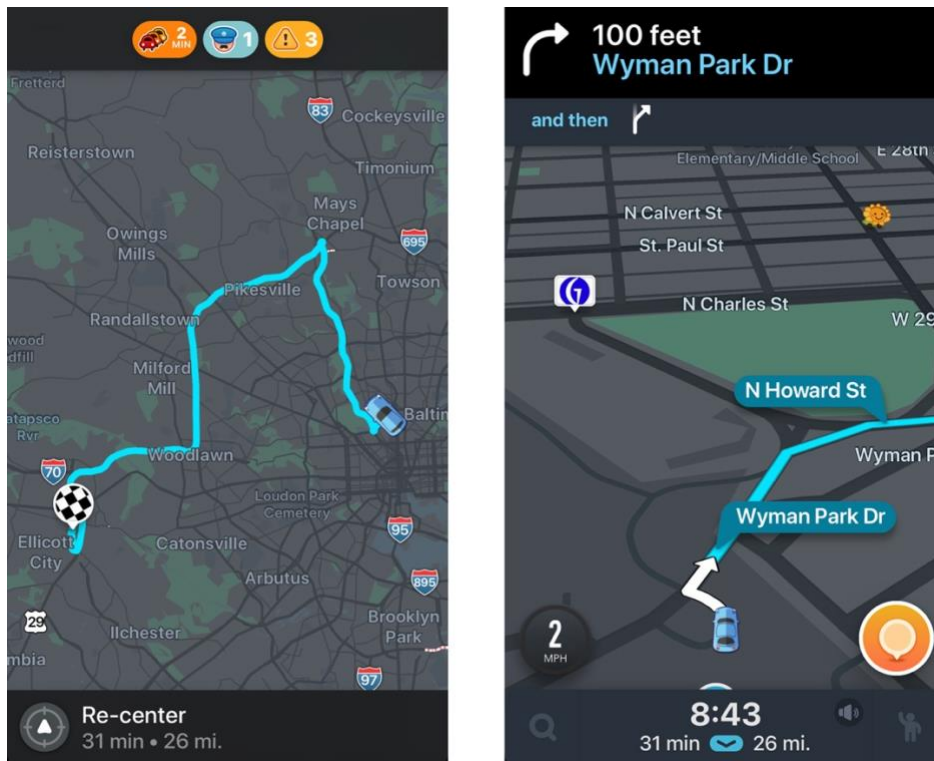


Figure 4. Screenshot of the Waze mobile app interface on iOS device. Waze's route "Overview" feature (left) and a screen state after re-centering displaying a beginning of the route (right).
Map data ©2018 Waze. (Screenshot by author)

To summarize, the interaction could be described in the following context:

- 1) The Waze programming chronotope works on an interpretation of a real road situation that is transmitted through different situational chronotopes. Waze alters situational chronotopes in space and time coordinates, and provides the driver with route choices from which to select;
- 2) Then the Wazer – keeping the sense of time continuity and spatial amplitude and distance – reacts by making decisions.

This process constantly repeats before our route has reached its destination. The order of events/utterances exchange would have to correspond to all chronotopes fused and connected by the user's decisions.

4.5 Establishing and Realizing Chronotopic Data Analysis

To outline different approaches in time-spatial design and explain why we selected Waze for exploring Bakhtinian chronotopes, we start by comparing a spatiotemporal component in computer games and in Waze.

4.5.1 Spatiotemporal Component in Waze and in Digital Games: Similarities and Differences

There is a growing body of academic research literature on representing time in digital games, particularly in digital game storytelling (e.g., Lemke, 2005, Wei, Bizzocchi, & Calvert, 2010; Vitale, 2009). Waze is also adopting game-like mechanics and modes and successfully using them to establish the app's gamified nature. For our research, it is important to discuss where similarities between the spatiotemporal exploration in digital games and in Waze start, and where and why differences between them occur.

Designs for both mediums support the examination of multiple spatiotemporal potentials before they realize in the user experience. Designers are trying to predict possible scenarios of different space-time combinations and prepare the game or Waze application for their realization. In computer games, key events (or player's fundamental choices) can lead to different results which causes a game to go into many possible realities. These predesigned realities could be parallel or intersect if they ask a player to

choice again. Players can follow one reality at a time, but technically they are allowed to change their choices and explore different realities. Players can always stop, take a pause, quit or restart their game. All game realities are virtual by its nature unless they are connected in some way to a real topography. One of the examples of game realities connected to a real topography is Pokémon GO. Pokémon GO explores real locations in searching and catching virtual Pokémon using mobile devices (Pokémon GO, n.d.). To some extent, we can describe game space-time frames as static. Static in a sense that even with all players' input data these frames are usually virtual and not dynamically connected to the real-world situation. Or, the amount of real-world data in the game environment is not essential. The game player has everything to enjoy the game by exploring a variety of virtual time and space scenarios. There is still a flow of time from the present to past and from present to future that the game player can manipulate, following game rules. Because of predefined game rules regarding time realization, the player is usually limited to the role of the observer or limited to "the level of the observer, ... this observer moves continually amongst a series of 'cells' of the past and future, thereby combining the linearity of modern temporal flow with the spatialized time of the computer database" (Vitale, 2009). The player shifts through the inner game database as a collection of possible game scenarios, seen as the game's "forking" pathways.

Waze is different because the application connects pre-designed frames with real-world spatiotemporal situations. Waze drivers still make some fundamental choices before or during driving, but they cannot change realities. From here it makes designing for Waze different comparing to designing for games. Predesigned time-space framing

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should be based on real-world time and space combinations, and adapted for dynamic processing and interpretation of quickly changing traffic conditions and user input.

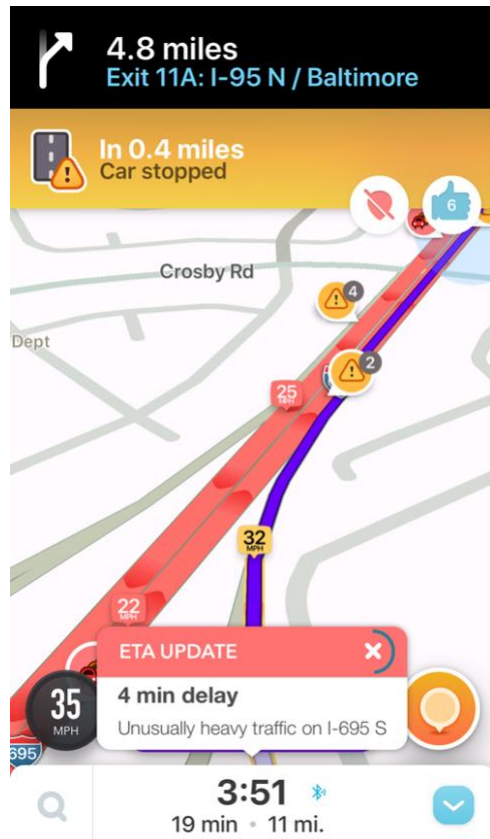


Figure 5. Waze. Screenshot of the Waze mobile app interface on iOS device. Waze displays “ETA Update” notification. Map data ©2018 Waze. (Screenshot by author)T

Waze users are not observers of linear time cells as game players are. They are drivers who try to select and effectively use the one most efficient route from a variety of possibilities. Waze users cannot quit or restart the way game players can. In Waze there are no time cells linearity similar to the game time series. There is no fixed time cells linearity that is based on players' choices or advances. For the Waze driver time is not even given in fixed or expected linearities. Traffic can build up ahead very quickly, the

ETA (Estimated Time of Arrival) can be changed, and an alternative route with different space-time characteristics could be proposed by the application (Figure 5).

Because time in Waze is inseparable from spatiality, the entire understanding of "time" in Waze becomes spatially-based or multi-directional. Time in Waze can be seen in its traditional linear form only in rare situations when the calculated route is not affected by any traffic flow updates and the ETA stays the same. But, because of the app's "aggressive re-routing," one usually experiences an ETA in Waze that is constantly increasing or decreasing. With ideal driving conditions, when it is possible to drive faster than Waze's initial prediction, the ETA will change, reflecting that less time will be needed to reach the destination. So, in Waze, no trace of a predesigned inherent linearity of time and action as is often seen in games, can be found and is not essential. If designing for games is based on the combinatorics of possible game worlds, it means we can still see games as a linear formation. Waze design is intended to catch and frame unexpected situations or predict the unexpected by design right when it actualizes. In Waze, a linear formation is getting different geometrical combinations because of continuous changes of time and place. Spatiality prevails over linearity. Or the chronotope in a Bakhtinian sense prevails over linearity.

From this perspective, Waze's time-space frames function as an exploration of multiple potential routes before they actualize, before they happen in a real driving situation. For our research, the discussed differences of space-time frames in games and Waze, are one of the fundamental reasons for exploring Waze's design through chronotopic analyses.

4.5.2 Space-time Framing in Waze: Design Algorithms for Connecting Time and Space

Bakhtin examined how different chronotopes correspond to particular literary genres, or to relatively stable ways of speaking, which, in their turn, form our worldviews or even form specific ideologies. For example, the chronotopic frame of the Greek adventure novel is very different from the frame of the Rabelaisian carnival (Bakhtin, 1981, pp. 84–258). As we noted above, Waze starts its space-time framing by finding specific route segments. Using a data-driven perspective and looking for the integrated dynamics of spatial and temporal references, Waze is finding a logical configuration of time and space that is then used as a segment for routing calculations.

According to Wazopedia's "Routing server" description, from the beginning the Waze server is looking for a physical expression of time and space — speed: "the routing server uses real-time road speeds (from recent Waze app users if available)" and then "combines the historical speed of the segment broken down into 10-15-minute chunks" (Routing server, n.d.). Waze's segments follow one of the chronotope definitions as a certain communicative (route) situation, repeated at a certain time and place. Time is connected to space because "[t]he time to pass through a segment is tracked separately for each route out of a segment" (Routing server, n.d.) and then time and space are interconnected in routing algorithms. For example, "if a segment ends with a left and right turn (no straight let's say), then the routing engine isolates the time through the segment to turn left and the time through the segment to turn right" (Routing server, n.d.). Space in this algorithm becomes fused with time, according to Bakhtin, "becomes

charged and responsive to the movements of time, plot, and history”, and “[t]his intersection of axes and fusion of indicators characterizes the artistic chronotope” (Bakhtin, 1981, p. 84), or, in our case, the driver's chronotope.

4.5.3 Waze's Real-time Data and Pre-built Data in Google Maps

What is also important and makes Waze unique is “that Waze uses real-time reports of current road speeds by preference over historical average road speeds ... [i]t is assumed that the speed of any Wazer ahead of you on a stretch of road will be the speed used when your route is calculated” (Routing server, n.d.). Waze's preference of real-time speeds over historical average speeds is one of the most important design differences between Waze routing versus Google Maps routing. Google Maps is more of a standard navigation application and its routing algorithms are based on historical metrics for typical routing conditions. “[H]istorical metadata enable Google not only to provide real-time traffic updates but also to anticipate future traffic for a specific day and time”, as far as “historical traffic norms can be created that are specific to time of day and day of week and which even account for seasonal variations such as additional school traffic during the school year” (Hughes, 2016).

The Waze algorithm relies more upon current user-generated information. Waze's calculations are "based on ... the data we, the Wazers, provided by driving around and editing maps", and "Waze also uses traffic congestion reports to reroute around slow traffic" (Waze routing vs. Google Maps routing, n.d.). The application users, Wazers, are active participants in data creation and exchange. They submit manually-inputted (or, as a later feature addition, voice-inputted) user reports while “driving around and editing

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maps" (Routing server, n.d.). Waze automatically combines and collects metadata such as user location and driving speed, verifies the reports of other users, further validates flow of traffic, and "[a]s the number and density of Wazers grows, this real-time data takes on a greater importance" (Routing server, n.d.).

Driving, submitting all kinds of real-time information, validating – upvoting or downvoting – the reports of other Wazers or map editing construct a continuous dynamic flow of user utterances, exchanges in the Bakhtinian sense of polyvocality. Waze's real-time user-generated data communicates the "meaning that is collectively created through a medley of speaking positions" (Wagner, Bratteteig, & Stuedahl, 2010, p. 75), and Waze's design as a shared communicative construct supports and mediates all levels of utterances as they are produced and embodied by users. Also, we need to insure all types of utterances, or all digital artifacts, are coordinated and closely connected with the physical world. For example, "Wazers' collaborative nature attest to social exchanges on a digital space that lead to material effects – from road safety to minimization of petrol use" (Ramos, 2017, p. 7). Digitally mediated user collaboration usually produces results that are material in their finality.

As we further compare Waze and Google Maps, we discover that Google Maps has a different approach and its own set of data. Waze and Google Maps use different base maps that originated and are maintained differently. Waze maps are mainly user-generated, created by Waze users. As one of Waze software engineers describes, "[s]ome countries started from an empty slate, in some other various data sources were used to bootstrap the process, but at the end, everything is edited and maintained by community"

(Antokolsky, 2018, January 6). Google Maps' base maps were created by the Google team using already existing data sources. As a result, prebuilt Google Maps base maps with historic road information are combined with the floating car traffic data from position/movement profiles of smartphones with the Android operating system. Google servers receive the floating car data even without participation from the drivers, – “even though Google Maps does not run in the background and is not even launched by the user, both Android and Google Maps send location data to Google” (Jeske, 2013, p. 6). The Waze protocol for transmitting data is less aggressive: “The Waze app requires an activated GPS receiver but the current location is transmitted directly after starting the Waze app. User tracking is not possible.” (Jeske, 2013, p. 6). These are primary reasons why Waze and Google Maps applications usually compute different routes.

For our work, this emphasis on the greater importance of live user-generated data can be seen not just as a reflection of Waze's original "goal to create optimal commutes" by finding alternate routes, but also as a way of continuously bringing personal chronotopes into account of Waze's main chronotope frames. We refer to Waze's high level of personal options for customizing navigation, compared to fairly basic customization features in Google Maps, and Waze's design ability to learn and save the driver's frequent destinations, preferred routes, and usual commuting hours. For example, even if our preferred routes are not the most effective from the Waze route optimization perspective, users confirm that “Waze does learn the way you like to go to common destinations and after a few trips will stop fighting with you and will start giving you directions along your normal path.” (Blandford, June 10, 2013). In addition, “Waze will

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also learn your travel patterns during the week and for most of my trips now I do not even have to enter my destination.” (Blandford, June 10, 2013).

Waze accentuates route customization and provides customizations options right after one requests navigation directions. Based on navigation experience at this step, “Waze is using all of their screen space for customizations that a driver could use to modify their experience better” (Cygan, 2018).

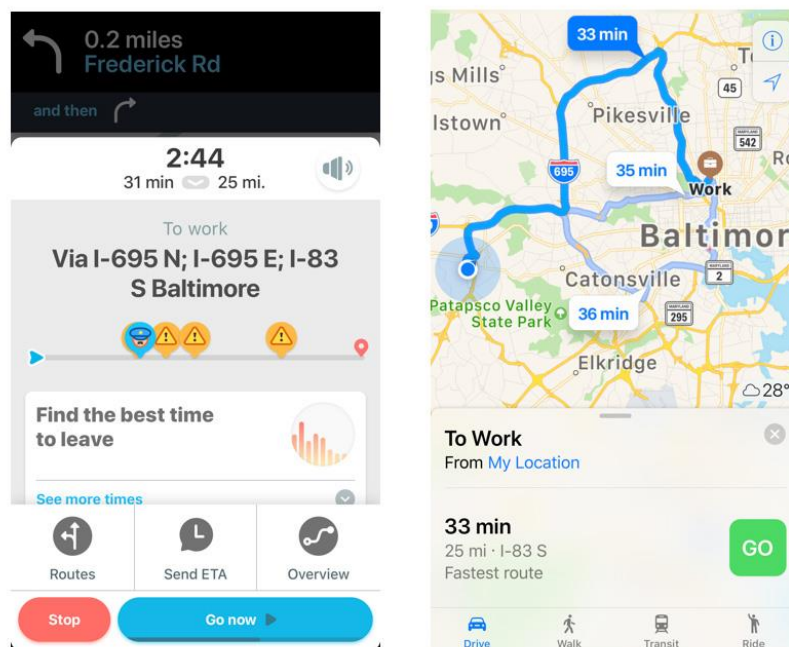


Figure 6. Screenshots of the Waze and Google Maps mobile apps interfaces on iOS device.
Navigation interface of Waze (left) and navigation interface of Google Maps (right) after requesting the directions to the destination.
Map data ©2018 Waze. Map data ©2018 Google Maps (Screenshot by author)

At this step interfaces of Waze and Google Maps are almost opposite in their design accents and possible interaction (Figure 6). Google Maps provides a condensed map overview of the directions that could even be confusing for the first time user. Three possible routes are presented at the same time on one map. Waze's screen is full of

navigation options. The ETA is the most significant number on the screen and then the user has a number of options to enhance his driving experience even before starting driving: a graphical summary of pinpointed real-time user reports on the route, different route variants, an option to send ETA, a convenient option to stop navigation, and, finally, the “Find the best time to leave” feature menu that, again, is highly customizable itself and could be tailored for one's personal schedule and locations.

Also, users can see this high level of possible customization in Waze from very different perspectives and use it very differently. One of the users points out a way to decrease Waze's foundational adventure aspect (studied later in this chapter). “[Y]ou can customize the 'aggressiveness' of the shortcut by selecting 'avoid difficult turns’” (Apple Maps vs. Google Maps vs. Waze, n.d.).

Especially important for our work is the next example, where Waze is mixing the chronotope of the app with the user's personal chronotopic details. Waze can prioritize personal time-space metrics over calculating the fastest route as usual. Here is a user description of such a case:

I have a favorite route between home and work that isn't the fastest but the traffic is so much lighter that it doesn't matter it takes a couple of minutes more than Waze's two favorite routes. After a couple of days it automatically displays personal favorite as the second route alternative. ...since I drove this route repeatedly I taught Waze it exists and that it should be among the routes displayed. (Preferred Routing, 2015)

Waze's possibility of incorporating personal experiences is also very important in the manner in which navigation apps are transforming the entire way we experience our time-space environments. The usual disposition is that traditional "[m]aps foster accurate knowledge about straight-line (or Euclidean) distances between places, while direct experience helps people estimate directions between imagined places" (Grabar, 2014). A previous generation of geolocating tools like Garmin, TomTom, and others provided a general shift towards a more universal perception of time and space, dominated more by common cartography and less by personal experience. More modern digital mapping software (with all the known differences between Waze, Google apps, Apple Maps, Hopstop, etc.) started providing the recommended route with consideration of different data sources. However, we can still say that people can "have other preferences their algorithms can't perceive" and, as a result, "[t]he habits, hubris, and quirky predilections that once manipulated my movements are being replaced by the judgments of artificial intelligence" (Grabar, 2014).

Waze is at least open to incorporating personal and social experience (individual and group chronotopes), and this perspective could be one of the directions for the future of app design and development, and one of the reasons why Google is still keeping Waze and Google Maps as separate applications. To support this idea, we can refer to newer products in consumer mapping that creatively respond to the hegemonic efficiency of already popular navigation apps.

One of the most interesting examples is Yahoo Labs and University of Turin team attempts to quantify "a nice walk" using crowdsourced impressions of streets, Flickr data,

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and survey responses. The experimental maps balance between “people’s emotional perceptions of urban spaces” and a route to a destination in a reasonable amount of time (Figure 7). So, their program algorithm is oriented on finding the prettiest route where the shortest route is just one of the possible explorations. Their route options are the following: (a) Shortest, (b) Beauty, (c) Quiet, and (d) Happy (Quercia, Schifanella, & Aiello, 2014).

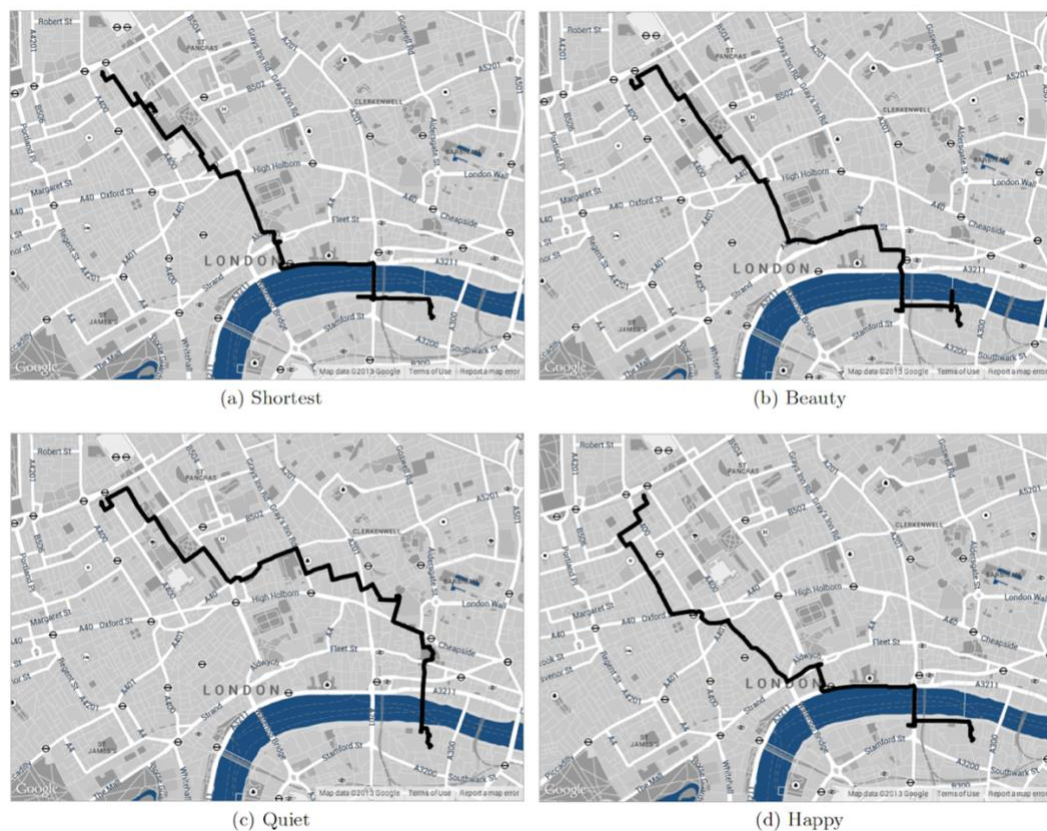


Figure 7. Yahoo Labs experimental map showing the different paths between Euston Square and Tate Modern in London (Quercia, Schifanella, & Aiello, 2014).

Very recently, in August 2018, Waze added an experimental routing similar to the Yahoo Labs map. In the United Kingdom, Volkswagen and Waze collaborated on launching a campaign named GTI Superdrives to help drivers to experience some of the

UK's most beautiful driving roads (Figure 8). Waze analyzed data and ranked routes based on the following key variables: "Roads eligible for Superdrive status are scenic yet close to at least one point of interest. They include a high number of engaging corners. They're roads on which users report little traffic and few accidents or other incidents." (Glon, 2018, August 7). The routes are also scored on their "Joy," "Scenery" and "Traffic" (Pawlik, 2018, August 31), to account for even more possible personal user preferences.

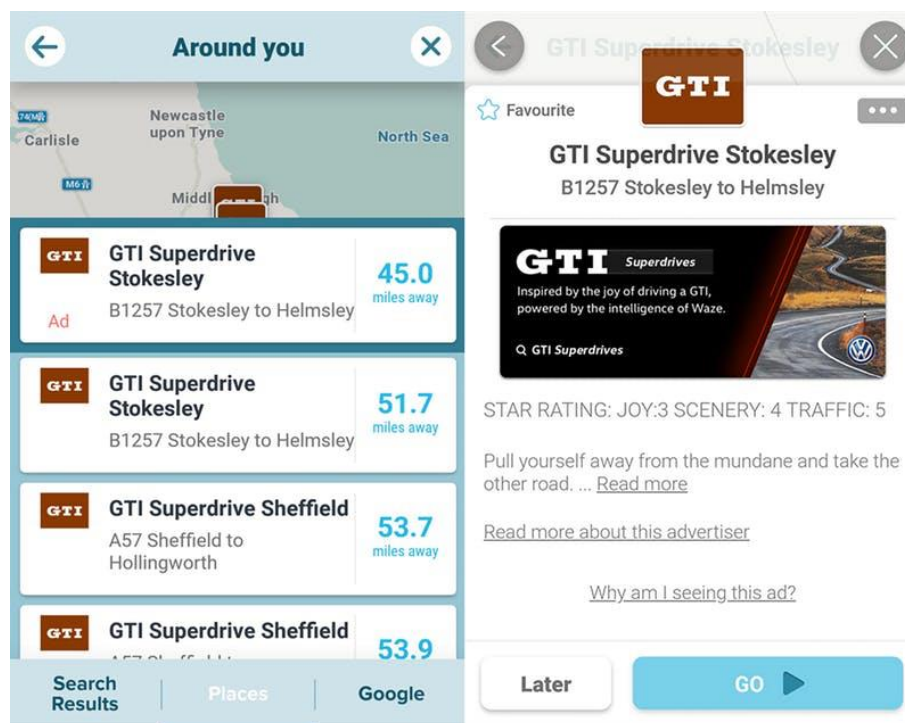


Figure 8. Waze's August 2018 UK GTI Superdrive roads (left) and GTI Superdrive Stokesley road's Star Rating: Joy: 3 Scenery: 4 Traffic: 5. (right) (Pawlik, 2018, August 31).

Then local volunteer Waze Map Editors were asked to cross-reference the selection. All Wazers receive a notification from the app when they are within a 12-miles of one of the Superdrive roads, and they can be rerouted to that road. The GTI Superdrive

feature is an example of possible options for future additions to Waze as they correspond to more parameters of personal time-space experiences.

We will discuss personal chronotopes and the multiplicity of chronotopes in Waze later in this chapter.

4.5.4 Comparing Routing in Waze and Google Maps Based on User Experience

It is important to explore more differences between Waze's routing and Google Maps' routing. Originally launched in 2006-2008 in Israel, during the summer of 2013 Waze Mobile was acquired and now is owned and managed by a division of Alphabet Inc., Google's umbrella corporation (Waze, n.d.). At the moment, even owned by one company, Waze and Google Maps are heavy contenders as two separate platforms doing almost similar things in incredibly different ways. The specific details of the possible connection between them in exchanging data are not publicly disclosed, and the applications continued to work independently for the most part.

Based on summaries of user experience, "[a]s Google owns Waze, it may pull data from Waze (this seems to happen, but I don't know to what extent)" (Waze routing vs. Google Maps routing, n.d.), and "[w]ith the recent acquisition of Waze by Google, Inc., changes have been made to the Waze Map Editor to include updated aerial and street view images from Google" (Using external sources, n.d.). We can summarize Waze and Google Maps data exchange in the following way: Waze still uses its own original routing algorithm designed by Waze team long before being purchased by Google. Also, as we can observe, this algorithm is a different one compared to the one used by Google Maps.

Summaries of user feedback taken from Wazeopedia forums outlines these differences. Wazeopedia is the Waze community wiki, that has two instances: the first instance is aimed to host global content, and another contains a unique wiki instance for each local Waze community. This way Waze content is "shared across the wikis, maintaining the collaboration while allowing the reader an insulated experience" (waze:Wazopedia, n.d.).

Essentially, as for any crowdsourced data based app, a quality of Waze's information depends on the number of Wazers reporting in a particular area. Waze "relies heavily on other users, so drivers who are in areas where there may not be a large number of Wazers might not get the value from this app that those in cities like New York or L.A. might" (Waze routing vs. Google Maps routing, n.d.). User feedback from around the world confirms this depiction: Waze "is more up-to-date and Waze knows about restrictions... much better in London for real-time road closures, traffic and short cuts. Google maps tends to prioritize main roads.", "Here on our country [Israel] Google maps not effective at all cos the roads are always get changed and new ways created.", "In my area of Southern California, mostly the LA basin, Waze always gives me a quicker route, which usually entails more turns and smaller roads than Maps.", "GM [Google Maps] prefer major routes while Waze can go around to pretty small routes as long as it takes you out of the traffic jam", and "Waze heavily relies on data from wazers while G[oogle] M[aps] relies on data from Waze (traffic and incidents), other Android users and also from government traffic information thus making it a lot more accurate on long routes outside major cities (where is less likely to have wazers)." (Waze routing vs. Google

Maps routing, n.d.). All this feedback also indicates a foundational difference of Waze's orientation on real-time user information and Google Maps' prioritization of historical average road speeds and use of the main roads.

Also, there is research data that confirms Waze's crowdsourced data to be very reliable. In a recent evaluation,

[o]ne year of Waze data was compared with the recorded incidents in the Iowa's ATMS [Advanced Traffic Management System] in the same timeframe. Overall, the findings indicated that the crowdsourced data stream from Waze is an invaluable source of information for traffic monitoring with broad coverage (covering 43.2% of ATMS crash and congestion reports), timely reporting (on average 9.8 minutes earlier than a probe-based alternative), and reasonable geographic accuracy. (Amin-Naseri, Chakraborty, Sharma, Gilbert, & Hong, 2018)

From the chronotopic perspective, according to the ratio and character of the temporal and spatial categories represented in different chronotopes, Waze and Google Maps are also presenting very different explorations of different chronotopes. Again, we research feedback from drivers who use both Waze and Google Maps, or from drivers who even "decided to do extensive test[ing] between the two" (Waze routing vs. Google Maps routing, n.d.).

A Waze user is "the type of driver who prefers to save time while driving and who doesn't mind too much that he's taken off the main roads and gets a more scenic route, as long as it saves him time." (Waze routing vs. Google Maps routing, n.d.). A user

of Google Maps is "the type of driver who prefers to drive on the main roads but wants to know how much delay he might experience so he can leave in time." (Waze routing vs. Google Maps routing, n.d.). Accordingly, we explore the process by which two applications utilize two different approaches to time and space resulting in two different apps and two different types of user experience: "Waze will take you anywhere to save time. Google keeps you on more main roads. If you need to get there ASAP, use Waze. If you don't, use Google Maps." (Waze routing vs. Google Maps routing, n.d.).

4.5.5 Nature of Time: Waze as Adventure Chronotope

A Waze driver prioritizes time and is ready for changing roads/space and has a more proactive role in general. Using Bakhtinian specifications of different aspects of chronotopes in his "Forms of Time and of the Chronotope in the Novel" (Bakhtin, 1981), we can classify a type of time for a Waze driver both as real-time and as adventure time that characterizes Bakhtinian adventure chronotope. The adventure chronotope "is composed of a series of short segments that correspond to separate adventures ... [w]hat is important is to be able to escape, to catch up, to outstrip, to be or not to be in a given place at a given moment, to meet or not to meet and so forth." (Bakhtin, 1981, p. 92). From the very beginning of using Waze, drivers experience and note this adventure aspect of Waze as one the main principles in routing calculations: "Waze seems like it has a risk/reward aspect to it. Sometimes the out of the way routes it takes pay off, sometimes you run into an unprotected left turn..." (Apple Maps vs. Google Maps vs. Waze, n.d.).

In Waze the *nature of time* is unique, user-specific and open to multiple possibilities: "[w]hen you enter a new time slot, any real-time traffic data that is available causes your client to recalculate your ETA and reroute you at that point." (Routing server, n.d.). Also, the order of incidents could be reversible to some extent. Describing the adventure chronotope in literature, Bakhtin describes it in very similar terms, "[t]he adventure chronotope is thus characterized by a technical, abstract connection between space and time, by the reversibility of moments in a temporal sequence, and by their interchangeability in space" (Bakhtin, 1981, p. 100). Thus, for example, Waze proposes multiple alternative routes as we drive, where there could be a difference in time getting to our destination, or time recalculation could be done for our chosen route. Here is a typical user exchange about Waze's alternative routing: "[I]t tells me to take different routes all time, routes I never would have discovered on my own. – Do you live in a maze? – I live in the Boston metro area. So yes." (Waze is stubborn, 2018, September).

The initiative and control of events don't completely belong to Waze drivers, as every driving moment contains a limited measure of choice, but similarly, as in the Bakhtinian literary adventure chronotope, there are moments with multiple possibilities, moments with the "occasional nodes of pure freedom separated by mechanical causal consequence" (Morson, 1998, p. 683). The "mechanical causal consequence" in our case is driver's dependence on road events and the main application's design algorithms. According to Morson, such moments of multiple possibilities are essential for forming specific types of chronotopes, "How often do such moments of multiple possibility take place? As it happens, Bakhtin asks this question in his chronotope essay, which classifies

narrative genres by how they answer it.” (Morson, 1998, p. 683). As we further explore, Waze and Google Maps are fundamentally different in the manner in which their design responds to “such moments of multiple possibility” because these two applications realize different types of chronotopes.

4.5.6 Waze's Adventure Chronotope as Applied Abstraction of Programming

Waze and Bakhtinian adventure chronotope also correspond in the way in which attention to space or map details and minute-by-minute route descriptions are related to fundamental abstract principles in the Waze application programming. We refer here to abstraction as one of the core concepts in the computer science and software engineering (especially in object-oriented programming languages):

Abstraction is applied in the process of identifying software artifacts (objects) to model the problem domain. It is the process of reducing these objects to their essence such that only the necessary elements are represented. Abstraction defines an object in terms of its properties, functionality, and interface (means of communicating with other objects).
(Abstraction, n.d.)

For navigation software like Waze, abstracting something means to capture the essence of what a particular function or a whole app does without losing interaction with unique time/space situations and the flow of social data.

We go back to the Bakhtinian analysis of the adventure chronotope where, as we remember, "...many items and events in this abstract-alien world are described in minute detail" (Bakhtin, 1991, p. 102). Although written by Bakhtin, the following question

sounds like it was asked by a modern program analyst, "How can this be reconciled with the principle of abstraction?" (Bakhtin, 1991, p. 102). As Bakhtin continues,

the abstraction is still there, because every feature described ... as if it were isolated, single and unique ... the sum total of these objects does not equal the countries that are depicted (or more precisely, enumerated) in the novel, but rather each object is sufficient unit itself. (Bakhtin, 1991, p. 102)

We believe, this Bakhtinian process of describing abstraction is reworked and even more connected to practice in Waze.

One of our references here is Waze's hyper-local – "every feature described" – map that is used as the app interface. Correspondingly, Waze is a hub of live user-generated information and users share different kinds of routing data constantly. Based on user feedback, it is "very common to find small roads in Waze that don't appear in any other service because they are local or private. You can find access to shopping malls, parking lots and even roads made by citizens in the middle of nowhere." (The difference between apple maps and google maps, 2018, August).

We can provide an example of Waze's "small roads" knowledge based on our recent driving experience. We needed to cross an area that is situated very close to M&T Bank Stadium right before Pittsburgh Steelers vs. Baltimore Ravens football game on Sunday, November 4, 2018. It wasn't looking realistic, but Waze proposed an effective way through. The entire route had a maze-like pattern as it corresponded to all temporary street closings and changed traffic directions in real-time as police transformed the area

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to "walking-only" mode. The key part was driving under an elevated section of Russel St. (the largest two way street, horizontally in the center of Figure 9). Right under Russel St., Waze found a small unmarked parking lot, between Alluvion St. and Warner St., that has openings from both sides allowing us to drive through. This unorthodox solution was not one that most people would find on their own without assistance from a crowd-sourced app and made my trip possible that day.

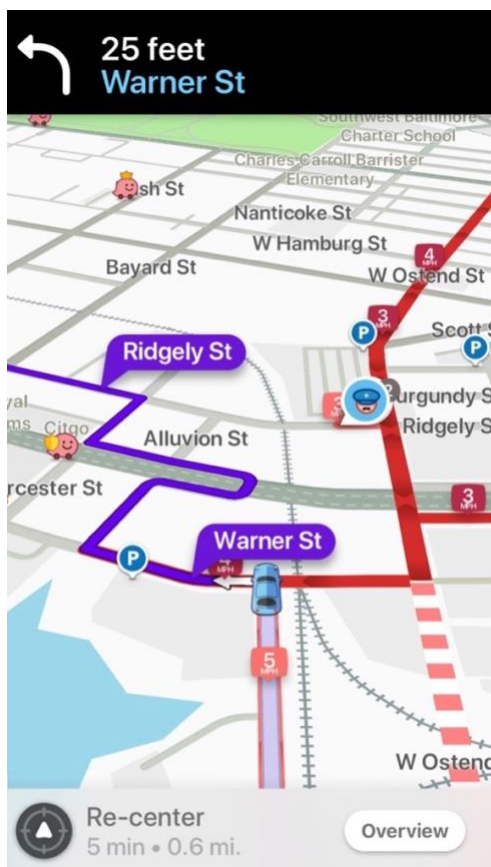


Figure 9. Screenshot of the Waze mobile app interface on iOS device.

Routing through an unmarked parking lot under Russel St. (Baltimore, MD)

Map data ©2018 Waze. (Screenshot by author)

In the same “hyper-local” way, Wazers pinpoint which gas station has the best prices at the moment, and outline directions to the station in the local area, specific to the

time of the day. Because of a high level of personal customization in Waze, hyper-local could also become hyper-personal. The same "Gas stations" feature could be customized to show a user's preferred fuel type, particular gas station type, and how all-related information is sorted: by price, by distance, or by brand (Set preferred gas stations, 2018).

This way each object becomes the "isolated, single and unique" software artifact and graphical abstraction when it is carefully placed on the map. Maps in Waze are tuned by local experts and constantly re-edited. Waze uses a point system to track use of its client application and – specifically – to track use of the Waze Map Editor. "Wazers who edit the map also have an edit count and an editor rank" (Your Rank and Points, n.d.). Some of the highest points possible are given for user actions related to map editing (Figure 10).



Figure 10. Screenshot of the Waze's web page in a desktop Internet browser. Waze's Map Editor. Adding road segment (Antokolsky, 2018, January 6).

The map is the interface – the Waze map defines the application interface and is used as the main working interface, and even as a marketing tool at the same time. All Wazers around are graphically indicated on the map. All map objects are important abstractions that communicate the input of a large amount of the real, substantial and relevant information. Still "each object is [a] sufficient unit itself" because of one's location in the time-space continuum in relation to other objects of interest: destinations, services, businesses, and other drivers. Abstraction is practically applied as a core principle, and abstraction is functional in displaying how different kinds of objects interact in space and time.

4.5.7 Spatiotemporal Waze: How Time Normalizes the "Suddenly" Spatialities

In Bakhtin's analysis of different types of chronotopes, adventure "time segments" are introduced and intersect with specific link-words, for example, "suddenly" and "at just that moment" (Bakhtin, 1991, p. 92).

Waze is using a very similar adventure vocabulary with even more emphasis on the time-space interrelation: "Route change: 4 min early: We found a better route" (Figure 11) or "Traffic is building up/freeing up ahead," or "Approximate time in traffic 12 minutes".

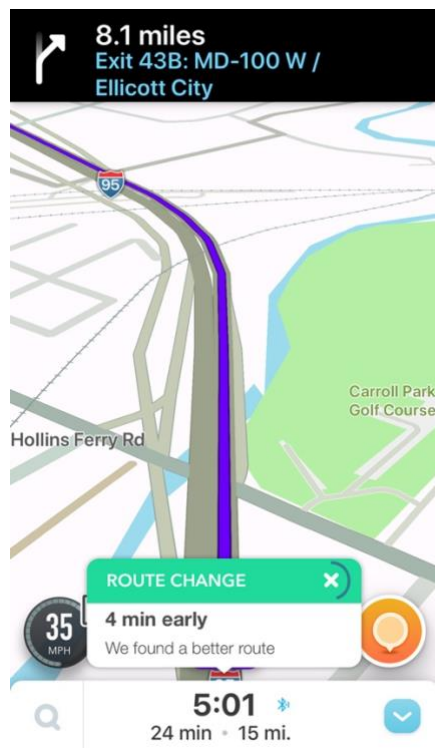


Figure 11. Screenshot of the Waze mobile app interface on iOS device.

“Route change: 4 min early: We found a better route” notification.

Map data ©2018 Waze. (Screenshot by author)

This chronotopically charged adventure "suddenly" language usually designates our driving during peak hours and can "characterize this type of time... where the normal, pragmatic and premeditated course of events is interrupted" (Bakhtin, 1991, p. 92).

In chronotope, time constitutes exactly that which normalizes the role of these "suddenly" spatialities. We already analyzed how Waze breaks our route into shorter and more predictable – more expected in their changing details – segments that are designed for stretching or compressing route time. In Bakhtinian adventure chronotope, correspondingly, “[t]ime breaks down into a sequence of adventure-fragments” (Bakhtin, 1991, p. 152), and this time sequence works as an already prepared organizing frame for absorbing and utilizing unexpected spatial events. As in Bakhtin’s adventure chronotope

[t]his 'suddenly' is normalized, ... it becomes something generally applicable, in fact, almost ordinary. ... Even the "unexpectedness" itself – since it is always with us – ceases to be something unexpected. The unexpected, and only the unexpected, is what is expected. (Bakhtin, 1991, p. 152)

The same way, Waze as a program is pre-organized for catching and normalizing unexpected route events using their time-space interconnections.

4.5.8 Nature of Space in Waze: Interchangeability of Space and Interdependency of Time and Space

As Bakhtin continues analyzing adventure time chronotope (we remember, "Forms of Time and of the Chronotope in the Novel" was written in the 1930s), it gives the impression that Bakhtin is describing the general purpose of what we know as today's navigation app. "... '[E]arlier' and 'later' are crucial, even decisively, significant. Should something happen a minute earlier or a minute later, that is, should there be no chance simultaneity or chance disjunctions in time, there would be no plot at all, and nothing to write about" (Bakhtin, 1991, p. 92). When finding the best route to get you to your destination faster, often "minute earlier or later have everywhere a decisive significance" (Bakhtin, 1991, p. 94) for choosing a specific route.

The nature of space in Waze is open and interchangeable, "governed by an interchangeability of space; what happens in Babylon could just as well happen in Egypt or Byzantium and vice versa" (Bakhtin, 1991, p. 100). Respectively, routes and different roads types – "non-streets, side streets, "Primary Streets" or the various Highway types"

(Routing server, n.d.) – are interchangeable. Time and space are interdependent, for example:

Consider a traffic light with long waiting times. The road segment leading to that traffic light will have a low average speed. If the average speed (based on the average waiting time) becomes low enough, a longer route that avoids the light becomes the preferred route. This has been observed in practice and is an example of emergent behavior. (Routing server, n.d.)

Referring back from Waze to the chronotopic time and space interdependency in Bakhtinian analysis, we see the same accent on the technical and mechanical relations:

[T]he link between space and a time has, as it were, not an organic but a purely technical (and mechanical) nature. The contingency that governs events is inseparably tied up with space, measured primarily by distance on the one hand and by proximity of the other (and varying degrees of both). (Bakhtin, 1991, p. 99)

Waze information design not only uses distance and proximity as core constituents for live data interpretation, but started using them in different new campaigns are positioned as additional features inside the main client application. We refer here to Waze's mobile proximity marketing campaign and Carpool service feature.

Waze's mobile proximity marketing is based on the idea of pushing advertisements in specific areas directly to potential customers who are driving near local businesses, or as Waze describes it, "Location marketing, with context: Reimagining the relationship between brands and drivers... creating meaningful branded experiences

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within the context of a drive.” (Waze: For Brands, n.d.). If Wazers are interested in these ads, they can interact with an ad to save places to visit later, receive a more detailed revised map, or get real-time navigation with step-by-step verbal instructions directly to selected places. Businesses are getting more information. If they partner with Waze they can use Waze’s database “to uncover unique insights based on driving behaviors ... see a city-by-city snapshot of drivers visiting commercial locations within a single day” or explore different driving patterns to see “when drivers are most likely to visit different business categories” (Waze: For Brands, n.d.).

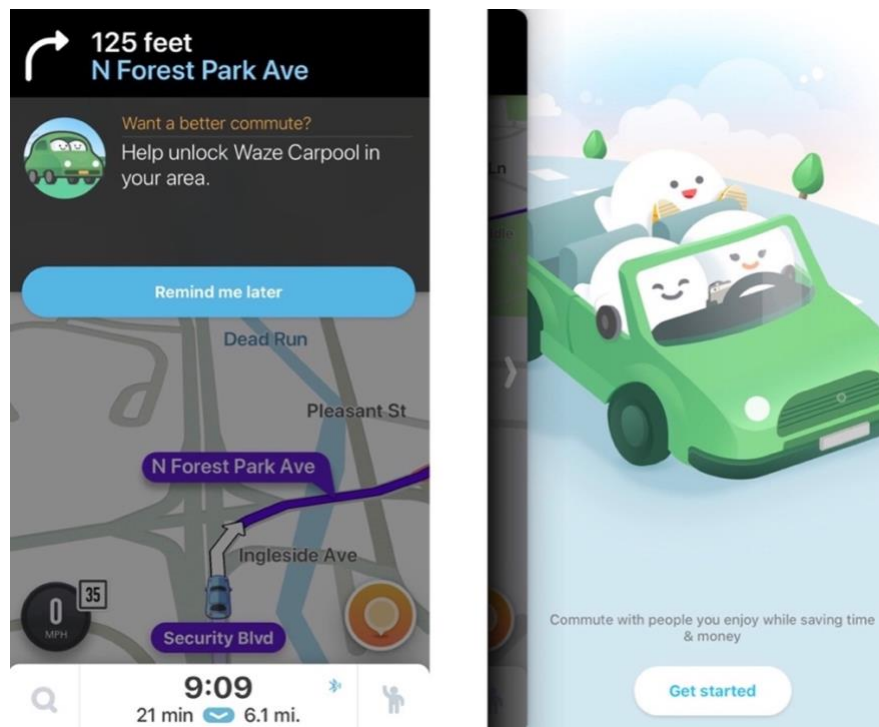


Figure 12. Screenshot of the Waze mobile app interface on iOS device. Waze is suggesting its “Waze Carpool” feature. Map data ©2018 Waze. (Screenshot by author)

Waze’s Carpool (Figure 12) is even positioned as a separate app and is based on the same distance/proximity metrics. Additionally, Waze’s Carpool uses details in user

profiles: driver's community – friends, coworkers, or neighbors – and can find and suggest the people they might want to carpool with based “on detailed profiles, star ratings, and filters like same-gender & coworkers only” (Make the most of your commute with Waze Carpool, n.d.). For example, over last three years Waze has expanded its Carpool service across the entire San Francisco Bay Area and “partnered with major regional employers to promote the inexpensive commuter option”, and “[u]nlike ride-hailing services Uber and Lyft, Waze Carpool pairs up riders and drivers through the navigation app who live or work in close proximity to one another” (Ohnsman, 2017). Based on user feedback, Waze Carpool users specifically point out this important social aspect in app's design:

Waze has some sort of social integration. ... I'd be happy giving a fellow student or employee of my company a lift, but probably less likely to give random members of the public. ... Completely agree with this; not only are you more likely to share a common origin or destination, but it also becomes an opportunity to meet someone new within your network.

(Waze Carpool: Hacker News, 2018)

Nature of place (as connectedness of time and space) in Waze could be characterized as action dependent: as we know, "Waze sometimes offers a new route to bypass heavy traffic" based on user/drivers actions, and "Waze uses the data from Wazers traveling through the segments to update the average speed." (Routing server, n.d.). The result is the app creating the environment of action sequences, determined by the driver's activities.

4.5.9 Chronotope of Google Maps: Different Design Priorities and Different User Activities

Following Google Maps basic design decisions – priority of historical average route metrics and preference of the main roads – a Google Maps user, as a result, is more passive in terms of his or her choices and activities. Choosing the main roads and just knowing ETA is less active as a driving mode and requires less interaction with the application and less attention to changing road situations. From the perspective of Bakhtin's theory of literary chronotope, we have explored similarities between the Waze app design and Bakhtinian definition of adventure chronotope. From the same perspective, the Google Maps app environment has a closer connection to Bakhtinian chronotope of the novel of everyday life or novel of the ordeal (Bakhtin, 1981, p. 252). In the novel of the ordeal chronotope, the human being is passive and the role of chance – “fate” or “providence” in the literary chronotope or just sticking to one original route in Google Maps – “presents the important role of change [in] one's life” (Bakhtin, 1981, p. 185). For example, if there's building traffic ahead while you are driving, Google Maps doesn't automatically update your route. Instead, if Google Maps discovers a traffic jam ahead, a special pop-up notification appears. A driver can choose whether to accept that rerouting or passively follow the original route. In case the driver doesn't react, after some time a pop-up disappears, and the original route is still shown. As we know, in contrast, the more adventurous Waze will automatically update your route (Figure 13) to avoid traffic and redirect the driver to go a different way.

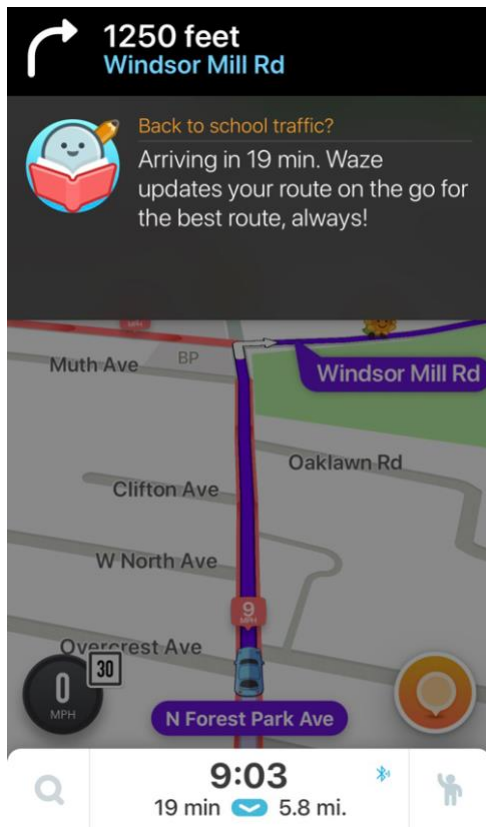


Figure 13. Screenshot of the Waze mobile app interface on iOS device.

Waze automatically updates your route.

Map data ©2018 Waze. (Screenshot by author)

Type of time in Google Maps according to Bakhtinian chronotope classification could also be characterized as real time, but without that adventure aspect we trace in Waze. In Google Maps the type of time is everyday time, cyclical everyday time, time of labor, and/or conventional time. The type of time in Waze and Google Maps is different with respect to how the ETA is calculated. Even if ETAs from Waze and Google Maps are usually pretty close (based on current existing research, as relative to Google Maps, Waze's estimated trip times are usually 3% shorter (Apple Maps vs. Google Maps vs. Waze, February 19, 2018), users still could feel or could react to ETAs and process them

very differently because of the different types of chronotopes realized by these two apps.

“Waze is also FAR more accurate in its initial estimate of arrival time than Maps. Waze, even on a 70 mile trip through rush hour traffic, is accurate to within a couple minutes.

Maps will almost always overestimate the arrival time by about 10-15%, and then gradually updates and gets more accurate as I get closer.” (Waze routing vs. Google

Maps routing, n.d.). Or “I feel like I usually beat the Google Maps eta but usually arrive right around the Waze eta” (Apple Maps vs. Google Maps vs. Waze, n.d.). We have

found interesting examples of user feedback in which perceiving differences in application's type of time becomes one of the reasons to choose one app over another,

“Google Maps seems to be slightly more "optimistic" than Waze, so being a prudent person, I prefer to rely on Waze's predictions.” (Zellner, 2013, July 25).

Nature of time in Google Maps app tends to be irreversible, repeatable and closed or scripted in advance. As one of the users interestingly confirms, such a “scripted in advance” aspect is the key factor when comparing Google Maps and Waze. “It's like Google Maps assumes speed limit and Waze assumes real life speed 20 km/h over” (Apple Maps vs. Google Maps vs. Waze, n.d.). One of Uber/Lyft drivers (a large and representative group of users who can constantly use both apps at the same time or switch them) describes a difference between time-perception using these two apps. “I also like Google Maps, and I use it when driving myself around. I don't always need to avoid traffic, or need the fastest route when I have nothing to do.” (Waze vs Google Maps: The Ultimate Showdown, 2018). Thus, this driver notes and uses Google Maps' more

regulated time, more predetermined in its nature time when there is no need to avoid traffic using adventurous Waze-like transgressive in its nature time.

Nature of space in Google Maps is enclosed, known, and homogenous. Following Google Maps' general rule – "the main roads" or highways are preferred. Adventuristic turns to small local roads – even if they could potentially save time – are usually not considered by Google Maps. We can summarize the user experience of space in the following way, "Waze algorithm is much more aggressive, meaning that it will make you take longer but faster routes more frequently than Maps. ... Google use[s] more generic routes that will please average drivers." (The difference between apple maps and google maps, 2018, August).

Respectively, *nature of place* in Google Maps is the "replaceable," everyday realm. As one of the users summarizes a difference between Waze and Google Maps experience, "If you want to just get to your destination, Google Maps is good enough. But, if you're looking to supercharge your navigation, give Waze a try." (Waze vs Google Maps: The Ultimate Showdown, 2018). A humoristic interpretation of differences between Apple Maps, Google Maps and Waze extends the same comparison:

Apple Maps: Our artisanal cartographers hope you enjoy this pleasant journey. 28 min

Google Maps: Our algorithm has determined an optimal path for the most efficient route given current traffic conditions. 25 min

Waze: Drive through this dude's living room. 17 min.

(Definitely not hiding..., August, 2018)

There is, of course, some exaggeration in the apps difference in their ETAs but this popular online joke really captures how the difference in the design of these three navigation applications and how they organize our routing experience.

4.5.10 Opened "Public Exteriority" of Waze

One more interesting and significant difference between Waze and Google Maps is seen in historical traces of the depiction of an individual. We refer to how Bakhtin connects "the image of man" and chronotope: "The chronotope as a formally constitutive category determines to a significant degree the image of man in literature as well. The image of man is always intrinsically chronotopic." (Bakhtin, 1981, p. 84-85). These depictions changed or repeated during different epochs in literature, and now we trace the similar development in social media applications.

Bakhtin's analysis of chronotopes in Greek literature points out the exteriority of an individual in Greek culture, "[t]here was as yet no internal man, no man for himself ... An individual's unity and his self-consciousness were exclusively public. Man was completely on the surface, in the most literal sense of the word." (Bakhtin, 1981, p.133).

We believe Waze uses the same kind of exteriority in its program functioning. Being "completely on the surface" is a key characteristic of Waze because we can see and monitor other Wazers around us when we are driving. Waze has a special app feature – "Wazers around you" (Figure 14). As Waze's user forum describes, "[w]hen you first start Waze it shows the amount of Wazers around you and then goes back to saying good morning or evening" (Always show number of Wazers, n.d.).

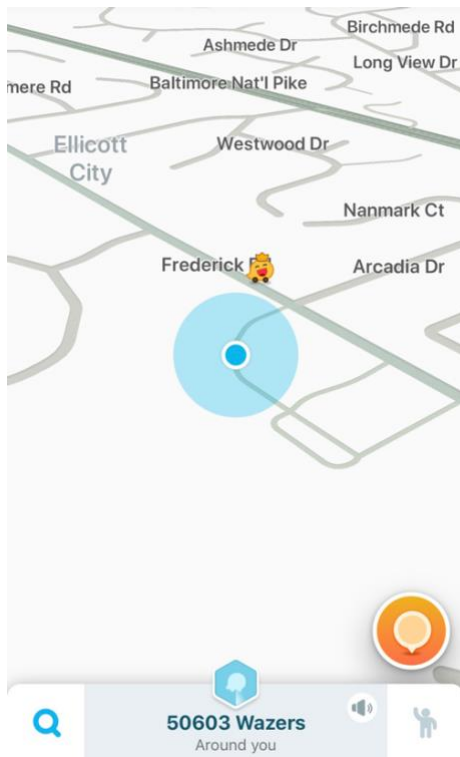


Figure 14. Screenshot of the Waze mobile app interface on iOS device.

“Wazers around you” feature. On the screenshot: 50603 Wazers are around (Ellicott City, Maryland, September 12, 2018, 8:25 AM).

Map data ©2018 Waze. (Screenshot by author)

This deceptively simple feature is not just a part of the visual interface but also is characteristic of the uniqueness of Waze as a social navigation app. Users immediately discover a sense of a visible driving community: "As you move into different areas it's important to know if there are plenty of other Wazers still around. ... if it could show how many Wazers are in front of you in the direction you're travelling so you know anything that is in front of you will be reported." (Always show number of Wazers, n.d.). Also, Waze allows communicating with other Wazers to make "this public exteriority" evident: chat with your friends and fellow Wazers, see you friend's locations, share your

drive (including non-Wazers), share your ETA (Figure 15), share a location, or send a private message.

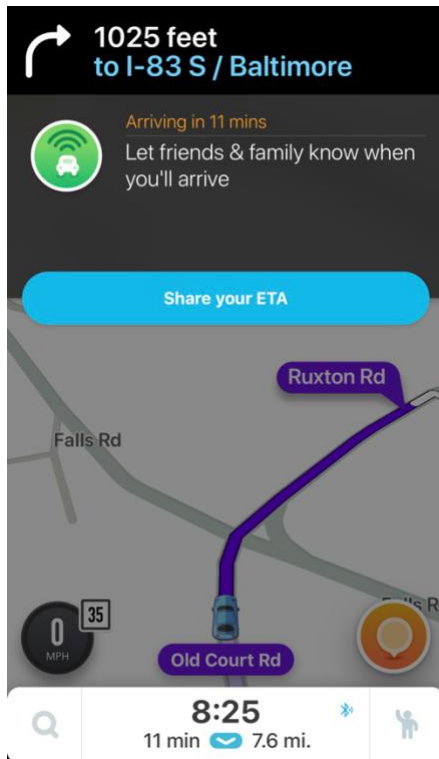


Figure 15. Screenshot of the Waze mobile app interface on iOS device.

Waze's "Share your ETA" feature.

Map data ©2018 Waze. (Screenshot by author)

The opened public exteriority of Greek chronotope, where "[t]o be exterior meant to be for others, for the collective, for one's own people... the unity of a man's externalized wholeness was of a public nature" (Bakhtin, 1981, p.135), will be broken in future literature development, and the concept of "the self-consciousness of European man" (Bakhtin, 1981, p. 135) will become the main aligning center for modern culture.

The individual in succeeding epochs becomes a more private, more singular individual. "The human begins to shift to a space that is closed and private, ... where it

loses its monumental formedness and exclusively public exteriority." (Bakhtin, 1981, p. 144). Google Maps doesn't pretend to be a social navigation application, there is no feature for showing or communicating with other drivers around, and, in this sense, Google Maps is closer to the depiction of an individual as "internal" man (a closed "man for himself"), the way it was developed in modern culture after classical Greek art and literature.

4.6 Realizing Chronotopic Design: User Experience of the Chronotope

Now, still referring to Waze as an example of the chronotopic conceptualization, we can examine the implications of the chronotope analysis for social media navigation apps on a bigger perspective and demonstrate how this strategy can be used for the overall design structure, how the chronotopic design can be realized, and how the user experience of chronotope can be created.

Once the purpose of the application has been set, and the overlying programming chronotope and the possible situational chronotopes have been identified, the next task is to identify the structural properties of each of these chronotopes:

- How time and space relations are structured and altered;
- Which events, objects, characters, possible pre-determined narratives are essential to each chronotope;
- Outline the role of the user and his or her input in connecting these chronotopes.

4.6.1 Designing the Temporal Structure of Chronotope

The chronotopic structure of space should be represented through those aspects of the application in which the chronotope is implemented. The temporal structure is usually connected to the main narrative of the media. We already compared Waze and computer games. Wei, Bizzocchi, and Calvert adapt existing narrative theory developed for literature to analyse computer games as storytelling and argue that narrative time in a digital game is a relationship between "operational time" (the time of the actions of the player) and "story-time" (Wei et al., 2010, p.3). We can apply this distinction to navigation apps and Waze in particular as two possible types of experiencing time.

"Story-time" is a continuation of our natural time, or a continuation of our real-time, as it could be measured in the narrative. For navigation apps "story-time" is the route-time. "Operational time" or action-time is different, because this kind of time experience is determined by app developers.

Following this duality, we can see that action-time is not necessarily connected or limited to traditional linear time continuity. Action-time as the temporal aspect of the chronotope becomes a fusion between an individual user chronotope and the real physical space of the road. So, as we can see again and as Waze does it, the main overlying chronotope of the app should be opened for its dual task:

- 1) to be infused with all possible events (all situative chronotopes), and
- 2) to take into consideration the real time of the user, to perceive and interpret possible characteristics of the experience of time (for example, the order of events, the frequency of events, and the duration of events).

The last part related to characteristics of experiencing time is also important because of possible differences in perception and schematization of narrative events. For example, the evaluation of the "speed" as it related to traffic could be very different. This is one of the reasons why Waze gives three different options for manually reporting traffic. These options are "Moderate," "Heavy," and "Standstill." So, various options for basic reporting provide flexibility when the user's subjective "time felt," the perceived temporal aspect of his personal chronotope, is altered by the objective duration of physical "clock-time."

Now, let's discuss forms of perceived time in chronotope and how they can be realized in designing the temporal structure of chronotope.

4.6.2 Designing the Temporal Order of Chronotope

When we compared Waze and Google Maps, we outlined that the direction and order of perceived time could be direct, reverse (transposable), or cyclical. The reversibility, the possible transferability, of the temporal order is the most important and interesting form of the temporal order from a design perspective. The order of events could be reversible not only because of "the reversibility of moments in a temporal sequence, and by their interchangeability in space" (Bakhtin, 1981, p. 100), but also because of the application or the driver has already learned the same kind of an event or an event is already known.

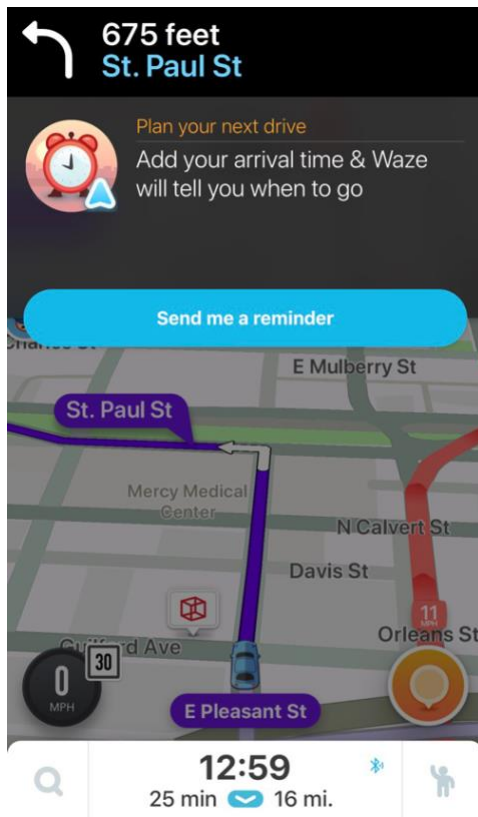


Figure 16. Screenshot of the Waze mobile app interface on iOS device.

Waze's "Add your arrival time & Waze will tell you when to leave" notification.

Map data ©2018 Waze. (Screenshot by author)

We believe the temporal reversibility is part of the logic behind Waze's "Time to leave notification" feature (launched in Spring 2016). We schedule a future drive (Figure 16) and choose only the time and date at which we would like to arrive to our destination. Then Waze lets us know when it is the best moment to start driving for a planned trip or for an upcoming calendar event (Figure 17).

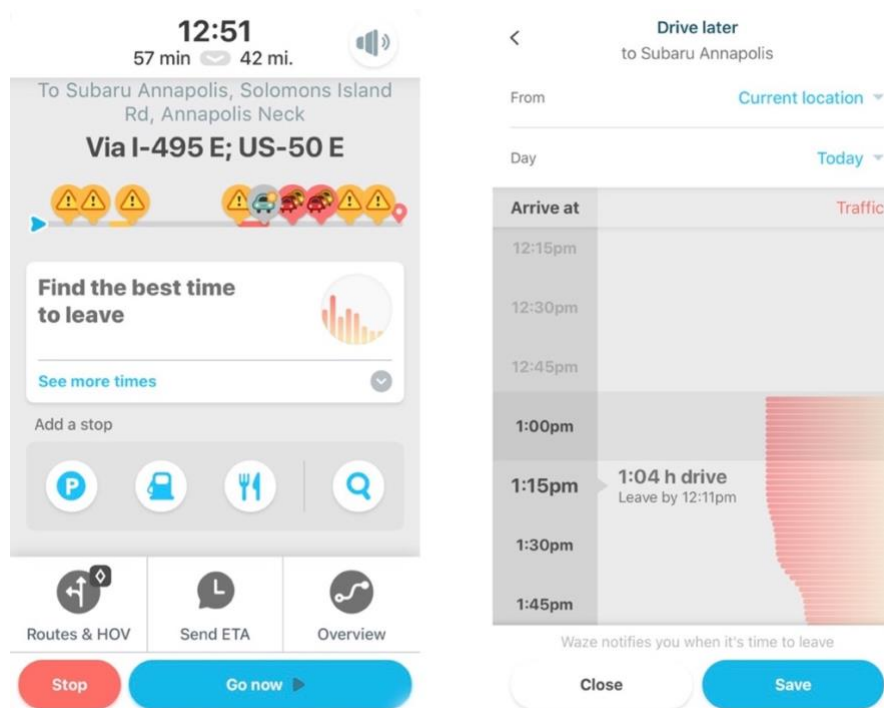


Figure 17. Screenshot of the Waze mobile app interface on iOS device.

Waze notifies the user when it's the best time to start driving: "Find the best time to leave" feature (left) and its corresponding "Drive later" time and traffic chart (right). Map data ©2018 Waze. (Screenshot by author)

"When you enable time to leave notifications, Waze will gather relevant traffic alerts both around your start and end locations to provide you a more accurate ETA and routing information." (Plan a drive, n.d.). When Waze calculates the most appropriate time to start driving, the application transfers the moment in temporal order, based on the calculated "interchangeability in space."

Also, there is one more mode in the same Waze's "Plan a drive" feature. We can use Waze to learn and monitor how long it will take us to get to our destination at different times throughout the entire day. Waze automatically makes necessary adjustments to starting times based on real-time traffic situations during the day. Here

Waze organizes multiple chronotopes by connecting them into one coherent continuity, Waze enables a cross-chronotopic synchronization where all time-space vectors are reoriented to be present and active.

Here Waze takes possible temporal reversibility to its full technical extent by providing all possible route-time scenarios. The choices of the user can change the order of events, resulting in creating a new route sequence, one that is unique to each user interaction. Waze is very chronotopic in using this feature. A time order is not actualized but exists as potential until user interaction starts to unfold and reveal possible order.

4.6.3 Designing the Temporal Duration and Frequency of Chronotope

Duration relates to the perceived speed of events. The speed of events is always contextual because it is defined by the duration of events in context with the user's personal perception and his general idea of "clock-time". Any navigation application should include constant references to it in "clock-time" (e.g., ETA or time in traffic).

Frequency specifies how often separate events occur in a presented temporal segment. Also, we need to account for the user's "responsiveness", as the speed of the user's response can alter app operation. On the other hand, app design decisions could be confusing for the user in how exactly user responsiveness is interpreted or even limited in terms of the same temporal duration and frequency. One of the very popular topics on Waze forums is dedicated to discussing the logic behind Waze's algorithms for presenting user-generated data for one or another time period. Here is an example of a very common question related to the duration of a Waze alert created by a user:

Yesterday there was a demonstrate on the street. The Police were diverting traffic. I made an alert "close road for event" but it only stay for 20 minutes, then disappear. The demonstration last about 3 hours according to the news. (Duration of alert?, 2013)

Here is a solution in response from another Wazer:

You should have used the Report > Closure option instead of Report > Hazard. It will allow you to set a duration for the closure. (Duration of alert?, 2013)

In this example, we can see that Waze's interface controls for submitting user reports could be improved, but the app design is definitely supporting different options for representing temporal duration and frequency.

4.6.4 Designing the Spatial Structure of Chronotope

We start by referencing Wei, Bizzocchi, and Calvert's (Wei et al., 2010) detailed descriptive framework of interactive space in computer games and compare it with interactive space in navigation applications. Wei, Bizzocchi, and Calvert classify the following characteristics of spatiality in digital game storytelling;

1) the "topographical space" mode – underlying, usually static spatial reference of the real world: a map or any mental constructs that features the spatial relations between locations or entities;

2) the "operational space" – the space revealed during game play through events and actions of the user;

3) the "presentational space" – the multimedia summary of "manifestations of the game world" (Wei et al., 2010, pp. 7, 8).

Now we can compare and better identify how interactive space is structured in navigation applications in general and in Waze in particular.

1) First, the "topographical space" in any navigation app is not static. This is a real and concrete physical world around us with permanently changing route situations.

2) Second, the "operational space" is the exposition of the "topographical space" as it is represented by different kinds of information feeds (feeds are different from application to application) and referenced by specific design approaches in application programming. For example, as we know, even the underlying mapping structure is constantly updated in Waze.

3) The "presentational space" in navigation apps usually allows taking into account user spatiality as a representation of the "topography" of his personal chronotope. The "topographical space" and "operational space" are combined in the "presentational space" with a subjectively experienced spatial aspect of the chronotope. Also, the "presentational space" composes a digital space where users accomplish their activities in relation to the app interface and other Wazers.

The "presentational space" should also include the car. We agree that when conceptually exploring Waze, "the interior of the car, often associated with a solitary disconnection to the external environment is re-examined, studied as a penetrable space by digitally mediated social interaction" (Ramos, 2016, p. 140). Physical and digital are embodied in one continuous time-space experience. In this connection, physical features

of the car become more distinct and meaningful for time-space connectedness. Routinely traveling through the actual space, getting a flow of road information through the windshield, side mirrors, wide windows or rearview mirror, the driver is experiencing different time constants. "[T]he driver looks up ahead and sees the coming road they will encounter; the driver looks to the side and sees what elements are coexisting in that particular present time; the driver looks through the rearview mirror and sees the road they have already traveled through" (Ramos, 2016, p. 146). This way time and space are condensed and exposed within the vehicle's interior as the driver processes them. All these car features, transparent or reflective car surfaces, are combined with Waze's interface on mobile device, and the driver knows "what is happening on the road ahead ... in advance," and "Waze destabilizes constructions of time, where the road and the drive become a play between past, present, and future" (Ramos, 2016, p. 141). Again, we notice how Waze is bringing in and effectively using a sense of play.

All three spaces are parts of the same spatiotemporal chronotope as they represent the real space of the road, the space of the user, and program features.

Such Waze's features as the "Number of Wazers around you", later added the "Number of Waze user reports around you", or the app user rank establishes a sense of scale and spatial positioning among Wazers and allow them to experience spatial connectivity. As one of the users notes, "Within the United Kingdom, I'm ranked at about 14,000 so there's probably 20-30 thousand people out there who are using it on a regular basis. ... There's a community there." (Ramos, 2017, p. 10). As a result, there is a spatial and social structure that positions all users among and in relation to other Wazers,

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and each individual Wazer is mirrored as a digital spatial subject whose performance is displayed onto the app's map interface.

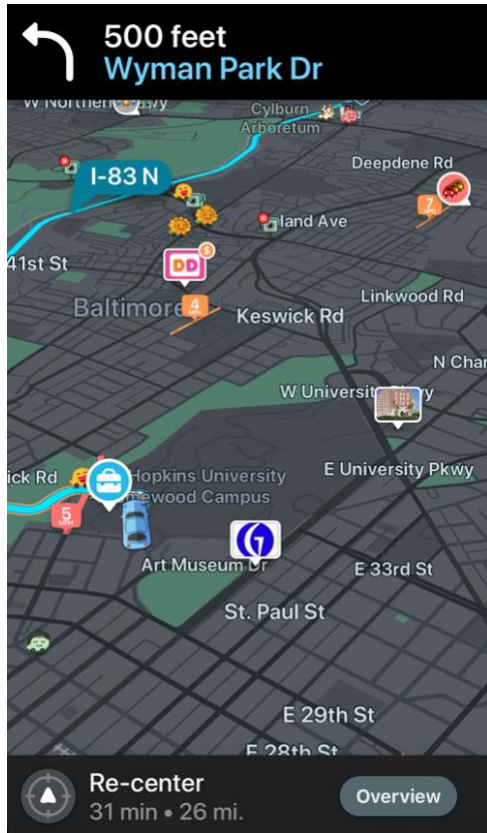


Figure 18. Screenshot of the Waze mobile app interface on iOS device.

Waze's "Re-center" and "Overview" features. Both features are very conveniently placed in the same row at the very bottom of the interface. They do not overlap the map and could be very easily be activated on the touchable screen of mobile device.

Map data ©2018 Waze. (Screenshot by author)

In order to further establish a direct connection between spatial characteristics of their route with the app interface, in order to basically fill up the app with real surrounding space, users should be provided with specific app features that correspond physical spatiality to the app's digital environment. The simplest feature that almost all navigation apps provide is a possibility of changing the size of represented spatial

elements: zooming in and zooming out, displaying a route overview (a condensed map of our route), and re-centering (bringing the app screen back to driver's current position) (Figure 18).

Waze has a more advanced "zoom via speed" feature. Normally Waze automatically zooms out when you are driving fast and zooms in when you are slowing down. Waze also has an option for to custom zoom. The user can resize the map to the preferred zoom rate and then save and keep this rate.

These tools for controlling spatial distribution establish a relationship between different elements of the space, and provide visual material or visual cues that allow the driver to reconstruct the space mentally. This mental reconstruction connects the real driving environment, its app mapping interface projection and the physical actions of the driver. Based on the dynamic flow of user data the database updates the digital map. The app interface is constantly changing. This way the digital map/interface is more than a representation of the environments ahead and around. This is not a traditional map (an immutable base map) with our representation on the flat surface of it at some point in time. Waze's map/interface becomes a mobile, movable laminated system for exploring space and time as they are connected and related to our actual movement.

Spatial distribution features used by the application allow exploring both spatial and temporal properties of the chronotope as the app sets up a dynamic digital representation of a real physical space where Wazers perform and drive in relation to each other. The app structures the perception of the space as it is related to some sets of related events: distribution of different objects in space, multiplicity of these objects, their

possible movement (cars), constant changes of these objects in proximity, sizes and proportions as they are related to the movements of the driver and his or her vehicle. All these sets of related events are predesigned and structured as a combination of the perspective and point of view of the driver on the app main interface. All interface graphics fuse a multi-level connection between spatial objects and their related time parameters and, as a result, in Waze's functioning, we explore a continuous translation of spatial meanings to temporal meanings and vice versa.

4.7 Comparing Waze and Bakhtinian Chronotope of the Road:

Differences in Bringing in Subjectively Perceived Environment

In this section, we concentrate on to what extent Waze is specifically related to the Bakhtinian chronotope of the road. From the first sight, the chronotope of the road and Waze as a navigation app should be closely related in their main characteristics. Now, having applied the chronotopic analysis to Waze's design and user experience, we are ready to compare Waze and the Bakhtinian chronotope of the road.

The chronotope of the road could be considered as one of the most influential for future application types of chronotopes defined in "Forms of Time and of the Chronotope in the Novel" as many researchers from different fields of study choose this particular chronotope to use in their studies. Different interpretations of the chronotope of the road with different levels of authenticity regarding Bakhtinian original theorization have been applied, for example, to the film genre in general and the American road movies in particular (Ganser, Pühringer, & Rheindorf, 2006); to mapping the travels of Leopold Bloom, the main character in James Joyce's novel *Ulysses*, as compared to the travels of

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Odyssey in Homer's epic poem *The Odyssey* (Travis, 2015); to literary works of Native American writers (Pittman, 1995); or to the GIS-based mapping of early modern narratives (Muri, 2016).

What is definitely similar for Waze and the chronotope of the road is bringing in particular characteristics of personal experience. According to Bakhtin, "The concreteness of this chronotope of the road permits everyday life to be realized within it. But this life is, so to speak, spread out along the edge of the road itself, and along the sideroads." (Bakhtin, 1981, p. 120). Applications can be learned or, in the case of Waze, chronotope of the app can be learned, and then to a certain extent rationalized and adopted by the user. We can say that users perform their own "chronotopization" of Waze. We refer to the term "chronotopization" which very recently appeared in Bakhtinian research. The "chronotopization" is "the way in which people do not just 'step into' existing chronotopes but build them anew while drawing on existing..." (Blommaert, March 18, 2018) chronotopes. From this perspective, we are also able to explore how the "narrative" produced by the app, Waze's pre-designed chronotope, effectively relates to real physical time and space. This is the mechanism of how Waze is adjusted to a not just subjectively perceived environment but is able to account for the multiplicity of personal or fused chronotopes.

Personal or fused chronotopes add a lot of possible additional spatial and temporal characteristic like user behaviour, driving habits, mood on a particular day, velocity, pace of perceiving events, any specifics in perceiving time and so forth. Driving intensifies perceiving the environment by a subject, driver and app user. For example, describing the

chronotope of "the open road", Bakhtin emphasizes two of its main characteristics, first, "[i]n the chronotope of the road, the unity of time and space markers is exhibited with exceptional precision and clarity" (Bakhtin, 1981, p. 98), and, second, "[s]hould something happen a minute earlier or a minute later, that is, should there be no chance simultaneity or chance disjunctions in time, there would be no plot at all" (Bakhtin, 1981, p. 92). As a result, our total route time takes precedence over the usual linear time of our life, or a space around us becomes connected to a different type of time, a unique "time out of joint", a changing route time. Also, we need to remember that the road itself, despite its material characteristics, in the chronotope of the road is a space rather than a fixed place, but still is a specific environment full of multiple social and cultural meanings.

The Bakhtinian chronotope of the road (Bakhtin, 1981, pp. 98, 120, 243-245) has three main structural elements:

- 1) Implied one-directional vector of continuous travel along a road;
- 2) Important narrative-forming "cross-roads": different symbols or metaphors of crossroads, junctions/disjunctions, or turning points that bring in the possibility of a change of direction as well as the introduction of new plot elements. Bakhtinian description connects space-time of the road with its strong metaphorical charge:

The chronotope of the road is both a point of new departures and a place for events to find their denouement. Time, as it were, fuses together with space and flows in it (forming the road); this is the source of the rich metaphorical expansion on the image of the road as a course: "the course

of a life," "to set out on a new course," "the course of history" and so on; varied and multi-leveled are the ways in which road is turned into a metaphor. (Bakhtin, 1981, pp. 243-244).

3) Random encounters as "the collapse of social distances". According to Bakhtin,

The road is a particularly good place for random encounters. On the road ("the high road"), the spatial and temporal paths of the most varied people-representatives of all social classes, estates, religions, nationalities, ages-intersect at one spatial and temporal point. People who are normally kept separate by social and spatial distance can accidentally meet... the collapse of social distances. (Bakhtin, 1981, p. 243)

The first element – a continuous movement – applies to the whole of the space, while other details in literary road chronotope are usually placed and connected more or less randomly along the road. In Waze's navigation, we're limited to a reduced number of road details. We are able to see details that are only related to our route or visible on the screen as close to our movement. When we follow Waze directions, there is no need for us to imagine elements behind our defined, limited area – behind the application space. On the contrary, literary chronotope relies much more heavily on the reader's imagination in order to add as many details as possible to make a narrative more realistic and closer to the reader's personal experience.

The second element – "cross-roads" as turning points – as the events encountered along the route proposed by Waze take on a meaning close to that of the interpretation of

threshold in Bakhtin chronotope of the road. A road as a threshold is a time-space situation that indicates a transition between different points. Points in space or points in time determined by past or future events, characterized by potential change, these points are always ambivalent. Regarding “cross-roads”, Waze and the chronotope of the road work similarly as they both attempt to represent the road, but in different ways. The literary narrative is using the power of metaphorical expression to represent the road. Waze visualizes the area closest to our route, containing a cluster of possible turning points. For each such points Waze is able to calculate routing possibilities as they could apply to our destination. The “cross-roads” are placed on the screen and arranged in such a way that their combination corresponds to the driver's movement and the overall chronotope of the app. At the same time, every Wazer has his or her own perspective of the chronotopic environment around as all elements on the screen are organized around a graphical representation of the user's car as the compositional center. This is one more way to emphase the interactive nature of the app and support the first-person experience of the user.

The third element – random encounters as the possible “collapse of social distances” – is the most interesting for a research element because there is no possible way for real encounters in a digital app the way Bakhtin describes them as structuring his chronotope of the road. However, Waze is a real social app and is based on social input. Wazers do not interact directly with each other. Through the interface they input data into the app. Visible forms of social interaction include the presence of multiple moving avatars on the Waze map-interface in real-time, where each avatar represents a real,

living person, the key act of reporting, thanking other users for their reports, and Wazers ranking. All these ways of interaction form a different kind of social communication that we explore as a concrete, actual social effect of the app's functioning. We agree that Waze's development, design, and research point us to

new forms of communication between members of a group, which are based on an exchange of interactions shifting in agency: from individual user, to app, to community of users – a series of three steps. (Ramos, 2017, p. 11)

Such situated interaction is still a form of social communication, even if the users are not communicating directly. This is a reconfiguration of social interactions based on a new, hybrid – physical and digital – form of temporal and spatial connections that Waze allows us to analyze.

A subject of the road, a Wazer, shares his subjective perception of the route events. Waze in these terms is more than the traditional object in subject-object relations. Waze as a software program with its algorithms is *objectivizing* real physical time and space for our subject, the app user. Waze reconstructs and extends personal chronotopes as related parts of the main chronotope of the app, trying to take into account subjective characteristics and respond with a calculated, rationalized, balanced and objective route.

As we can see, Waze does not entirely correspond to the Bakhtinian chronotope of the road. Waze has its own distinctive chronotope, and this chronotope is more related to the main elements of the adventure chronotope as we discussed earlier in

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this chapter. Also, the Waze chronotope adds its digital connection and is unique in recombining social relations.

4.8 Conclusion

Applying the chronotopic analyses as the interpretative and explanatory frame to the development and design of Waze confirms and validates the effectiveness of this application's unique features and emerging practices. The original positioning of Waze as one of the most non-traditional and interesting social media apps, user success and the highest user ratings, and continuous development of the app by introducing innovative features correspond to the necessary principle, when "digital design research is at once contextualized and also in the process of being made" (Wagner, Bratteteig, & Stuedahl, 2010, p. 76). The necessary condition is when we are able at the same time "designing for, and researching affordances for, participation, along with means to investigate participants' experience and the dynamic relations of their articulations" (Wagner, Bratteteig, & Stuedahl, 2010, p. 76).

Summarizing, we want to stress the effectiveness of Waze's interface in displaying quantitative and qualitative information as dynamic and connected flows. As we already discussed, the main interface is a dynamic map that mostly represents non-numerical data. There is no traditional opposition of quantitative and qualitative data sets or the common prevalence of numerical approach in time-space displaying data. Also, "[w]e should consider that 'qualitative' does not simply imply the absence of numbers. [E]lements ... could easily be quantified ... but are given meaning through their display in a way that emphasizes a quality or characteristic of the phenomenon." (Lockton, Ricketts,

Chowdhury, & Lee, May 6, 2017) In the same way, for example, we see Wazer's cars around us, but there is no need to calculate their exact numbers. We are interested in the intensity of their movement, in their density or we are merely concerned about seeing enough Wazers along our route to have a visual and mental confirmation of a large number of Wazers around that should provide more reliable route information. We understand their amount not numerically but as a visual and mental quality pattern, as a non-numerical pattern-based moving form that is very effective in establishing and supporting our understanding of the app, and our relationships and agency with systems and users represented in the app.

For example, one of the most recent major updates to Waze that extends user participation and makes it safer is adding hands-free navigation, using just your voice. This feature, "Talk to Waze", allows a user to initiate a drive to a specific place, communicate with Waze during a drive, send reports, and change the app settings without touching your mobile device. Consequentially, the current Waze voice command list consists of more than 30 commands (Voice command list, 2018).

Also, an interesting direction for future development possibilities is suggested by adding hand gestures to Voice Control. Waze already can be started by waving your hand in front of your smartphone screen (initiating the mobile device's proximity sensor), and Voice Control can be combined with a set of hands-free wave-gestures that do not involve actually touching the mobile device's screen (Voice Control for Waze, July 4, 2018). As an example, we can refer here to the AmpDamp, a design concept for orchestrating polyphony in social media environments.

AmpDamp designers refer to Bakhtinian understanding of polyphony as their grounding principle (Acker, Chalmers, Burton, Wythoff, Lodato, 2013, p. 1091). They describe their interface concept in the following way:

Connecting a physical knob to a browser extension, AmpDamp translates the gestures of turning up (amplifying) and turning down (dampening) into a dynamic orchestration of the “volume” of a user’s social media feed. ...

Current binary options in social media interfaces (follow/unfollow, mute/unmute) fail to provide sufficient granularity for a user to manage the nuanced voices and rhythms in her social media streams. By combining hardware (a knob) with software (a browser extension), we propose a design to increase the granularity and temporal modularity of social media interfaces. (Acker et al., 2013, pp. 1090, 1092)

Waze’s chronotropic features could integrate such an addition to its interface to establish an even better connection with different temporal and spatial components.

We believe Apple is already moving in this very interesting and promising direction in connecting our physical sensations and our time/spatial environment as we drive. We refer to Apple Watch and Apple Maps integration, particularly to the Taptic Engine and its haptics or the haptic notifications (Haptic Feedback – Human Interface Guidelines – Apple Developer, n.d.). While wearing Apple Watch, Apple Maps directions also come with a gentle tap on your wrist. The result became one of the most user-friendly and most used features of Apple Watch. Here is the feedback from three different users: “to add for Apple maps, the Apple Watch will vibrate to notify of a turn,

lane change, etc. is coming up. Really useful...”, “the Apple watch integration is a godsend when you're really lost.”, “I get prompted by my watch to take turn without looking at the screen.” (Apple Maps vs. Google Maps vs. Waze, n.d.).

Analyzing relations between space and time, we have explored how the same foundational design concepts are carried out together and connect: application programming, selection and use of data sources, application design with the mix of dynamic visual elements, along with kinetic ones in tangible interface, and later added voice commands. And, as the most important result, this provides an open dialogical environment for user participation and social communication. According to Bakhtinian view of utterances forming polyvocality, Waze functions as an intersecting activity platform, where users “gather and gain their identity and discursive capacities and communicative strength by way of their being articulated collectively” (Wagner, Bratteteig, & Stuedahl, 2010, p. 76).

Waze enables a digital space for transactional collaborations between users, where every Wazer is a participant in a mediated meaning making flow shared between the app, data flows and other users. The result is a seamless time-space connection between digital routing and physical driving.

Following Bakhtin's socio-historical view of chronotope, we described how multiple chronotopes are realized in Waze and how user interaction with the app through its design and deployment decisions is connected to the society-wide patterns of social practice. Also, it is very important to add and take into account a political dimension in how Waze reorganized the social driving experience. We agree that

[t]his reorganization ... has a distinct political dimension as drivers are gifted the ability to fundamentally change the driving landscape as they travel through it, challenging the way in which we have historically relied on state agencies to provide us with information on road conditions. (Hind & Gekker, 2014, p. 84)

From this perspective, we believe Waze's original design and user practices point to an alternate type of social community, to the different, – more open, dialogically open in Bakhtinian sense, – social constructs and could be used for further rethinking of design approaches for supporting new and emerging types of social relationships.

Chapter 5: Conclusion

We situated Bakhtin's dialogical discourse into a field of information and interaction design and user research addressing how discursive capacities of concepts of polyphony, heteroglossia, addressivity, carnivalization, and chronotope offer new insights into practical, theoretical, and methodological challenges in design research and analysis of design practices. We studied Bakhtinian dialogic theory as one of the foundations for the participatory design framework articulating a change of perspective from a user-centered design process to participatory design approaches in design theory and methodology.

Summarizing results of our literature review and especially considering an advantageous potential of existing Bakhtinian interdisciplinary research, we outlined and discussed a foundation for expanding Bakhtin's discourse from the perspective of information and interaction design. Also, as our literature review confirms, there was rather unsystematic or even sporadic attempt to apply Bakhtin's ideas in the design research field. The use of Bakhtin's discourse in design studies explored only some of his main concepts or their most common interpretations without establishing a coherent discourse approach and generally follows the limited number of well-established patterns that came from other disciplines or from interdisciplinary research.

Our work contributes to the research as the systematic application of Bakhtin's dialogical concepts to interactive and information technology by revealing the use of these concepts as design principles and strategies for designing for social media tools and

systems. We applied Bakhtinian core concepts as one dialogic coherence emphasizing its definite social-historic dimension in the whole of cultural communication.

We started with a qualitative analysis of Bakhtin's works and studies of Bakhtinian theory from the perspective of information and interaction design. We used an extensive case sampling of modern social media applications with their variety of media design types and discourse modes to develop and support our initial hypotheses about interconnectedness between Bakhtinian ideas and design research and practice. Then, in correspondence with our research questions, these theoretical and empirical findings were summarized as a foundation for detailed research of the Waze navigation app using the explanatory chronotopic data analysis.

To provide a practical connection between Bakhtin's dialogical discourse and information and interaction design, we analyzed it in the empirical context of social media design that provided pertinent research data in a vast array of interrelated design tools, user interactions, immediate feedback related to user experience, and different discourse modes. We chose designing for social media as an empirical object for this research because modern social media integrate the use of a variety of design and research approaches and their immediate implementation in social interaction.

As we studied, designing for social media with its aim to support interpersonal communication directly relates to the foundations of Bakhtin's communication theory. Following our interpretation of Bakhtinian ideas, we consider any designs for digital media environments also as discursive constructs themselves. We believe, our application of Bakhtinian dialogicity opens new possibilities in analyzing the role and importance of

underlying design decisions as a powerful and influential way in predefining actual user practices and their characteristics in social media communication.

Any communication contains particular personal voices and utterances (polyphony) and a complex mixture of multiple social discourses (heteroglossia). From this perspective, Bakhtinian concept of the heteroglossia represents the persistent co-existence of socio-ideological contradictions and refers to the conflict between official and unofficial, centripetal and centrifugal discourses within the same social environment. What is happening in such an environment is a multi-layered interplay of both centripetal and centrifugal tendencies. The centripetal tendency usually represents already existing official discourse, and the centrifugal tendency usually represents unofficial or an emerging discourse. The centripetal tendency is *monological* as it directs towards a unitary meaning, while heteroglossia is centrifugal, expands into many meanings, and develops *dialogical* environment. Accordingly, any design decision and its subsequent social practice could be explored as supporting these monological or dialogical tendencies.

Thus, heteroglossia, as the continual intersection of changing user perspectives with specific content and their resonances, constitutes an explanatory framework for the non-linear ongoing design process where users can participate in constructing and enhancing each other's experience. As we studied, polyphony is more related to the user-centered framework, as the design development of the artifact is based on the linear data flow between the designer and the user. Heteroglossia, as a dynamic inclusion of

otherness, better explains the participatory design frameworks with its needs for nonlinear communications.

An important question that arises in social media discourse is the issue of how different voices interact, and if there is a predefined, predesigned positioning for dominative voices. Both polyphony and heteroglossia, at their levels, do not simply imply the inclusion of multiple utterances into communication. For designing for social media, we must not forget that some utterances may be also excluded from discursive exchanges by specific design decisions or conventions. Thus, the specific construction of power relations by different design decisions produces an effect in *dialogization* or *monologization* of the social media environment, leads to the authoritative influence on possible discourses and gives chances for controlling and influencing actions of other users.

In practice, the "authoritative discourse" or unconditional type of discourse is often supported by social power relations and/or social media design. Bakhtin identifies the "authoritative discourse" as the specific type of discourse, which, following socio-cultural context, has hierarchical superiority. The authoritative word (the authoritative monoglossia) is anticipated to be hierarchically or historically, socially or culturally more "legitimate" because it derives from different power centers and adheres to various factors of authority. Such superiority demands the listener or user to assimilate the "authoritative discourse" as "unconditional allegiance" rather than accept and allow interpretation. Examples of "authoritative discourse" might range from religious dogma,

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or scientific theory, to, in our case, a popular and influential (e.g., Facebook) design model that created a specific type of social practice.

So, we explored the Facebook platform to evaluate the social effects of Facebook design decisions from the carnivalistic perspective based on Bakhtinian concept of the carnival as a set of specific social and cultural practices. In our exploration, by its original design, Facebook provides users with the inherent possibilities for dialogue in the social environment. There are carnivalistic features that affect user/participant roles and possible power distribution. Both polyphonic and monologizing discursive dynamics are present. The polyphonic dynamics include the built-in possibility for conversation and multi-voicedness. The monologizing dynamics include prioritization of visibility of certain postings and, as a consequence, limitation of visibility of specific postings that can result in the unequal distribution or manipulation in getting public interest to particular topics. Very often carnivalistic features – that following Bakhtin are ways for potential subversions of any established hierarchies – are counteracted by Facebook's universal design conventions and practical features.

As a result, Facebook gives a two-fold perspective to the festive-carnival ability in the Bakhtinian sense. From one side, Facebook effectively uses or channels some of the carnival strategies for its own benefits in order to become something bigger than just social media platform. Because of its initial success in user engagement, a new specific form of social communication has been created. On the other hand, we explored how the design of Facebook can manipulate and even lessen the creative power of carnivalization with specific controls and limitations for interactivity.

This way Facebook's universal design conventions and features cause limitations to dialogic multi-voicedness in communication and allow inequality in participation by enabling/disabling particular features of the platform. There is no design mechanism in Facebook for content mediating and distribution based directly on user participation or user interactions that could potentially prevent disinformation spread or counterbalance social bots distorting activities in the way Facebook was used to affect results of the 2016 United States presidential election. We believe this is one of the main reasons for current concerns about Facebook's role in future political campaigns. Also, these political implications of social media design and deployment point to recent attempts in increasing a level of government involvement in controlling Internet use as it relates to techniques for managing the flow of online information and especially to the ways to control it in the current extremely polarized social and political environment.

Facebook's design tendency to "universalism" and homogenization is in direct contradiction with Bakhtin's understanding of the dialogue and carnival as a kind of *existential heteroglossia* with an inversion of social and conceptual hierarchies. Ideally, the design of social media should be responsive enough to – using Bakhtinian language – support collaborative creation of discursive meanings through a medley of speaking positions. These discursive meanings should address the direct and proactive participation of users in the design development process. Acknowledgment and awareness of the dialogic frame as design strategy contributes as an essential verification condition in making a genuine dialogue possible in the social media environment. To

confirm this, we researched Waze as a system that is based on the dialogical recombination of a dynamic time-spatial data received through user participation.

Bakhtin's concept of the chronotope originally accounting for time and space relations in written narrative, provided us with a possibility to identify and theorize a *digital chronotopicity* which is a dynamic result of multi-accented, data- and process-driven communications in social media applications. The connected moment and situation (chronotope) indicate a dialogue that is a dynamic result of combining different streams of digital information. The concept of chronotope as an analytical category is at the center of our analysis. Temporal and spatial information flows within applications create the necessity of such a digital chronotopicity that grounds both data flows and represents the practical functionality of modern real-time social navigation media.

Waze and Google Maps (however in very different ways) found the most appropriate chronotope for their driver's needs creating the *digital polyphony* of different voices where multi-voicedness is based on a combination of running applications on users' mobile devices, streams of dynamic data, and route-calculating algorithms. Multiple voices (multiple sensors) are equally participating in such dynamic digital chronotopicity. The result is that instead of traditional static maps and static routes we see dynamic dialogization of maps and routes because the app's algorithms are oriented on working with the simultaneous presence of alternative routes. Because of real-time updates on traffic conditions maps are active and actionable for local decision-making purposes. Waze achieves temporal and spatial coherence bringing multiple streams of information together and presenting them to users in the form of dynamic chronotopes

each with its own characteristic timing and pacing: unique route(s) calculated for each unique user at unique moments in time.

Existing Waze-related research provides detailed insights on how the app is functioning in the social environment (crowdsourcing for data generation). However, there is less attention to the exact way in which Waze combines and processes time-spatial characteristics dynamically from a development and design perspective. Also, existing Waze research is more based and concentrated on directly studying empirical examples of the app's use rather than on developing adequate methodologies that should explore the app's foundational principles and align different research tasks and approaches. Additionally, current Waze research (the same as the mobile navigation apps design research in general) is mostly focused on quantitative analysis exploring how the app performs as a system, but there is a gap in research that is oriented on adding and using *qualitative data analysis*. Our research on the Waze app using qualitative analysis methodology and techniques and, specifically, the explanatory chronotopic data analysis contributes to filling this gap.

We collected our research data through examining an expansive complex of online materials that include different platforms for acquiring user feedback: user discussion forums, author blogs, help or wiki resources with user posts, comments, and other additions. All these online platforms are open for public discussion. Diverse groups of users with very different evaluations interact to discuss specific topics related explicitly to Waze, Google's package of geo software, Apple Maps, MapQuest, and similar social media applications. We referred not only to product-specific industrial sites

supported by Waze or Google but also to a growing body of multi-topic forum communities (like Quora, Mac Rumors, Ars Technica, or Reddit), and to open-source software development platforms (e.g., GitHub) that can be searched for product-specific or feature-specific threads. We believe that the diversity and multivoicedness of online forum resources specifically correspond with the Bakhtinian understanding of social communication as continuous dialogical practice for collective meaning-making.

We aimed at detailed and comprehensive descriptions of design and user experience using qualitative research as exploration within the dynamic contexts of reality. Analysis of qualitative data often allows studying challenges that are rarely explored with quantitative data, as we interpret wide-ranging feedback from many different users and understand complex situations. We believe Bakhtinian understanding of dialogue is closely connected to the way in which qualitative data represents the user's subjectivity and aims for consistency in data analysis. Applied from this perspective, qualitative research as dialogic exploration is very appropriate for studying Bakhtinian dialogic theory in the context of the social media applications that display interlaying flows of dynamic data.

Our process was to derive concepts that are supported by identified patterns in our research data, then develop those concepts concerning their characteristics and according to our research questions. While classifying and selecting user forums data for content analysis, we used the dialogical approach to preserve original dialogic relations in forum threads, approaching every participant as the "conscious, feeling subject," and analyzing

how user feedback may subsequently be affected by the usual multivoicedness and language expressivity of online communication.

We believe that there is a significant research potential in applying the idea of the *exploratory chronotopic data analysis* to Waze and Google Maps apps as they provided effective interfaces and dynamic data models for integrating spatio-temporal elements. So, from the perspective of our work, the chronotopic analysis is two-fold: we analyzed, first, how social media navigation apps in their information and interaction design connect time, place, and space. And, second, how user experience data from large, crowdsourced online resources is referencing these spatial and temporal connections.

As noted, we explored that as a system Waze is based on the dialogical recombination of a dynamic time-spatial data received through user participation. Then, taking into account the Bakhtinian concept of chronotope as the experiential and critical approach, we researched Waze using the exploratory chronotopic data analysis. We developed and implemented our interpretation of the chronotopic data analysis to examine the design and user experience of Waze. Using Waze as our main research case study, we explored user experience and user feedback to research how the app enables new digitally mediated time and spatial practices to be realized and embodied by users.

We applied Bakhtinian notion of different levels and types of chronotopes to the design and functioning of Waze. Bakhtin describes major, fused, wide-ranging chronotopes and an unlimited number of minor chronotopes. In terms of Waze, we can see this fundamental chronotope as the chronotope of the whole application – "corresponding generic techniques" (Bakhtin) – that assimilate its design and

development, functioning and operating as they are reflecting and processing appropriated aspects of reality. On the second level there are minor or different situational chronotopes that Bakhtin also names "motifs". Each major chronotope can include within it an unlimited number of minor chronotopes. For Waze "motifs" are all typical events that could change routes and make it different from the beginning or during the process of driving: e.g., a map issue, a traffic jam, a road closure, or a hazard on the road. All of them enter as constituent elements into the fundamental Waze app chronotope. The majority of these Waze events are reported by active Wazers and shared with the rest of the app's drivers.

Bakhtinian scholars usually specify only two levels or two types of chronotopes: "major" and "minor" chronotopes, "representational" and "embodied" chronotopes, "chronotope of the whole genre" and "chronotopic motifs" chronotopes without specifying any additional levels. We believe there is an additional level that corresponds to the potential result of communication, especially when we apply chronotope to modern social media applications. We can approach the Waze user and his personal time-space experience exactly at this level. Waze functions because of the direct participation of the user. The act of physical driving and digital guiding create the hybridity between driver, space, vehicle and the app. As a result, inside this hybrid environment which connects very different types and levels of utterances, the user interacts with the large combined system of chronotopes: "major" Waze's chronotope and extended "minor" event chronotopes. We believe the *additional* chronotope level is established when a user responds to the above mentioned "major" and "minor" chronotopes and connects them

with his own individual situation, combining them with his own chronotopicity. As Bakhtin suggests, in addition to the chronotopic space that the work organizes, there is a chronotope within which this very organization *occurs*. We can describe this chronotope as a chronotope of a user/driver and refer to an author and reader equal relations in representing reality and creating meaning. The author is producing a text, and the reader is actively renewing the same text. What is important and different is that there are many situations when our user/driver becomes the author. For example, user reports and map editing could be qualified as an author's activities. So, we can position our Wazer as the author and the reader at the same time because of the different ways of interacting with the Waze app and Waze's openness in taking into account different chronotopes. We explored how three main chronotopes interact: the chronotopic space that the app organizes, a chronotope within which this app's functioning occurs, and author/user chronotope.

The third, level of chronotope, the *user chronotope*, connects the physicality of the immediate individual time/space environment and the rest of the discussed types of chronotopes. This is where the chronotope of the Wazer is mixed with the chronotopes of the application and its possible situational chronotopes. A user's activities and their consequences fuse all chronotopes and create a unique spatiotemporal experience where our user is directly present with all its first-hand subjectivity.

So, we analyzed how multiple chronotopes are realized in Waze and how user interaction with the app through its design and deployment decisions is, on one hand, connected to the society-wide patterns of social practice, and, on the other hand, has the

potential to transform existing social practice. By analyzing relations between space and time, we have explored how the same foundational design concepts are carried out together and connect application programming, selection and use of data sources, application design with the mix of dynamic visual elements, along with kinetic ones in tangible interface. And, as the most important result, how they provide open dialogical environment for user participation and social communication. According to the Bakhtinian view of utterances forming polyvocality, Waze functions as an intersecting activity platform for dialogizing flows of digital data and user participance.

Through the unique technological design of interaction forms, data exchange formats and the app functions, Waze coordinates and frames the purposes that can be realized by its users. Considering that any design decision is always axiologic and temporal-historic, it is very important to accentuate a political dimension in how Waze reorganized the social driving experience: users are able to fundamentally change the driving landscape challenging the historical way in which state agencies provided information on road conditions.

As our chronotopic analysis of Waze revealed, relations of time and space in Bakhtin's notion of the chronotope offer a unique and useful tool for characterizing how time and space data could be combined in social navigation apps. We studied how the chronotope can usefully be extended beyond its traditional focus on the literary field, to other areas, such as design for modern social media in general as it corresponds to overall tendencies in social communication. Applied this way Bakhtinian chronotope provides a new dimension as it allows the design to reflect an always flowing, ever-changing,

spatialized temporality. This allows changes to become an immediate part of the user experience, and additionally to have a conceptual and analytical framework to study this flow from an interaction and information design perspective.

Waze's possibilities for incorporating personal experiences are very important in the manner in which navigation apps are transforming the entire way we experience our time-space environments. Examined from such a chronotopic point of view, social media could be better structured to gather and process different kinds of coordinated time-spatial data. Due to the recent growing attention to real-time location-aware interactive technologies and a general tendency to accommodate and utilize personal time-space characteristics of users, the addition of this perspective should provide more ways to capture usually complicated-to-reflect details of the individual user experience, like personal habits and preferences or personal patterns in social and cultural interactions.

We believe the above-mentioned results of our research are useful and important as they correspond to the need to accommodate an increasing polyphony and heteroglossity, even a polarization, of modern social and cultural discourses, and – most importantly – to continue to have all participants in dialogic relations. Thus, researching Waze's design and user practices using Bakhtin's dialogical discourse as an interpretive framework, we suggest a possible model for an alternate type of social interaction. A new form of performative practice that is actualized through technologically mediated dialogue, which could be used for further rethinking of design approaches for supporting new and emerging forms of social relations. From this perspective, the exploration of Bakhtin's dialogical discourse extends our understanding of information and interaction

design as a continuous dialogue which is tempered by socio-cultural activities and conventions and which occurs in shared social constructions.

Bakhtinian relationally-responsive dialogue contrasts with the traditional representational-referential analytical understanding of social communication. The spread of social media demands establishing practices in design research for investigating the user experience, articulating dynamic participants' relations, researching possibilities for participation, and designing for participation. Further exploration of the relational-responsive dialogical processes and pre-building possibilities for such responsivity (addressivity and answerability) should allow users more choices in how they contribute. From a Bakhtinian perspective, design environments should trace and allow wider fields of social participation, and should be centered on the acceptance of user participation in a variety of ways.

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Appendix: Application of Bakhtinian Chronotope:

How to Design Chronotopic Experience

Bakhtinian chronotope organization is applied here as a way for dynamic connection of different time and space information that also establishes pattern-forming tendencies in the social and cultural experience. This outline is created with the intention to be used as a guide providing key points of attention from information and interaction design perspective and examples from the social navigation app Waze that, based on our analysis, is successfully employing principles of Bakhtinian chronotopic relationship.

This guide is developed for a broad range of applications that aim at the practical use of dynamic connection of real-time and historical time data, space, and place data as it is integrated with our social activities. Our guide can be applied for designing different types of navigation and geolocating software, locative geoweb social media tools, collaborative geo-mapping, simulated online environments, spatio-discursive constructs, historical visualizations, and GIS (Geographic Information Systems) tools as they could be connected to a variety of spatial humanities resources.

Table 3. Application of Bakhtinian Chronotope: How to Design Chronotopic Experience

Key Design Points of Attention	Corresponding Waze Examples
1. A general approach to data gathering and combined data use	
Explore how time and space relations are structured and altered. Consider which events, objects, characters, possible pre-determined narratives are essential for representing time-spatial relations.	
Include <i>different flows</i> of time-space data that correspond and complement each other.	Waze's coordination of multiple data streams:
Provide a way for your users to generate data and take part in data management. Use personified data. Outline a role of the user and the user input in generating/validating data resources.	

Structure a continuous <i>utterances</i> exchange between the user, data flows, and your app.	Waze is based on social data input – user-generated data:
If possible, give priority to <i>real-time</i> and <i>user-generated</i> data.	real-time road reports submitted by users, map edits from online Waze community.
	Sensor data: location coordinates for cars/drivers broadcasted by the Waze application.
Establish a <i>dialogic</i> relation between data resources: ideally, all information flows should work as a coherent whole unless there is a programmatic need for accentuating some of the data flows (or streams) in your design.	Pre-built digitized street maps (open for addition and editing), GPS location information, sensor data: location coordinates for cars/drivers broadcasted by the application
Provide a way to validate your data flow dynamically.	Data Validation: feedback (approving) from other users.

2. Designing temporal structure

Explore possible <i>types of experiencing time</i> ("time felt") by your user.	
For example, "story-time" and "operational time".	
"Story-time" is a continuation of our natural time, our real-time, as it could be measured or processed in an app design: consider the order of events, the frequency of events, the duration of events E.g., evaluate the "speed" as it related to traffic.	For Waze as a navigation app "story-time" is its route-time. Waze gives three different options for manually reporting traffic: "Moderate," "Heavy," and "Standstill."
"Operational time" is usually the time of the actions of the user as he responds to "story time" events.	"Operational time" is action-time, a kind of time experience as it related to user actions that in turn are determined by Waze developers.
Design for different types of experiencing time.	

3. Designing temporal order

Order of perceiving time could be direct, reverse, or cyclical.

Reversibility is especially important for interaction design because of a possible *interchangeability of events in space*: a user can learn the same kind of an event or an event could be already known.

The temporal reversibility is part of the logic behind Waze's "Time to leave notification" feature: we schedule a future drive, choose time and date at which we would like to arrive to our destination. Then Waze letting us know when it is the best moment to start driving for a planned trip. "Plan a drive" feature uses the same interchangeability of events in space: we can use Waze to learn and monitor how long it will take us to get to our destination at different times throughout the entire day. Waze automatically makes necessary adjustments to starting times based on real-time traffic situations during the day.

4. Designing for temporal duration and frequency

Duration relates to the perceived speed of events that is always *contextual* because it is defined by the duration of events in context with the user personal perception and his general idea of "clock-time". Any navigation application should include constant references to it in the "clock-time" (e.g., ETA or time in traffic).

Waze provides constantly updated ETA. ETA could be sent/shared.

Frequency specifies how often separate events occur in a time segment. Account *user's "responsiveness"*, the speed of the user response as it can alter app operation.

Multiple interface controls for submitting user reports that represent frequency and support different levels of user's "responsiveness".

Provide different options for representing temporal duration and frequency

5. Designing spatial structure

Consider the following characteristics of movements and interactions in space representation:

The "topographical space" mode – underlying, usually static spatial reference of the real world: a map or any mental constructs that features the spatial relations between locations or entities.

Pre-built digitized area maps,
Use of historic data references;
consideration of existing (personal) driving patterns and habits (Waze can learn and accommodate spatiality of our personal route preferences)

The "operational space" mode – the space revealed during actions of the user: structure space through events and movements occurring;

The "operational space" is the exposition of the "topographical space" as it is represented by different kinds of information feeds and referenced by specific design approaches in application programming. For example, even an underlying mapping structure becomes operational as it is constantly updated in Waze.

The "presentational space" mode – the multimedia summary, visual manifestation as a *result* of an app's functioning

In Waze the "topographical space" and "operational space" are combined in the "presentational space" as they all represent and respond to user experience of any driver: the "presentational space" composes a hybrid, physical/digital, space where users accomplish their activities in relation to the app interface and other Wazers around.

Physical and digital are *embodied* in one continuous time-space experience.

Consider a connection between physical and digital characteristics of space: space of the road, space of the user, program features, visual data, digitized data, digital interface.

E.g, Waze's car icons and "Wazers around you" feature establish a sense of scale and spatial positioning among Wazers and allows them to experience spatial connectivity.

Provide your users with specific app features that correspond physical spatiality to app's digital environment:
a possibility of changing the size of represented spatial elements: zooming in and zooming out, displaying a route overview (a condensed map of our route), and re-centering (bringing the app screen back to current driver's position)

Waze has more advanced "Zoom via speed" feature: normally Waze automatically zooms out when you are driving fast and zooms in when you are slowing down. Waze also has an option for custom zoom: user can resize the map to the preferred zoom rate and then save and keep this rate.

6. Employ gamification

Adopt game-like mechanics and modes and use them to establish an app's gamified nature to encourage participation.

Carnavalesque playfulness: Waze provides each user with a digital representation in the form of an avatar; based on their user ranking, Wazers select different avatars, each avatar depicting different personalities – or in Waze's playful terminology – “moods”.

Nonstandard graphic style: funny cartoon-looking imagery.

Extensive use of over-sized icons in its connection to *grotesque* form deformations: grotesque realism as the main part of visual carnival culture in Bakhtin's notion of the carnivalesque.

System of *ranks and points* for different reports and activities (some of the highest points possible are given for user actions related to map editing)

Add game-like elements to base more advanced app features.

Carpooling. Users can get *free gas* by using the Waze Carpool app. If any other users are going in the same direction, they'll be seen on your screen. Drivers and riders and are agreed to share the cost of gas. Ride payment is set up in advance at a rate suggested by Waze. The Waze Carpool app can be set up to charge riders' credit cards automatically.

Gather teams with friends or other Wazers to solve map and other issues.

7 Conclusion: utilize chronotopes

Explore correlations, *typical patterns* of time-space organization and activities in space and time, examine certain *communicative situations, repeated* at a certain time and place – Bakhtinian *chronotopes*, minor and major – analyze, address them and use them in your design as a way of incorporating user experience and users' participation in the situated, dynamic processes evolving through actions and events in the past, present, and future.