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## Mapping Temporalities and Processes With Situational Analysis: Methodological Issues and Advances

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**Key words:**  
situational  
analysis; time;  
process analysis;  
police; qualitative  
methods;  
grounded theory  
methodology

**Abstract:** Qualitative methods incorporate certain concepts of time and temporality. In this article, methods are introduced as media of visualization that allow researchers to render certain temporal aspects of social life visible and intelligible while hiding others. This approach to qualitative analytical methods holds various insights, which are demonstrated by examining the distinctive media design of mapping techniques in situational analysis. Even though situational analysis was developed to support historical analysis, the visual features of its maps hamper the representation of succession and the analysis of the step-by-step making of processes. To address this issue, I propose a rearrangement of the media features of flat maps to build flip maps. With flip maps researchers can widen their analytical capabilities by creating moving situational maps. The new type of analytical map supports the analysis of multiple temporalities and processes without losing the beneficial visual characteristics of mapping that allow for depicting the wider configurations of elements that shape processes. An analytical example of a police emergency conversation is used to illustrate these new opportunities.

### Table of Contents

- [1. Introduction](#)
- [2. Temporal Complexities as Methodological Problems](#)
- [3. Maps as Media of Visualization](#)
- [4. Laying Out Multiple Temporalities and Mapping Processes](#)
  - [4.1 The empirical example: A police emergency call](#)
  - [4.2 Timing practices and time elements in different types of maps](#)
  - [4.3 Historical discourse, synchronous slices and merging periods](#)
  - [4.4 Moving maps for processual analysis](#)
    - [4.4.1 Interpretative procedures of flip mapping](#)
    - [4.4.2 Empirical example: An emergency call conversation](#)
- [5. Summary: From Flat Maps to Flip Maps](#)

[Acknowledgments](#)

[Appendix 1](#)

[References](#)

[Author](#)

[Citation](#)

## 1. Introduction

Social theorists have long elaborated on concepts of time and highlighted that basic sociological categories are intricately linked to certain concepts of temporality (for an overview: ADAM, 1994). STANKO and RITSERT (1994) traced the nexus of time and theoretical concepts back to the philosophy of ARISTOTLE, who already recognized time as one of the basic dimensions of every category of thinking. In the following, this well-established temporal lens is refocused on methodological aspects to examine how methods enable and restrict the analysis of certain temporalities. In particular, I discuss the temporalities of situational analysis (SA). In doing so, I aim to contribute to the development of SA and the reflection of methods as media of visualization. I propose an adjustment of the mapping techniques of messy and relational mapping by using a dense, multilayered, and moving series of maps that improves the situational analysis of temporalities and processes. The major contribution of this rearranged mapping technique—that I call *flip mapping*—is that adopters can visualize sequences and the making of processes as well as the elements that situate and configure these processes. This includes the possibility to analyze interactional micro-processes with SA. [1]

Similar to theoretical discussions of temporalities, researchers have shown an increasing awareness for temporal issues in recent methodological debates (HANNKEN-ILLJES, 2007; SCHILLING & KÖNIG, 2020; STAMM, SCHMITZ, NORKUS & BAUR, 2020). In this article, I propose that sociological methods incorporate certain implicit or explicit concepts and visualizations of time. In the sociology of knowledge, proponents of hermeneutic analysis presume a sequential order and experience-based teleology of planful action (MAIWALD, 2005). Conversation analysis is oriented towards the present and successive turns of conversations (SACKS, SCHEGLOFF & JEFFERSON, 1974). Interpretative image analysis is focused particularly on the simultaneous capture of flat images (SCHNETTLER & RAAB, 2008). The idea of a nexus between time and method is taken up to discuss the possibilities of SA for the analysis of temporalities and processes. [2]

SA is derived from grounded theory methodology and Anselm STRAUSS' social worlds/arena theory (CLARKE, 1991). Adele CLARKE (2005) combined these symbolic interactionist concepts with poststructuralist thought to focus on narrative, historical, and visual discourse. SA's most apparent feature is the combination of several types of mapping techniques that facilitate the organization of research projects and data analysis. In recent years, SA and its mapping techniques have made their way through the landscape of qualitative social research and have repeatedly been pushed into new directions (for an overview, see: CLARKE, FRIESE & WASHBURN, 2018; MARRES, 2020; OFFENBERGER, 2019). When it comes to the issue of temporalities, I argue that SA's maps incorporate a primary focus on the situation as a time mode of concurrence and synchronicity. Its maps allow a simultaneous grasp of the situation of inquiry and help assemble constitutive elements and their complex relations (CLARKE & KELLER, 2014), but hinder the analysis of other time

modes and the analysis of the *step-by-step making* of change, transitions, and processes. [3]

In Section 2, I introduce the methodological problem in question. I discuss the relevance of temporal complexities in social life with a particular focus on the FOUCAULDIAN thinking that already inspired the turn to discourse in SA. In Section 3, I briefly describe the different types of maps, address them as media of visualization, and scrutinize some visual characteristics of mapping strategies. In this rather methodological discussion, I lay the foundation for the exploration of mapping strategies in SA. In Section 4, I focus on SA's visualizations of temporalities and its possibilities for processual analysis. To illustrate how the mapping techniques of messy and relational mapping render certain temporalities visible and how they might be adjusted to improve the visualization of heterogeneous temporalities, I mainly rely on an empirical example drawn from a research project on police emergency call processing. The example consists of the mapping of a field protocol of a single police emergency call. I show how the course of the conversation is related to formative conditions of emergency call processing and to the elements that arise during the call conversation itself. In Section 4.1, I briefly introduce and situate the example within my ongoing doctoral research. Sections 4.2 and 4.3 comprise a discussion of existing mapping techniques with a focus on their features for visualizing temporalities. In Section 4.4, I propose comprehensive adaptations that expand SA by moving the maps to address the coexistence of different, sometimes even contradictory, time modes in the data and to open up SA for processual analysis. Therefore, I suggest changing the media arrangement from flat maps to *flip maps*, building on messy and relational mapping techniques and expanding analytical possibilities. In Section 5, I present reflections on the relationship between mapping and time. [4]

## 2. Temporal Complexities as Methodological Problems

In the following two sections, I address the relevance of rethinking methods from a time-sensitive viewpoint and discuss how methods mold our abilities to visualize and interpret temporalities and their making. As outlined above, temporal facets of social life have become a widely discussed issue in social theory and empirical research. Exponents of modernist "stage theories" (ABBOTT, 1995, p.101) imagined social time as constant progress and development. The different critics of theoretical modernism, with its complementary bias of actor-centered and structuralist theories, pointed to the ambiguities and dialectics of timing. The "existence of different modes of social time(s) which may exist side by side, and yet are to be distinguished from the time of physics or that of biology" (NOWOTNY, 1992, p.424) is now widely acknowledged. It follows that at the same moment, elements of social life form part of a variety of overlapping series of events. These events are prefigured in past practices, repeated in some aspects, and form part of processes and open-ended transformations (FOUCAULT, 1991 [1980]; PORTSCHY, 2020). [5]

Furthermore, scholars raised issues of marginalized times, conflicts over temporal regimes, and the powerful formation and sustainment of temporal

patterns (THOMPSON, 1967). While in actor-centered approaches (NOWOTNY, 1992; see also ADAM, 1994) subjective agency and experience are addressed, practice theorists promote a multidimensional approach (KOCH, KRÄMER, RECKWITZ & WENZEL, 2016, see also SCHATZKI 2006). Studies have been carried out to investigate the emergence of historically dominant, but consistently contested, temporal regimes and their crises (FLEISCHER, 2013), as well as the temporal patterns of government(ality), subjectification, and knowledge (BINKLEY, 2009). [6]

Scholars in the vein of Michel FOUCAULT, who is one of the main influencers of SA, promoted the analysis of "temporal manifolds" (PORTSCHY, 2020, p.395) to understand power-knowledge. Empirical analysis has to unfold the plural and relational character of socio-material times with their rhythms, durations, continuities and repetitions, futures and pasts, as well as their pacing. Single events are constituted at the intersections of different practices and they are subject to power struggles. In discourse analysis, the concept of series (FOUCAULT, 2002 [1969]) exemplifies this rationale. A series of events is constituted in relation to practice-discourse formations. Formations comprise the regularities that function as the conditions of discourse-practice and form the iterative entanglements between different processes (e.g., certain technological changes, biographies, trajectories of objects and issues). However, the events of a series do not solely incorporate the repetitive time mode of their formation; they establish an ordering of succession, which opens up for processual contingency and for the possibility of transformation (PORTSCHY, 2020). The concept of series thus allows researchers to ask for temporal intersections, overlaps, and struggles without presuming a dominant time mode, be it repetition over teleology or synchronicity over succession. In this sense, the analysis is oriented towards the wider configuration of temporally-extended processes. By relating events with their formative conditions, processes gain their specific meaning and intelligibility for participants and (participant) researchers (ROUSE, 2018 [1996]). [7]

This way of thinking about temporal complexities accompanies FOUCAULT's (2002 [1969]) historical *a priori*, which CLARKE (2005) combined with grounded theory methods to include the analysis of historical discourse. In order to fully incorporate temporal complexity and "push grounded theory around the postmodern turn" (p.291), scholars need to reconsider the mapping techniques of SA as they dominantly depict the time mode of simultaneity. To consolidate this argument in the following section, I introduce analytical methods as media that allow and restrict the visualization of certain aspects of the research situation. In doing so, I introduce the perspective used to scrutinize the mapping techniques of SA. [8]

### 3. Maps as Media of Visualization

The history of sociological research practices and methodologies has been deeply interwoven with research media and media change, especially in the domain of qualitative data collection, registration, and storage (BALL & SMITH, 2020; KNOBLAUCH, 2017). In contrast to data collection that now comprises speech, images, or video, data analysis has largely remained text-based. Written text continues to be the most important medium of analysis with the exception of explicit visual methods. In this section, I aim to rethink visualization in qualitative interpretation methods by introducing a perspective on maps as media of visualization. [9]

Philosophers of science pointed out that modes of visualization are deeply related to the capacities of scientific understanding. In order to describe this nexus, Henk DE REGT (2017) referred to the German term *Anschaulichkeit* [visualizability] as it was used in debates in early quantum theory. *Anschaulichkeit* coalesces the two meanings of intelligibility and visibility. DE REGT pointed out that theories require not only logical but also *visual plausibility* of assumptions. Visualization becomes an "epistemically significant feature" (p.228) and condition of scientific understanding. This applies all the more for qualitative research methods. Methods allow researchers to render the world (visually) disposable in a certain way and mobilize (past) research practice and its (provisional) products as analytical resources. However, they also restrict the visualizability of other aspects of empirical situations. Because SA was designed for empirically grounded theorization and includes different ways of visualization in mapping techniques as an important feature of data *analysis* rather than for the presentation of research outcomes, visualization becomes an even more important feature for scientific understanding. In a more general sense, the concept of *Anschaulichkeit* makes methods understandable as *media* of interpretation through visualization. Methods mediate between theoretical, methodological, and empirical practice and mold researchers' abilities to grasp the complexity and messiness of social life (MATHAR, 2008). Thus, different methods also incorporate certain ways to render time visible and intelligible as they articulate events by synthesizing, aggregating, and dividing temporal relations (NEVERLA, 2010). It seems almost redundant to state that changing the mediated visualization of data also reshapes the intelligibility of empirical phenomena. In data analysis, traces of empirical phenomena are often rapidly transformed to text. Later on, data are disassembled in a sequential (e.g., hermeneutics, conversation analysis) or more fractal manner (e.g., coding techniques of grounded theory methodology). SA scholars add maps as a hybrid format to complement these ways of analyzing data. [10]

There are five basic mapping techniques (CLARKE, 2005; CLARKE et al., 2018): messy mapping, ordered mapping, relational mapping, social worlds/arena maps, and positional maps.

1. During messy mapping, researchers write down "all the analytically pertinent human and non-human, material, and symbolic/discursive elements of a particular situation as framed by those in it and by the analyst" (CLARKE, 2005, p.87). These elements are laid out on a paper or slide in a rather disorderly way that encourages researchers to think about the plurality of involved entities. The messy map is the basis for and taken up in all the other mapping types as their raw material.
2. With ordered maps, researchers categorize the elements of the research situation in a table. The list forces researchers to order the data at hand. Furthermore, they are stimulated to find more elements as the table depicts the field of non-knowledge (CALLON, 1981).
3. In relational mapping, researchers explore the relations between elements within a situation of inquiry. This analytical step is performed by drawing lines between the elements on a map and by asking questions about the qualities of these relations.
4. Social worlds/arena maps are deeply rooted in the theoretical tradition of symbolic interactionism. Researchers assemble the collective actors of discursive fields who raise and negotiate issues in the research situation. The map depicts social worlds that are literally circled around a common arena in which they participate.
5. Positional maps are for analyzing discourse. These maps are topical coordinate systems that researchers fill in with the positions taken and not taken in discourse arenas. The ordered design depicts lacunas and thus helps to find silenced positions. [11]

The mapping processes are accompanied by memo writing (extensively discussed in CHARMAZ, 2006). Memos are analytical notes taken during analysis and refer to analytical questions, which researchers direct towards their maps and data. Researchers can describe whole maps, certain elements and positions, as well as the relations between elements and positions. In the following discussion, I focus on messy and relational mapping techniques because they differ the most from other interpretative methods and seem most promising for the adaptation to processual and temporal analysis. These maps especially soften the textually ordered sequencing of interpretative methods as written elements are combined with a rather pictorial layout. The map layout is a rearrangement of the textual modality of most method designs, which makes it possible to simultaneously grasp the complexity of research situations. During the interpretative step of writing down names of situational elements, researchers perform an abstraction as they translate empirical singularities into comparable terms. Through this conceptualization step, empirical data are aligned with theories and other socio-material elements of the research process and its possible future results (LATOUR, 1990; ROUSE, 2018 [1996]). In SA, the hybridization of text and image in maps becomes a major resource for analysis and differs drastically from word-by-word or line-by-line reading, interpreting, or coding of texts, because the elements of a situation can be captured at a glance. [12]

SA's flat and hybrid design has advantages in mobilizing empirical data. There is no limitation in terms of data collection and it allows for the integration of different types of data sources (CLARKE et al., 2018). Furthermore, the map is not limited to a physical location or a participant's definition of the situation, which helps to transcend interactionist situationalism and process reductionism (see HOEBEL, 2019, for such a criticism). Rather, following DEWEY's (1938) pragmatist conception, situations are defined in the research process itself as a relation of theory, research question, and empirical data (CLARKE & KELLER, 2014).<sup>1</sup> This methodological openness allows for adapting the method to historical and process analysis, in which "the situation" is characterized by transformation and change. At this point, the often-diminished role of visual method design is obviously a relevant feature for scientific knowledge production and thus for researchers' abilities to draw things together (LATOURE, 1990). [13]

In the following section, I scrutinize SA and its potential for visualizing temporalities. I argue that adopters of SA face problems concerning temporal analysis because the map, as its most important analytical tool and medium, interferes with the visualization of the step-by-step making of transitions and processes by depicting situations as completed wholes (see below and ABBOTT, 1995). To tackle some of its issues, I suggest a rearrangement of its media characteristics to incorporate filmmaking techniques and its *Medien-Zeit* [media-time]<sup>2</sup> (GROSSKLAUS, 2000). The basic operations of filmmaking are not necessarily concerned with filming with a video camera. Rather, the main feature of this medium is that temporalities are broken up into frames and rearranged into a sequential order of images. Thus, filmmaking involves an interplay of breaks and continuation that can be used as analytical movements (ibid.). [14]

#### 4. Laying Out Multiple Temporalities and Mapping Processes

Time is not an unknown in situational analysis. On the contrary, introducing historical analysis as a particular form of temporal analysis into grounded theory methodology was one of the main contributions of SA scholars, who criticized classical grounded theory methods for the predominant focus on the time layer of the present and a remaining transcendent universalism (CLARKE, 2005). In her endeavor to push grounded theory methodology around the postmodern turn, CLARKE highlighted the need for taking historical changes of situations of inquiry into account. Concerning time and history, the important influence of SA is derived from Donna HARAWAY and Michel FOUCAULT, who prominently claimed that researchers have to situate practices, objects, and knowledge historically and culturally. [15]

Concerning this historicizing methodology, two follow-up issues are raised that relate to temporalities. First, within the deeply relational theory/method package of SA, researchers examine the relations between various elements, which form the specific historical conditions, due to which new elements can occur and

1 For a discussion on DEWEY's concept of the situation and the problem-solving definition of situations, see also JAEGGI (2018).

2 All translations from German texts are mine.



vanish in a particular moment or period. In this sense, SA scholars define the situation in a pragmatic way. The situation is integrated within the process of inquiry and represents a genuine, but always provisional, "unified whole" (DEWEY, 1938, p.128) above the sum of its parts. One of the important contributions of SA is to add that these "wholes" can only be understood when researchers consider who and what is excluded, marginalized, or silenced. The maps visualize the situation and allow for a *simultaneous* capture of various elements. Second, as CLARKE insists on *taking history into account* (CLARKE & KELLER, 2014), one of the main questions is how situational elements relate at moments in time and how the elements and their relations change over time. Thus, situations constitute time layers<sup>3</sup>—rather than geographical spaces—which researchers define and delimit by creating empirically substantiated maps. Temporal aspects of social life can form part of these maps in different ways. [16]

In the following subsections, I examine the ways in which messy and relational mapping techniques visualize different times and timing elements. I use an empirical example of an emergency call taken from my ongoing doctoral research. In Section 4.1, I introduce the example, underlying research questions, and the context of data. The example is first used to illustrate the messy mapping of temporalities (Section 4.2). Then I turn to the ways SA scholars analyze historical discourse as one of the main innovations of SA within the tradition of grounded theory methodology that is concerned about temporalities (Section 4.3). I argue that although SA opens up several ways for analyzing temporalities, it does not allow for depiction of the *making* of processes and change. However, series of maps as one variant of mapping historical discourse can be adopted to tackle this issue. I revisit and extend these analytical procedures by introducing the flip map, which (similar to flip books) adds basic filmmaking techniques by moving the maps and thus helps researchers to improve the analysis of orders of succession within SA (Section 4.4). The flip map combines the main advantage of SA—the visualization of complex configurations of elements within a given situation—with the possibility to analyze their relevance, relations, and reconfigurations within ongoing processes. [17]

#### 4.1 The empirical example: A police emergency call

To illustrate the existing mapping strategies in SA and the new flip map, I elaborate on the empirical example of a single police emergency call conversation. The example is part of my ongoing doctoral research about emergency call processing in Austria and the role that media technologies play. In this section, I introduce the concrete data that comprise the main sources of map making and the context in which these data were gathered. Figure 1 (see Section 4.2) shows a messy map of the conversation. [Appendix 1](#) contains the relational flip map in which the same call is decomposed into a series of map layers. Both maps depict a field protocol of an emergency call that took place in summer 2019 and lasted about two minutes. During the examined call, several

3 In "Archeology of Knowledge," FOUCAULT (2002 [1969]) extensively made use of the metaphor of time layers to present discourse analysis as an archaeological practice, which reveals layers of "sedimented" practice.

communicational issues arose, which contributed to the denial of a police intervention. [18]

Police-related emergencies are processed in specially equipped control rooms. In the Austrian police control room design, the conversation between callers and call takers is separated from dispatching police units and other tasks in police operation control. The emergency conversation forms the first phase of the emergency process. I define emergency call processing as the work of continuous refinement of knowledge production and classification (BOWKER & STAR, 1999). In the emergency processes, police officers define incidents in conversations with callers and organize temporal relations of police interventions by identifying and prioritizing the reported incidents. The call conversations and control rooms have been crucial for the development of ethnomethodological conversation analysis (SCHEGLOFF, 1989) and its advances towards technology, embodiment, and materiality in workplace studies (HEATH & LUFF, 1992; SUCHMAN, 1997). Workplace researchers conducted in-depth video ethnographies, but failed to relate emergency conversations and processing to their wider specific historical formations "outside the control room." To fill this research gap, my project departs from the configurational thesis (NICOLINI & MONTEIRO, 2016) that researchers cannot sufficiently describe the fabric of (emergency) processes by only examining its inner workings and local surroundings. In emergency processes, various actors rather synthesize and reconfigure particular processual as well as recurrent, formative elements that transcend single processes and the boundaries of the control room and the police as an organization. Emergency processes are highly regulated, controlled, and shaped in normative negotiations and struggles, technological development and transfer. To examine these wider process configurations empirically, I follow the implementation of a new central information and communication system (computer-aided dispatch system) in Austrian police control rooms. [19]

Emergency processing is a "strategic research field" (SCHMIDT, 2012, p.75) to investigate timing practices in which actors such as technology developers, police officers, and regulating institutions constantly raise issues of time (KNOPP, 2020; ZEBROWSKI, 2019). Its organizational and technological practices include a plethora of modifications of timing. Therefore, investigating emergency calls covers three basic, interrelated dimensions of time and timing (KOCH et al., 2016): 1. the specific timing practices (e.g., scheduling, waiting), 2. the temporality of specific bundles of activity (practices) as they implicitly structure events and as they refer to certain past and future events, and 3. the ineluctable ontological temporality of *praxis*. [20]

Because the configuration of emergency processes is not locally or temporally bound to the control room, I conducted a multi-sited ethnography (MARCUS, 1995) that linked participant "over-the-shoulder" observations in Austrian police control rooms with annual observations and field interviews at two leading European security fairs (STOCKMARR, 2015). In two consecutive years, I visited five different control rooms in Austria, in total about 40 times and took part in a training course for a new computer-aided dispatch system. During the field visits

in control rooms, I was able to listen to emergency conversations and observe dispatch activities. However, due to organizational security measures, I was not allowed to move freely within the control room. Instead, I mostly sat next to different officers who were responsible for me during their shift. Observations lasted from one to nine hours depending on officers' availability to supervise my visit. I carried out most of these observations in one control room responsible for an urban environment. The other control rooms differed in task (traffic control, parking area monitoring) or geographical environment (rather rural). These observations were much shorter and each site was visited only once. During the field visits, I took notes and protocolled my observations after each stay. [21]

To gain insights into the ongoing technological transformations of Austrian emergency call processing, nine semi-structured interviews and one group discussion with employees of a private software company complemented observation methods. The interviewees were high-ranked police officers who organized the local implementation of the dispatch system, police officers, software engineers, and staff of technology companies. The interviews lasted from one to two and a half hours, and were accompanied by constant mapping of sites, actors, and practices involved in the socio-material shaping (WAJCMAN, 2015; WILLIAMS & EDGE, 1996) of the emergency process. The flip mapping technique was specifically conducted for in-depth analyses of single emergency processes. [22]

#### **4.2 Timing practices and time elements in different types of maps**

The notion of timing practices highlights an important shift in the sociological research on time. It stresses that time is not a naturally given, objective, or abstract aspect of the social. Instead, time is organized, imagined, experienced and measured (THOMPSON, 1967). The modernist idea of an abstract, linear, and chronological time has been replaced by a notion of culturally dispersed human and non-human activities of *timing* (CZARNIAWSKA, 2004). With the mapping techniques of SA, it is possible to render these activities visible and intelligible as specific elements of a situation of inquiry. They can form an element of messy, relational, ordered, or positional maps. With these techniques, researchers can answer questions of which and what kind of elements participate in timing activities, how they relate to other elements, how the elements coordinate timing and (de)stabilize certain temporal regimes. The researcher's categorization of elements in the charts of ordered maps and positional mapping marks discursive positions, normative negotiations, and struggles over temporalities.<sup>4</sup> Figure 1 shows how "traditional" messy mapping helps illustrate the complexity of an emergency call conversation of approximately two minutes. In addition to technological, human, and cultural elements, the messy map can include time and timing elements.

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4 For a discussion on the temporality of norms and normativity, see ROUSE (2017).



classification may be seen as a timing practice itself that is embedded into narrative, organizational discourse and incorporated in technology design. Through messy mapping, I have identified central themes and formative conditions of emergency call processing. The maps have depicted the existence of norms, technologies, and other elements of practice and discourse that configure certain temporal regimes. However, in the maps, their enforcement and effects within the conversation, the alignment of the conversation, and the performative proceeding have remained hidden. [25]

### 4.3 Historical discourse, synchronous slices and merging periods

Through a second—and central—strategy of mapping temporalities, researchers historicize the situation through discourse analysis. This strategy responds to widespread criticism towards grounded theory methodology, which is said to limit its focus on the present as its principal time layer (CLARKE, 2005). It enables the analysis of "lines of transformation" (FOUCAULT, 1991 [1980], p.74) and the history of certain discursive arenas and social worlds. For historical analysis, SA scholars propose similar mapping techniques like for the analysis of the present: Elements are laid out in a messy way, then ordered and related. To map discursive positions and negotiations, positional mapping is suggested. The most important difference to other mapping techniques is that researchers perform these analytical exercises for at least two different (historical) moments or merge certain periods into one time layer (CLARKE, 2005; MESSAGE, 2016). Writing memos accompanies these procedures and is the main technique to describe and analyze the relations of elements between historical moments. The technique of creating a series of maps inspires the flip map that is discussed in detail in the next section. However, the existing historical maps still do not depict the making of change processes. To demonstrate these shortcomings, I turn to examples given in the seminal books of Adele CLARKE. [26]

The first approach to historical discourse is the mapping and comparison of different historical moments. It resembles the well elaborated discourse analytical technique called *synchrone Schnitte* [synchronous slicing] (JÄGER, 1997, n.p.) that allows for the analysis of historical moments in their own right and supports their comparison. This mapping technique visualizes the altering sets of elements of two or more dates and depicts which elements occur, vanish, or change over time. Researchers write memos about each historical moment and the changes they find between the maps. However, even though slicing is an easy and fast method to map *what* changes, it causes two major problems. [27]

The first issue is of practical nature and relates to the dilemma of historical research in gathering rich data: It is rather unlikely that scholars find the same type, density, quantity, and quality of data in two historical moments (JÄGER, 1997). This problem may drastically influence the research outcome. In many historical research projects, this issue can be tackled by planning data collection, while other methods lack these possibilities. In particular, ethnographers attend change rather than compare "before and after." Ethnographers cannot foresee what will become relevant to the research field and what data they, therefore,

need to collect. Thus, ethnographers have limited possibilities to gather rich comparable data in the same way as well-planned historical projects can. [28]

The second, rather methodological problem is the timing of slices or maps at certain moments in history. Scholars may rationalize the moment to cut in a theoretical or empirical manner, but slicing always produces interim phases that are no longer under in-depth scrutiny. Episodes in which people and their things make changes may be wiped off the map. This problem is reinforced by the mediation of maps, which tends to flatten performativity. Maps only show that the elements change, but how change is actually performed is kept in the dark. ACKERMANN, BEHNE, BUCHTA, DROBOT and KNOPP (2015) pointed towards this problem in an in-depth analysis of historical discourse using synchronous slicing. They could only detect what aspects or elements changed. The discursive making of transformation that occurred between discursive events remained hidden. Furthermore, discourse under scrutiny consisted of different discursive strands, all of which had their own temporalities. Change did not succeed in lockstep and all strands had their own important events. Synchronous slicing therefore seemed too coarse-grained to analyze the step-by-step making of (historical) processes and the complex and overlapping temporalities involved. [29]

A second approach to historical projects and diachronous research illustrates periods of time in a single map. In her first methodological book on SA, CLARKE (2005) gave the example of a research project on modern contraceptives. She merged a time period from 1915 to 1965 into one map layer. It allowed her to illustrate the controversies and references surrounding contraceptives over a period of over 50 years. Nevertheless, flattening 50 years of history in a map comes at a high cost, as it depicts the diachronous discourse history of this period as if it happened synchronously. Transformation and succession become rather invisible in such maps. [30]

In summary, existing historical mapping strategies allow scholars to identify differences between historical moments by cutting the diachronous flow of discursive and non-discursive practices into slices. Through this procedure, researchers are able to grasp the elements of the (historical) situation and render history "mappable." The analysis of the performativity of change is left to memo writing. However, the maps hide the performance of change, which diminishes their analytical power, especially in explorative and ethnographic endeavors. Furthermore, existing mapping techniques turn out to be problematic when researchers account for recent theories on temporal complexities and timing, which emphasize the variety of temporalities involved in each event and the performativity of change and processes. [31]

#### 4.4 Moving maps for processual analysis

How can we adapt the mapping techniques of SA to further incorporate temporal complexities and how can they be used for processual analysis without losing their methodological advantages? I propose moving the maps and including some aspects of filmmaking methods. Similar to an illustrated flip book for children, researchers can multiply synchronous slices by making a new map layer for every emerging element or event of the process under scrutiny. The many maps can be put on top of each other and "flipped" later on to form a stream of mapped moments. This easy trick allows for analyzing the step-by-step making of processes and change by visualizing new elements and their conditions of occurrence. Of course, this technique is very different from video analysis or watching a video of an empirical scene, as it involves interpretative steps of abstraction by naming empirical data, disassembling and reassembling the temporal order of elements, and relating elements to each other. [32]

As argued before, filmmaking is not only a way of recording, storing, and presenting moved images, but it also involves different interpretative procedures and temporal modifications. This entails 1. the fragmentation of flows of practice by cutting and arranging sequences (disassembling), 2. the temporal synthesis or reconstruction, which turns the maps into meaningful processes (reassembling), and 3. several modes of sequencing, or changing speeds and directions of moving images while analytically watching the flip map as a processing and transforming whole. Thus, flip mapping does not simply reflect a supposedly given reality and its elements. Rather, researchers perform a mediated analysis of empirical data deploying different "theoretical lenses" (NICOLINI, 2009, p.1396) with specific scales and scopes. With the flip map, researchers can "extract" certain—and especially temporal—facets of social life. [33]

The flip mapping techniques parallel poststructuralist temporal concepts by highlighting fractions in the material and allowing researchers to scrutinize the often invisible "small" shifts in interim phases that pave the way for "big" events. This feature makes moving maps an appropriate medium for visualizing distinct types of temporalities: the series of events that is aligned in social processes as well as the synchronicity and disposability of circumstances and conditions. The flip mapping visualizes relations of past, present, and future and facilitates analysis of different and overlapping temporalities. Hence, SA scholars can benefit from this extension, which loosens the maps' dominant time mode of simultaneity to open it up for the plurality of times and timings and the step-by-step making of change and continuity. Further, the technique allows for adapting historical and discourse analytical maps to the analysis of short-term micro-processes. Researchers can visualize elements that happen locally and processual, but which transcend micro-situations by coalescing the micro-macro-dichotomy in the flat design of each flip map layer. [34]

#### 4.4.1 Interpretative procedures of flip mapping

In flip mapping, researchers adopt the aforementioned basic procedures of filmmaking as interpretative steps of disassembling and drawing together elements of processes. Thereby, the following analytical steps build up sequences, allowing for time-sensitive analysis. First, researchers lay out all elements of the process. The resulting fast, analytical messy map (see Figure 1) contains all the elements that occur during the process and can be complemented by ordered mapping to stimulate field knowledge. In this step, the ordered temporal relations of the empirical process are dissolved similar to open coding in traditional grounded theory methodology and simultaneity is (visually) imposed. The movement between disassembly and reassembly reminds researchers that the empirical temporal relations of the process are not naturally given but can be configured differently. The certainty that alternative configurations are possible is a prerequisite for analytical interpretation (BAUMAN, 1978; CLARKE, 1991). The laying out of elements is accompanied by asking questions about the data and writing memos. At the end of this first step, researchers have *provisionally* gained an overview over the elements that make up the process. After this first messy map, existing strategies of SA suggest researchers to continue by relating elements to each other or ordering them. [35]

In flip mapping, researchers now focus on the temporal seriality of elements to reassemble empirical orders of succession and synchronicity. First, one adds all the elements given in the socio-material formation of the process (here: regular elements of police control rooms) that may become relevant during the process ([Appendix 1](#), p.1). Because these elements do not genuinely emerge during the process under scrutiny, the researcher can flatten these elements into a single time layer depicting the conditions of possibility of the process. Additionally, given that this step requires some field knowledge, it is helpful to check the entries with ordered mapping, because the map has to contain all formative elements that *might* become relevant. Relative to the research question, formative elements<sup>5</sup> may include normative issues, rules and other sociocultural elements, architectural arrangements, technologies, objects, as well as human actors. Formative elements prefigure and relate the process with other processes, wider patterns of change and persistence in the field. All these elements have to be understood as (always temporary) objectivations or subjectivations produced in past and historical practice. As conditions, they are mobilized, activated, or turned passive during the processes they shape. [36]

The third step is at the core of flip mapping: Every new occurring element is added in the respective temporal order of the empirical process. With this analytical technique, researchers must slow down to reflect on every single step of the process, including its manifold temporalities. This is achieved by multiplying the aforementioned synchronous slices. Slicing is applied for every new element,

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5 Formative elements are an important feature in trans-sequential process analysis (SCHEFFER, 2007). In SCHEFFER's concept, these elements relate sequences and events within a process. I rather refer to the Foucauldian notion of (trans)formation being the regular conditions and the connective tissue *between* processes or series of events (FOUCAULT, 2002 [1969]).



be it an interaction, an event, a statement, or a bodily action. What counts as a new event or element depends on theoretical assumptions grounding the research question. [37]

The step-by-step mapping technique is shaped by the applied software. If researchers adopt the slide templates<sup>6</sup> provided for messy and relational mapping, they can add new elements to the slide, then duplicate it and start this step all over with all emerging elements: every new element or interaction is put on a new slide which contains all the elements that were on the previous map as well. This way, previous elements stay visible for analysis as traces of earlier episodes of the process and therefore conditions and elements of the following activities. [38]

After reassembling the process with several successive messy maps, researchers start to draw lines between elements and analyze the ways in which elements are empirically related to constitute the processual configuration (see [Appendix 1](#)). Once more, during this relational part of flip mapping, researchers focus on the actual doing of processes. Every single map slice can be analyzed relationally within itself. For processual analysis, emerging elements are drawn to their conditioning elements. If the research question emphasizes the role of certain elements for the process (e.g., the relevance of media technologies), these can be traced throughout the process. Asking analytical questions of the drawn relations and memo writing should support the analytical process and conceptualization. The broader view gained by situational maps continues to be an important methodological advantage, which allows for visualizing the couplings of processes and their conditions. The visualization of "situatedness" is one important advantage over the (micro-)situational methods of ethnomethodological conversation analysis and other methods of process analysis. Nevertheless, the multiplication of map slices directs the researcher's attention towards orders of succession. Messy and relational flip mapping can be accompanied by ordered maps, which chart the types of elements of certain episodes of processes. Ordered mapping can help to better follow elements throughout the process and to identify episodes and phases.<sup>7</sup> [39]

After adding all the elements in diachronic order and relating them to each other, researchers can start to travel across time. Once more, this step enhances SA researchers' abilities to grasp seriality and analyze processes. This mapping technique helps to adopt a holistic perspective and the identification of patterns and conditions that affect the various episodes of the process. There are several modes for doing this: watching the flip map from its beginning to the end, at slow and fast speeds, jumping in at specific moments, or moving back and forth. Again, researchers' analytical imagination can be stimulated by taking a reconstructive (following the given series of events) or a deconstructive stance (skipping, going back and forth). [40]

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6 See <https://study.sagepub.com/clarke2e> [Accessed: July 22, 2020].

7 For a similar, but rather theory-driven adoption of ordered maps, see KHAW (2012).

#### 4.4.2 Empirical example: An emergency call conversation

To demonstrate how flip mapping enhances processual analysis, I turn to the emergency call example introduced in Section 4.2. This emergency conversation is a suitable example because the process seems easy to delimit. It begins with the moment the caller connects with the police communication system and ends when the police call taker hangs up. Additionally, the conversation brevity allows for a thorough analysis of the empirical interactional process and its relations to wider configurations. As with other mapping techniques, flip mapping was not designed for presentation of empirical data in research papers, primarily, but supports analysis by visualizing complexities. The analysis basically consisted of performing the aforementioned steps, visualizing the emergency call conversation described in the field protocol in a dense series of maps, and writing memos. [41]

The relational flip map is attached in [Appendix 1](#). It consists of 21 layers. The map contains elements that are generated in the particular conversation as well as elements that were found to be relevant in the research project but not necessarily produced within the conversation. These additional elements function as possible conditions of the conversation. Each layer depicts an event in the conversation and its multiple relations to elements that shape its occurrence. These relations are made visible by drawing lines. Elements that are produced throughout the conversational process are picked up in the following layers. [42]

With the following analytical samples, I highlight the different analytical stances researchers can adopt when performing flip mapping. First, researchers can go through the flip map step by step and analyze each layer in its own right while building up the series of maps. Second, they can use the ready-made flip map to follow the process as a whole or the course of certain elements throughout the process. The fine-grained *step-by-step analysis* of each map accompanies the making of successive map layers. The major advantage of mapping techniques is that the visualization accounts for the fact that events are not solely produced, mediated, and normed by elements that emerge within the conversation itself. The formative elements present in the map relate to other "production sites," situating the process and its events within wider configurations of technology development practice and discourse, negotiations over instructions for conversations and incident classification, or the narratives that produce the normativity and memories of the respective control room. [43]

For the purpose of this article, I refrain from presenting a full analysis and memos for every single map layer. Rather, I present a few steps and the results of the analysis of the first episode, which is the incoming call and its "initial categorization" ([Appendix 1](#), p.2). By taking the step-by-step perspective, I focus on the configuration of processual occurrences and circumstances and draw together elements that make the initial categorization possible and meaningful. Thus, the following remarks on the depicted episode are concerned with how the initial categorization is constituted and how it may shape subsequent episodes. [44]

The operation system signals every incoming call. The signals consist of sound and the caller's telephone number on a display that is colored differently depending on an automated classification of telephone number types. The combination of color and number forms the material basis for an initial categorization of incoming calls by their "origin" (e.g., from a registered police telephone, from other emergency services, national/international calls, from a phone booth). These visualizations are related to cultural know-how reproduced in the control room through initial instructions and training, when officers start to work in the control rooms, and in daily practice. The signal categories are aligned with anticipation about what comes next, who the caller might be, and how the call may proceed. Both technological display and know-how co-constitute this initial categorization of the call. Foreign telephone numbers are related to the anticipation that the caller might not speak German and, thus, that communication might become difficult. A phone booth display relates to expectations that the call might be fake. The practical meanings of the display indicate a non-compulsory but relevant police expectation towards callers not bound to single emergency conversations. Police reliance and classification of incidents is not only based on the characteristics of the reported incident, but also on the police officers' classification of and trust in the caller. The incoming call in the example is displayed as an Austrian mobile phone number, which is the most open class of callers and thus hard to anticipate who will be on the line. It leaves the call taker with a rather open stance towards the upcoming conversation. [45]

The analysis of the first step of the emergency process involving a police officer hints to the deep interwovenness of technologies, police know-how, and categorization within the process. The diverse technological displays indicate a type of caller and enable a certain way of understanding in relation to practical and discursively circulating normative know-how. This opening of the emergency call prefigures consecutive episodes by provisionally indicating the trustworthiness of the caller. In temporal terms, the initial categorization relates the incoming call with the productive features of the communication technology and cultural memories that render it intelligible in a certain way. These products of past practice are visualized by the lines drawn in the maps. For the particular process under scrutiny, the first step indicates a certain openness of the police officer for the consecutive ones. In the following stages of step-by-step analysis, researchers continue to lay out maps for every single event in the process and write memos about them. Relations of succession become visible through the different configurations of elements in the series of maps and the relations within one map. [46]

When we turn to a *holistic analysis of the process*, a first view of the whole flip map in [Appendix 1](#) shows that there is a plethora of socio-material and cultural elements that mold the conversation's field of possibilities. In contrast to existing mapping strategies, researchers can observe that throughout the process, the complexity of the situation grows, and we can see which elements become active and relevant during the conversation. Activation means that they practically relate to other elements within socio-material activities and thus configure a meaningful and effectual process. For example, a list of street names becomes an active

element when the call taker is trying to understand the street named by the caller ([Appendix 1](#), p.5). This list is not a necessary element of the process, but rather a disposable one that becomes meaningful within the particular course of conversational sequences. [47]

The flip map is again examined following questions of how classification and categorization are performed, and especially how the course of action contributes to the rejection of the caller's claim for police intervention, how certain elements are made relevant, which temporal relations emerge in the process, and also which elements and relations may be missing. In an overview of the conversation, one can divide it into successive episodes. After an initial categorization of the call by the police operation system ([Appendix 1](#), p.2), the police officer defines the conversation as an emergency call by saying "police" (p.3). Then, the caller describes what happened (p.4). After the caller's first description, the call taker asks for the location of the reported incident (pp.5-10). This important episode is characterized by difficulties that prolong its duration. When a location is found, the participants of the conversation turn to defining the incident, which again is a phase entailing conversational problems and repair work (pp.11-14). The call taker then rejects the caller's claim for police response (p.15). Suddenly the call breaks down, opening up the space for the police operator to consult the observing researcher (pp.16-17). Then, the police officer makes a call to reopen the conversation and again asks what actually happened. In the end, the call taker finally rejects the caller's claim for police intervention (pp.18-21). [48]

Throughout this overview, the map shows how the call taker successfully organizes the call through routine questions aligned with the material requirements of the operation system and temporal conversational norms of the police control room. She manages to impose the temporal order of question and answer: the first question defines the place of emergency, the second one tries to classify the caller's problem and then the operator finally rejects or accepts the caller's claim for police response. At this level of granularity of analysis, the call resembles the typical temporal structure of police emergency calls (WHALEN & ZIMMERMAN, 1987), but within topically ordered question-answer episodes, the progressive line of problematizing the incident is broken up by repetitions and the breakdown of the conversation. If we want to understand how these become problematic, we have to consider the wider configurations of police emergency processing. [49]

The caller's initial description of the incident ([Appendix 1](#), p.4) is supported by the noise of bodily movements and shouts addressing a supposed offender. The call operator interprets this report as potentially relevant for the police and indicates this by asking for the concrete location. [50]

In the following locating phase, the caller and call taker confront difficulties that contribute to the progressive disintegration of this emergency call process. The operator does not understand the described offense and in the middle of the negotiation of meaning, a technical breakdown slows down the conversation again. The fact that the participants are not able to define a meaningful

emergency cannot be understood only as a problem of linguistic comprehension. Instead, this practical problem is related to the temporal normativity of emergency processes. Matters of speed, immediacy and timing are main issues of emergency response (ZEBROWSKI, 2019). The problem of synchronizing emergency and response is visible in the call taker's justifications to deny the request for police intervention. Thereby, immediacy is not only a matter of synchronizing with one single call, but also with the overall rhythms of demands for police response. Officers are under pressure to handle calls rapidly in order to be ready for the next one. These temporal and classification norms circulate in trainings and narrations. Additionally, temporal exigencies are brought forth in societal and political discourse on emergency call processing and reproduced in technology design, discourse, and configuration. In practice, callers have to demonstrate a certain synchronicity of their call for police response and the incident, too. The temporal desynchronization during the call provides a legitimate justification for the denial of the caller's claim under these circumstances ("If the offender went away and nobody is hurt, please go to the police station with the video"<sup>8</sup>). Thus, caller and call taker assemble multiple temporal demands and alignments. [51]

The caller's description of the incident, which the call taker initiates with an open question after finding out about the caller's location, continues to be problematic and further desynchronizes the conversation with the site of emergency. Throughout the course of the call, the operator changes her questioning from open to closed and more specific questions. While the call taker seeks to classify the incident type by offering a categorical assignment to police operation types ("Are you arguing?" refers to the police classification "dispute"), the caller tries to justify his claim by giving reasons to trust him (e.g., by offering video evidence). The participants' opposing conversational tactics produce ambiguous meanings that cannot be aligned by asking questions about further characteristics of urgency such as injuries or the presence of a threat. The caller does not assign himself to the emergency characteristics offered, which leads the operator to deny the caller's request. [52]

Moreover, the following breakdown is not just a contingent occurrence within a singular process. Its possibility also impacts the ways processes are handled and the symbolic meaning of control room technologies significantly. Technologies for emergency call processing (e.g., radio and communication platforms) are built to prevent breakdowns in communication (KNOPP, 2020). The mentioned order of questions is organized around the possibility of a breakdown. If communication breaks down, the caller can be located and police cars sent there. Thus, breakdown is a trans-processual discursive as well as material element of emergency processing that relates single processes to technological change and works as an implicit orientation for the temporal ordering of conversations. [53]

Analyzing the process, we see that the participants are unable to synchronize the conversational localization and classification practices and the incident site. While

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8 The call was carried out in German. I translated the field protocol.

the conversation continues, the supposed offender moves away from the site of the incident, which the operator takes as equivalent to an absence of threat. Moreover, both caller and police officer cannot align with the temporal norms of emergency response. The initial description, which was interpreted as potentially relevant in first place, loses its meaning during the conversation. The conversation participants thus fail to align relevant elements of a meaningful incident. In the succession of events, the attempts to repair the conversation become the center of engagement. Repetition becomes a crucial, but failed technique for meaning-making. Its timing contributes to the rejection of the caller's claim for police intervention.<sup>9</sup> Several elements are involved to support meaning-making and locating (e.g., lists of locations and altering questions). However, the officer reacts to the continuous failure to define what is going on by holding the caller accountable ("I don't understand you." Then later: "You speak German so badly."). Throughout the course of the conversation, the question of who is to be held responsible for the conversational problems cross-cuts the orderly phases of questioning. The caller does not reject the ascribed responsibility, which displays that the risk that the caller might sanction the police officer for rejecting the call is low (e.g., by filing an official complaint). This constitutes a situation in which the process is dominated by police exigencies towards incident characteristics. The denial of the caller's request hints towards the nexus of police-specific intelligibility of the described situation and timing. Desynchronization caused unintelligibility within the normative order of emergency processing. The conversation fails only within a certain configuration of elements and conditions, which constitute the boundaries of what can be defined as emergency. [54]

In sum, temporalities play a substantial role in this process. Time efficiency and efficacy in handling emergency calls relate to the making of the process with its results as well as with its formative elements. Police-defined urgency relates these elements in a meaningful way and constitutes boundaries of intelligible participation in emergency processes. The call taker has successfully ordered and led the conversation through her questions, but at the same time the conversation participants have failed to align with speed norms. Over the course of the conversation, there has been a continued disintegration of the claim that was brought forward by misunderstanding, attributing responsibilities for the failing call to the caller, and ambiguities about the characteristics of the incident. [55]

The major contribution of flip mapping is the visualization showing that the result of the process is not solely produced, mediated, and normed within the conversation itself. The formative elements present in the map relate to other "production sites" that situate the process and its events within wider configurations. All of them mold the temporal relations of the conversation. The conversation orients towards immediate response on the one side and articulates organizational requirements on the other. Furthermore, classification and conversation norms align the sequential order of the process. This short analysis

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<sup>9</sup> In the map, this is visualized as a first occurrence of the offender ([Appendix 1](#), p.4), followed by a long phase without the offender occurring again (p.10). In the later phases, the offender is not mentioned by any of the participants.

of the maps recognizes and transcends the analytical focus on micro-events, single processes, or interactional situations and poses questions to its formative elements. [56]

The conversation under scrutiny points out that agency in emergency response is deeply associated with the construction of appropriate timing, which is composed of various locally and temporarily distributed elements. A last contribution of SA is the reminder that processes gain their meaning not only by the elements present in the situation, but also by those which/who are silenced. As time efficacy and efficiency become the major issues within particular processes and within wider formative practices and discourse, they constitute "other times." The flip map of the conversation delineates such an example of "other times" that—within the specific socio-technological and cultural formation—is excluded from emergency processing lacking means to render the incident intelligible. The denial of the caller's claim is visible as a series of interactional events transforming urgency into non-urgency, when the conversation could not align the caller's description with the wider configurations and societal and organizational exigencies towards what counts as an emergency. The flip map illustrated that the call taker step by step rendered the caller into being the problem in the conversation, which also raised opportunities for the denial of police intervention in an ambiguous situation. [57]

## **5. Summary: From Flat Maps to Flip Maps**

Temporality is an essential aspect of sociological theories, which are incorporated into methodologies. Methods as media of analysis allow for the visualization of certain temporal aspects and restrict the analysis of others. SA scholars challenge existing text-oriented methods and the mapping techniques allow for an analysis of simultaneous or flattened complexities and investigations in historical changes. Nevertheless, its mapping techniques have restricted the step-by-step making and performance of processes and transformation. [58]

The arguments of this paper circle around a practice-theory-based research project in which I am investigating the mediatization of short-term processes. The presented flip map was designed around these questions. Compared to micro-oriented methods, flip mapping holds the same advantages as other mapping strategies. Researchers can visually dissolve the supposed distinctions of (inter)action and context (micro and macro). Therefore, it allows them to encompass the wider configurations of practice by visualizing its formative elements, far-away objects, discourse about deeply incorporated cultural norms, and inequalities. This also suggests that flip mapping is scalable for more extended and long-term processes. [59]

However, I restricted my argument mainly to messy and relational maps because these map types seem to differ most from textual design. Other maps (positional, ordered, and social worlds/arena maps) can be adjusted in a similar manner. The series of maps are primarily made for analytical purposes. Because of their complexity and design, they can rarely be included into the text flow of research papers. Flip maps seem most appropriate for in-depth analysis of particular



processes by depicting how they relate and transform elements of a wider configuration and how these elements gain relevance within interactional processes. [60]

By performing a rearrangement of media characteristics of mapping techniques towards moving images, the flip map includes a wider range of temporalities into SA and expands its analytical repertoire. Several types and scales of processes can be visualized and interpreted in their step-by-step transition and ongoing configuration. This approach builds upon existing mapping techniques, especially messy and relational mapping, as well as the technique of synchronous slicing. The flip map as a digital medium and method enhances the opportunities for mapping strategies by increasing the quantity of map layers and moving these layers. The quantitative change entails a qualitative step towards a method design that supports the visualization of temporal manifolds present in social processes and practices. It enables the analysis of diverse, distinct, and even conflicting temporalities and the activities that perform processes, synchronicity, and timing in a general sense. Thus, flip mapping opens up SA for the analysis of short-term processes and their relations to trans-processual, locally, and temporally dispersed formations. [61]

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## Appendix 1

Final flip map of an emergency call<sup>10</sup> ([PDF](#))

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<sup>10</sup> The last slide of the map exhibits the field protocol of the emergency call and shows which layer depicts which part of the protocol.



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