CHAPTER 30.

COMING TO GRIPS WITH COMPLEXITY: DYNAMIC SYSTEMS THEORY IN THE RESEARCH OF NEWSWRITING

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Systems such as languages are dynamic: they change continually as their elements and contexts interact. In the context of newswriting for example, if journalists invent new words and these words become part of the general vocabulary over time, then language is changed through language use—with impacts upon further language use. DST is a research framework focusing on principles of change.[1]

Depending on the system, change can be discrete, linear and completely predictable, such as when the flow of traffic is controlled by stoplights. In contrast, language change as well as conversations and text production are complex dynamic processes; they are not entirely predictable. Explaining them needs to take into account processes and interrelations from individual to global levels and from short to long-term timeframes. Therefore, DST treats the complexity and dynamics of its object as integrally as possible.

DST originated in biology, mathematics, and physics. Later, it was applied to mental and social processes. Today, DST deals with systems as varied as evolution, weather, business organizations—and language. In their position paper, Beckner, et al., 2009 propose a DST approach to explain how language is acquired and used, and how it changes. Cameron & Deignan (2006), Ellis & Larsen-Freeman (2006), Lantolf (2006), Larsen-Freeman (2006), MacWhinney(2006), and Verspoor, de Bot, & Lowie (2011) focus on emergence in the development, acquisition, and use of language.

As Larsen-Freeman and Cameron (2008, pp. 18-19) argue in the introduction of their book *Complex Systems and Applied Linguistics*, sociocultural, interactionist, systemic, integrationist, and ecological approaches to language (e.g., Halliday, 1973; Harris, 1993; Sealey & Carter, 2004; Vygotski, 1978) overlap with DST in their basic asumption that language use, and mental, linguis-

tic, and societal structures are interconnected. In the chapter about "complex systems in discourse" Larsen-Freeman and Cameron broach the issue of "the dynamics of written discourse" (pp. 185-188) —a reasonable starting point for combining DST and linguistics of newswriting.

In this chapter, I focus on DST's potential for explaining the dynamics and complexity of writing processes in real-world contexts. A newswriting process by an experienced journalist about demonstrations in Lebanon is referred to throughout the chapter, as a case of such real-world writing. The case is selected from the Idée Suisse research project, where newswriting practices were investigated in the context of conflicting media policies and market demands.[2] Drawing on data from the Lebanon case, interactions between micro and macro dynamics of newswriting can be explained within the limited space of this chapter. For example, it can be shown that the apparent detail of changing one single word at the beginning of the writing process means reframing both the process and the resulting text product dramatically. By making an example of this Lebanon case, I outline key concepts of DST from five relevant perspectives.

	00:00:00 anchor's introduction	In Lebanon, on a day of high tension in Beirut where the assassination of R. H, two years ago, is being commemorated, thousands of faithful of the former prime minister poured into Martyrs' Square this morning in the centre of the Lebanese capital. A demonstration flanked by a plan of maximum security measures. R… G…
  	00:00:18 offtext	The Lebanese do not work on this anniversary day. They instead have come by the tens of thousands from all over the country. From Tripoli in the north or from Saida in the south. Saida—the city of Rafik Hariri, assassinated two years ago to the day. They have come by road and some also by the tranquil path of the Mediterranean. What all the demonstrators have in common: the Lebanese flag to express the love they avow for their quartered country which is coveted by troublesome neighbors.

Figure 1. Key pictures and translated text of the news item produced in the Lebanon case. The context: In Lebanon, ethnic and religious diversity as well as expansion plans of neighboring countries are threats to national unity. In 2005 the

Investigating text production processes as dynamic systems means reconstructing their structure and dynamics, that is, their elements and relations (part 1) as well as their processes, their stability and change (part 2). Beyond explaining what systems actually consist of and do, DST then evaluates dynamic alternatives: what a system, at any state, could do and why (part 3). Finally, explanation is needed on how the dynamic system maintains its identity despite change (part 4). Such research produces outcomes mapping micro-development and macro perspectives: for example situated knowledge about emergence in collaborative text production, or empirically-grounded models of writing phases (part 5).

STRUCTURES: ZOOMING THROUGH LEVELS AND TIMESCALES

One of the key questions for DST is what a dynamic system consists of at a given point in time. When DST focuses on structure, it describes the *elements*

	00:00:47 quote man	We are here for Rafik Hariri and all the martyrs. And to truly say: I protest against Syria.
	00:00:57 quote woman	We want culture, education, public transportation, not arms. We wish to learn, make progress, and live a normal life like everyone else.
	00:01:07 offtext	The demonstration is orchestrated by the anti-Syrian majority, currently in power but whose legitimacy is contested by the opposition forces, led by the Shiites of Hezbollah. Where the fear of new violence today, is again resounding in people's heads so much, the two explosions that went off yesterday morning on the Christian mountain very close by. Two unattributed attacks but double the warning to the Lebanese army, the only guarantee of the country's unity at the moment.

Figure 1, continued. ... Lebanese Prime Minister, Rafic Hariri, was killed in a bomb attack. While European media often report on politically motivated violence in Lebanon, this item foregrounds peaceful demonstrations on the second anniversary of Hariri's assassination.

and *relations* of the system under investigation, its nested *levels* and *timescales,* the *openness* for interaction with other systems, and the *context.*

In DST, a written text can be seen as the frozen state of the dynamic system of newswriting. Different kinds of semiotic elements, such as letters, words, sentences, paragraphs, and pictures, are interrelated in a way that the news item can evoke complex mental representations in the dynamic system of reading or listening to and understanding news. In the Lebanon case, the journalist R. G. produced the following text about demonstrations in Saida (Figure 1). It was broadcast on the 14th of February 2007, in the French news program *Journal* of the Swiss public broadcaster SRG SSR.Just like the written text or a writing process, every system consists of interacting *elements* and *relations p*roducing a certain overall behavior at a given time. In a DST view, elements can be dynamic systems themselves. A newsroom, for example, can then be seen as a dynamic system consisting of other dynamic systems such as individuals, peer groups, organizations, roles, rules, expectations, tasks, products, processes, money, time allocations, and so on. This dynamic system is embedded in contexts such as audience, sources, public sphere, and competitors in media markets. In a TV newsroom, this interplay results in overall activities such as broadcasting at airtimes and conferencing, newsgathering, and newswriting in between (Figure 2).

However, behavior in such a system happens on various nested and interconnected levels and timescales: from the milliseconds of neural processing to the minutes of newswriting, hours of daily production cycles, years of organizational restructuring, decades of professional careers, centuries of language

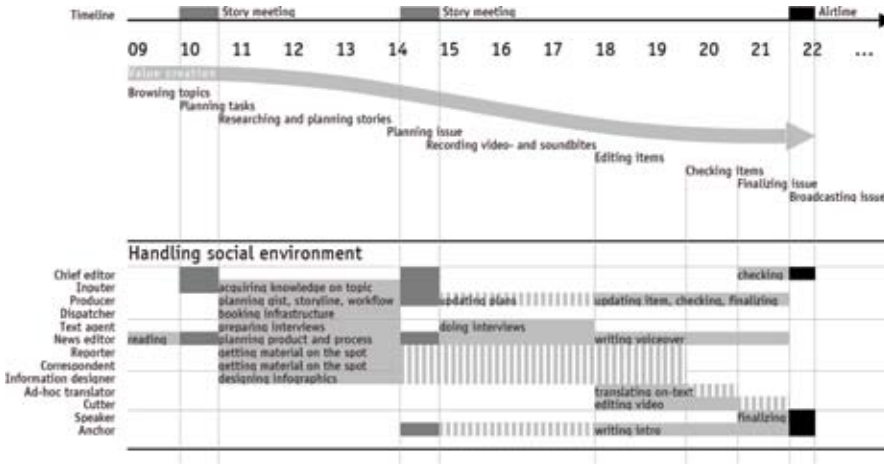

Figure 2. Roles, tasks, and time allocations as key elements of the workflow structure in a newsroom

change, and eons of evolution. On some levels such as newswriting or daily production cycles, the agents are mostly aware of their activity, on others, the system behaves beyond the agents' awareness.

Open systems allow and need particular in- and output to maintain their stability: Resources such as source texts enter the dynamic system of newswriting from outside, products such as news items leave it. The dynamic system of writing a single news item ends when the deadline is reached or the item is submitted to be broadcast.

Ignoring the deadline when writing a single news item could affect the *context* of this system, namely the overall system that produces news continuously. Conversely, the unpleasant experience of lack of content at airtimes could trigger a stricter management of deadlines and thus change the contextual constraints for the next newswriting processes. Thus, dynamic system and contexts are mutually and inseparably connected. A dynamic system can initiate changes in its contexts and it can also adapt to changes in its contexts. This is why DST treats context as a part of the complexity and dynamics of a system under investigation.

DYNAMICS: TRACKING CHANGE IN CONTEXT

What happens with the dynamic system over time? When DST focuses on dynamics instead of structure, it describes how systems *change,* why this often takes place in a *non-linear* way, and how *stability* and *variability* of the system are balanced as *stability in motion*. Change in the system of writing a single news item for example can take the system from smooth writing-down phases (Figure 3, phases A and B) to jumpy phases where the emerging text is restructured (D and E).

In a DST view, systems are always open to *change*. Elements, relations, and contexts change in their specific timescales as they interact. In this multilevel flow of change, the future states of a dynamic system continuously depend on the respective present states. In the dynamic system of collaborative newswriting, even highly routinized and standardized procedures such as writing a newsflash or embedding a quote are adapted to context each time they are performed. Moreover, revising a peer's text under time pressure can end in rewriting the item and offhand comments about the peer's writing style; the comments can initiate changes in procedures and policies—which in turn will affect future collaboration in newswriting. Returning to the Lebanon case, a linear flow of words into stretches of language on the screen can suddenly be interrupted, for example in order to delete and replace a previously written word (Figure 4).

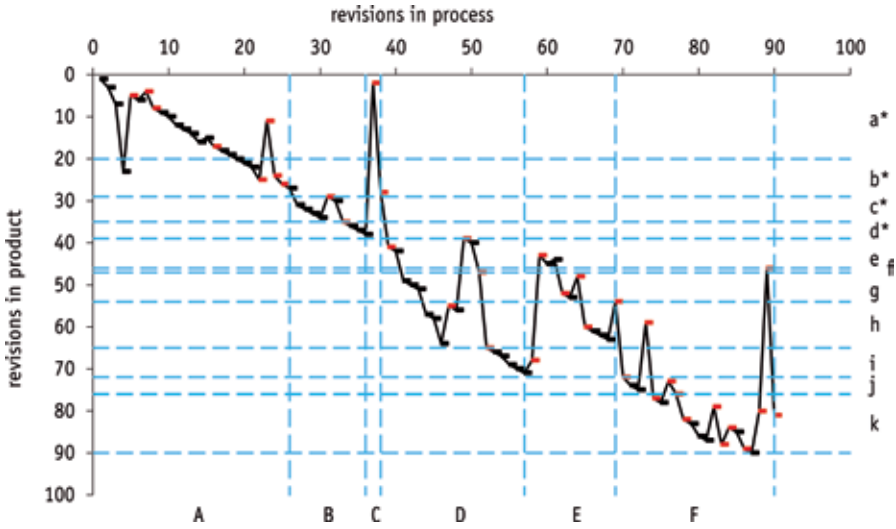

Figure 3. Progression graph of the Lebanon writing process. Progression graphs indicate how the writer moved the cursor through the developing text. These cursor movements are interpreted as the writer's shifts in focus. The temporal sequence of revisions in the writing process is represented on the ordinal scale of the x-axis; the spatial sequence of revisions in the text product shows on the y-axis, also ordinal. For further discussions of progression graphs in particular and progression analysis in general see Perrin (2003, 2006) or Perrin & Ehrensberger-Dow (2008).

Such complex changes are not random, but neither are they completely predictable. New system properties may emerge when a dynamic system adapts to context. As these new properties can change the way a dynamic system behaves, they also can alter the way the system changes. Therefore, change can be *non-linear:* sudden, radical, dramatic, turbulent, and chaotic instead of smooth, continuous, and steady. New words on the screen can trigger new ideas in the mind of the writer and thus set a story off in an unpredictable direction.

Another example of the unpredictability of complex processes: in the Idée Suisse research project that the Lebanon case was part of, coping with overbooked cutting rooms proved to be an important success factor on the logistic level of newswriting. However, from a DST view, this does not mean that providing additional cutting rooms would augment wellbeing, efficiency or text quality. If a newsroom were a simple system, behaving linearly, then adding more workplaces for cutters would proportionally shorten the waiting line of journalists wanting to cut their videos. In a non-linear DST scenario, however, easier access to video workplaces can discourage planning and eventually extend the wait. In an alternative non-linear scenario, easier access motivates experi-

mentation; new, more effective strategies of cutting might emerge, the cutting time per news item would decrease, and many of the new workplaces would remain under-utilized.

The emergence of new strategies in the non-linear scenarios can start by varying the cutting procedures or lexical choices and end in different fundamental changes in the overall behavior of the dynamic system. *Variability* being the seed of change, capturing local variation around stabilized ways of activity is crucial for DST. In contrast to top-down research, DST thus considers variability as data, not as noise. Smoothing away seemingly senseless details and variability, for instance by statistical averaging, would mean losing crucial information for detecting emergence and explaining change. Thus, the lexical change in the example above from "voie express" to "voie tranquille" could be crucial and deserves attention, as discussed below.

EVALUATION: IDENTIFYING THE CONTROL PARAMETERS OF CHANGE

Of all the various possibilities, what does a dynamic system do at a particular moment in time? When DST focuses on evaluation, it outlines the *state space* as the landscape of the potential *trajectories* the dynamic system under investigation could follow on its way from *state* to *state* through *shifts*. *Attractors* in this state space stabilize the system, and *control parameters* determine its trajectory.

^{19}{Ils sont venus p}$^{19}|_{20}$ar la route et même pour certains par la voie ^{20}[express]$^{20}|_{21}$ ^{21}{tranquille}^{21} de la Médit^{4}[e$|_{4}$]^{4}érannée … $|_{5}$

^{19}{They have come b}$^{19}|_{20}$y the road and some even by the path ^{20}[express]$^{20}|_{21}$ ^{21}{tranquil}^{21} of the Medit^{4}[e$|_{4}$]^{4}erranean … $|_{5}$

Figure 4. Excerpt and translation of S-notation, showing deletions in n[square brackets]n and insertions in n{ curly braces }n. Wherever the writing is interrupted to delete or add something, S-notation inserts the break-character |n. The subscript and superscript numbers indicate the order of the steps: Right after having inserted "Ils sont venus," the author jumps forward to delete "express" and insert "tranquille." For further discussions of S-notation see Kollberg & Severinson-Eklundh (2002) and Severinson-Eklundh & Kollberg (2003).

The overall behavior of a system at a given time is called a *state.* A *shift* is the dramatic change between very different states of a system. At a particular moment, a system is in a particular state, performing a particular pattern of behavior. The synopsis of all possible states of the system is its *state space*. In the example of the newsroom, the state space includes three typical states: conferencing, newswriting, and broadcasting. The simplified system of the newsroom shifts cyclically from one state to the next on its *trajectory* through the state space. A very different state shift can be observed in the Lebanon case: After R. G. had written the first two paragraphs and translated the selected quotes himself from a written English translation received from the news service, the computer crashed. The translations were not saved, so R. G. had to do them again before writing the last three paragraphs. This crash and other computer problems increased the time pressure, in particular for the cutter who, as R. G. says, then had to rely on R. G. for the story instead of asking critical questions.

The more finely graded an analysis of a dynamic system is, the greater the number of states in the state space. In the newsroom, the state of *newswriting* then might expand to three states: *defining the task, writing the text,* and *implementing the product.* The state of *writing the text* can further expand to *setting the goal, planning the text, controlling the writing flow,* and *revising the text.* No matter how fine the gradation, change will happen smoothly within the preferred states and dramatically in the shifts between them.

The states into which a dynamic system preferably moves are called *attractors.* The simplified system of the newsroom moves cyclically among the three attractors *conferencing, newswriting,* and *broadcasting*. Such attractors are called *cyclic attractors*. In addition to this type, there are two others. The *fixed point attractor* is where a dynamic system prefers to settle down. In a dynamic system of writing a single news item, a fixed point attractor is reached when the final version of the text is ready for publication. On a more general level, reaching expertise is a fixed point attractor in the dynamic system of a professional's trajectory. In the Lebanon case, the journalist R. G. can be considered close to this attractor:

> R. G. (born 1959) was awarded a degree in modern languages, took a six-month trip around the world to "20 or 30 countries" in between, wrote four suitcases full of travel diaries that he still reads, and produced short films ("three to four minutes long") for a TV travel show ("*Trip around the World").*[3] He completed a two-year program in journalism and was a journalist at Radio Suisse Romande, the French-speaking public service radio station in Switzerland, for 20

> years. In the first 10 years, he worked on the local desk and after that in foreign affairs, which involved a lot of travel.[4] On the side, he helped set up an agency for which he produced foreign television reportages. R. G. still travels a lot; in the previous year for instance, he was in Lebanon.

In contrast to the fixed point attractor, the *strange attractor* is where a system shows high responsiveness and unstable behavior; a minute change in input can produce a dramatic change in behavior. Looking for good pictures among masses of uninteresting ones is such a strange attractor in the trajectory of the dynamic system of newswriting: the system remains in this highly unstable, critical state until the pictures are found and the system moves on:

> Three hours before airtime, the journalist R. G. received the assignment to prepare an item about demonstrations in Lebanon. Since R. G. knows his way around Lebanon and had been there recently, he said he felt familiar with the topic. He read an ample amount of text too and received lots of visual material—two hours of images from Lebanese TV, mostly crowds of people with placards. In addition he obtained video recordings of two interviews with demonstrators. Although he found two passages in them with relevant quotes, he said he found it an effort to make the material vibrant.

An attractor thus draws the dynamic system like a magnet. It is easy for the system to move into a strong attractor, but once it is there, a push is needed to overcome stability and send the system out again. In the newsroom example, it takes such a push to get people ready for the newsroom conference in time. Towards the end of the conference, it can be hard to finish on time and then start researching. The same goes for the transitions between activities of text production: once in research mode, writers might find it hard to stop gathering information and start writing. In text production mode, some feel more attracted to revising the text they have written so far than to composing new text. Finally, close to the deadline, they might have problems to stop revising and post their items for publication. In the Lebanon case, reproducing the well-known stories of violence was such a strong attractor the journalist had to overcome:

> R. G. limited himself to the main topic, "a photograph" of the demonstrations starting on the martyrs' square.[5] He consciously abstained from biographical background infor-

> mation and spectacular pictures of the assassination of the former prime minister of Lebanon that the demonstrators were commemorating, since the assassination had already been shown many times. Moreover he decided not to start with pictures of the demonstration itself. Instead, he first showed the people arriving in masses to demonstrate.

The pushes to overcome attractors come from *drivers* in the dynamic system. The drivers help the system move around the state space, avoid certain attractors, meet others, and leave them again. Motivation is an example of such a driver, helping a dynamic system of reflexive newswriting to switch between the attractors of routinized activity and purposeful learning. This means alternating between newswriting routines and breaking out of these routines, trying out new procedures, and enhancing repertoires of writing strategies and techniques. As the drivers control the trajectory of the dynamic system in its state space, they are also called *control parameters.* Knowing what they are facilitates interventions to the system, for instance in coaching sessions. In the Lebanon case, the journalist's experience and, at the same time, his openness to the unexpected worked as drivers:

> In an early, linear phase in the writing process [revisions 1-25, see Figure 3], R. G. wrote the voice-over for the introductory scene. The scene shows how people traveled en masse to the demonstration in boats. Finding these boats in the video material surprised him, he says.[6] In his very first sentence, R. G. refers to another fact new to him: as he just learns from the news service, the Lebanese had that day off. So the beginning of the product was shaped by details that were new to the experienced journalist.
>
> After a closer look at the pictures that were new to him, he then adjusted a word that turned out to be a key word for the whole writing process. R. G. had first talked about an expressway to describe the direct route over the Mediterranean Sea ("la voie express de la méditerrannée"). While interweaving the text with the images he realized that a tranquil path ("la voie tranquille") would better fit the slow journey of a boat. So he deleted "express" and inserted "tranquille" instead [see Figure 4]. With this revision, cued by new details and R. G.'s language awareness, the design of the item emerged: R.

G. started combining strong symbols.

IDENTITY: EXPLAINING EMERGENCE AND STABILITY IN MOTION

Despite change, a dynamic system must maintain its identity; otherwise, there would be no reason to conceptualize it as an entity in space and time.[7] How does the dynamic system persist in the face of change? When DST focuses on identity, it explains *stability in motion, cycles of emergence* in the light of *co-adaptation* and *self-similarity.*

As change never stops, any perceived stability of a dynamic system is *stability in motion,* an equilibrium in continuous adaptation and change—for a certain period, between more dramatic phases of change. Larsen-Freeman & Cameron (2008) illustrate this concept of dynamic stability with the "constant adjustments [that] are required to overcome the force of gravity in order for us to stand erect on two feet" (p. 87) and with swimming: "without the extra input of energy produced by waggling hands or feet, floating would cease. … the movements of the swimmer are adaptations made in response to the environment—to the need to prevent sinking" (p. 33).

Changes on one level of a dynamic system can lead to categorically new, *emergent* properties on a higher level. Such emergence happens, for example, if revising and criticizing single news reports triggers changes in style policies or if missed deadlines stimulate a media organization to optimize its workflows. The emergent new properties on the higher level of the dynamic system then affect activity on lower levels, for instance stylistic choice or process planning in newswriting. Whereas activities such as qualified criticism or missing deadlines can be identified ex-post as some of the reasons for the emergence, it is hardly predictable which specific activity will cause a shift in state. Thus, emergence produces a new whole which is not reducible to and not explainable by the sum of its parts. Holland (1998, p. 2), describes this phenomenon as "much coming from little." In the Lebanon case, deciding on the formulation of "voie tranquille" provides the journalist with the idea of using strong symbols as leitmotifs.

> With "tranquille" R. G. found the leitmotif of his item. He says that he loves the adjective because it corresponds not only to the image of the boats but also to the tranquility of the demonstration. He expects the "tranquil" to resonate in the minds of the audience.[8] Just as consciously, he talks about

> using the term *drapeau libanais* (Lebanese flag) as a symbol of the demonstrators' desire for political independence. The same is true for the term résonnent (resonate): explosions from Syrian terror attacks had not simply happened the previous day, they were reverberating in the minds of the demonstrators.

It is through *cycles* of such emergence that a dynamic system evolves—and may change fundamentally on particular levels over time. In newswriting, new procedures, skills, policies, workflows, and technologies emerge. However, the system maintains its overall identity as long as salient properties change in line with contextual changes. Newswriting is, after centuries of change, still bound to investigation, facts, relevance, recency, and broad impact in a context of public discourse which has also changed in similar ways to newswriting itself. In the Lebanon case, this means mapping traditional expectations of Swiss media politics with new media market demands:

> R. G. overcame the critical situation of using brash stereotypes when under time pressure. Instead of catering to the market and resorting to predictable images that could overshadow publicly relevant developments, he absorbed his source material, listened to what was being said, and discerned what was important in the pictures. By doing so, he was able to discover a gentle access to the topic that allowed him to produce a coherent and fresh story and at the same time managed to reflect the political finesse required by his employer's remit of promoting public understanding.

Changing in line with contexts means changing in mutual response, in *co-adaptation* and, in the long term, *co-evolution.* Elements and relations of a dynamic system perpetually interact with each other, within and beyond the system. Thus, emergence on one particular level of a dynamic system motivates change throughout the system, the connected systems and the context—and feeds back to that level as the co-adapted context fuels future activity. That is what happens if faster technology accelerates newswriting and enables tighter deadlines, which call for even faster technology. The behavior of a dynamic system changes, but since the context likewise changes, the system maintains its identity—dynamically.

Self-similarity is another characteristic of dynamic identity. A textual, static realization of self-similarity is the leitmotif, where some simple concepts repre-

sent the gist of an entire text. DST, however, focuses on dynammic self-similarity. It considers change in dynamic systems self-similar on several levels and timescales. A very general pattern is that throughout a dynamic system most changes are minor, whereas major changes are seldom. Specific patterns are formulated in power laws such as Zipf's law, which says that, in a reasonably large corpus of language data, the most frequent word occurs twice as often as the second in the frequency rank, three times as often as the third, and so on (Zipf, 1949). The linguist George K. Zipf found this pattern of word frequency in English, Latin, and Chinese. Moreover, the distribution has remained stable throughout centuries of language change. Zipf summarized that the recurrence of the pattern meant "finding for the acts of speech what physicists have long since found for the acts of inanimate nature: behind all the apparent diversity and complexity of the phenomena lies the sameness of fundamental dynamic principle." (Zipf, 1949, p. 126). It can be assumed that Zipf's law "holds in all languages where it has been tested" (Ferrer i Cancho, 2006, 131).

Clauset, Shalizi, and Newman, (2009) scrutinized and re-analyzed 24 sets of real-world data from studies whose authors assumed that the data structure followed power laws similar to Zipf's law. Clauset et al. found that most of the data sets followed power laws or similar regularities. Examples are "The frequency of occurrence of unique words in the novel Moby Dick" (best fit in the sample), "The number of citations received between publication and June 1997 by scientific papers published in 1981 and listed in the Science Citation Index," and "Sizes of e-mail address books of computer users at a large university" (p. 677). Thus, there are good reasons to search for similar scalable patterns in writing processes in general and newswriting in particular.

In the Lebanon case, the emergent solution makes a case for solutions to similar problems on more general levels. On an institutional level, emergent solutions are needed by R. G.'s employer, the Swiss public service provider SRG SSR, which has to find its way out of increasingly intense conflicts between the traditional public mandate and the pressure of media markets. On a societal level, emergent solutions are urgently needed by journalism in the face of media convergence.

Public service broadcasting companies are among the most important broadcasting companies in Europe. In Switzerland, the public broadcaster, SRG SSR, also has the highest ratings. As a public service institution, SRG SSR has a federal, societal, cultural, and linguistic mandate to fulfil: to promote social integration by promoting public understanding. "In their programs SRG SSR promotes understanding, coherence, and exchange among the parts of the country, linguistic communities, cultures, religions, and social groups …" (Translation of the programming mandate 2007, article 2, paragraph 2).

As a media enterprise, though, SRG SSR is subject to market and competitive forces. Losing audience would mean losing public importance. Therefore, the mandate presupposes that reaching the public will promote public understanding. In the research project in which the Lebanon case was analyzed, the researchers investigated how those working for the broadcaster deal with the following tasks a) fulfilling their public duty by providing programs and items that contribute to the public debate and promote public understanding, while also b) actually reaching the public in an increasingly competitive media market, and finally c) dealing with growing economic pressure and increasingly faster technological change.

The overall findings show that the knowledge of how to bridge the public mandate and market forces cannot be identified in executive suites, but in newsrooms. Whereas the managers usually are frustrated by the expectations of media politics, some experienced journalists find solutions to overcome the conflict between the public mandate and the market. These solutions tend to emerge when the journalists tackle complex and unexpected problems in critical situations within their daily routines, as R. G. did.

The following conclusions could be drawn from these findings: The conditions for emergent solutions in news teams need to be systematically improved top-down by media politics and media management, and the tacit knowledge involved must be systematically identified bottom-up at the workplaces and then made available to the whole organisation. Based on these recommendations, the stakeholders working in media policy, media management, media practice, and media research have set up follow-up activities for knowledge transformation, such as systematic organisational development, consulting, coaching, and training.

OUTCOMES: CONCEPTUALIZING AND MODELING COMPLEX DYNAMICS

Doing research in the framework of DST means exploring behavior within and across very different levels and timescales. As DST considers everything to be connected with everything else, decontexualizing and atemporalizing single phenomena is out of the question. Instead, DST research foregrounds certain aspects, such as the role of emergence in individual writing processes, and investigates them in more detail while remaining open to contextual behavior that might explain change. This calls for multi-method approaches combining in-depth case studies and large corpora as well as analysis and modeling.

Case studies can reveal where, when, how, and why change happens on the micro level of situated activity. As the Lebanon case has shown, a new pattern

of process management or product design can emerge in the critical situation of newswriting when a journalist tries to juggle conflicting expectations. If the new pattern succeeds, it might become part of that journalist's repertoire. Understanding such micro processes means shifting from a static view of newswriting (see Section 1, above) to the dynamic perspective of DST (Section 2). An evaluation perspective (Section 3) identifies control parameters of micro change. Finally, an identity perspective (Section 4) allows us to see the micro development as representing a principle that also underlies changes on higher levels and larger timescales.

Thelen and Corbetta (2002) describe the study of micro development as "the study of the processes of change, not only the endpoints." (p. 59). "The goal of microdevelopmental studies is to understand change itself: what are the mechanisms by which people forgo old ways of behaving and adapt new ones" (Thelen & Corbetta, 2002, p. 60). Micro developments are "the motors of change" (Thelen & Corbetta, 2002, p. 59). Because of the self-similarity of dynamic systems, it can be assumed that "the processes that cause change in a matter of minutes or hours are the same as those working over months or years. In other words, the general principles underlying behavioral change work at multiple time scales"(Thelen & Corbetta, 2002, p. 60).

Tracing such micro development as the motor of change needs *dense corpora* with rich procedural data over short periods of time: the activities of collaborative writing and conferencing in the newsroom have to be captured as broadly and in as much detail as possible. In contrast, tracing change on macro levels and timescales of the newsroom, journalism, or even society in general needs *large corpora*. The samples have to be wide enough to allow for generalization; the sampling intervals close enough to infer variability and shifts in state; and the data collection prolonged enough to grasp long-term change. Combining dense and large corpora enables researchers to situate micro development within the context of macro development.

In the research project the Lebanon case study is part of, newswriting was conceptualized as balancing practices in a complex context of conflicting expectations. Newswriting, then, was metaphorically modeled as a helix of 16 interacting fields of situated activity (Figure 5).

The dynamic system of situated text production can be described in terms of fields of relevant activity (Figure 5). It begins when writers understand and accept a production task *(defining the task)* and ends when they send the results of their work along the production chain, such as to colleagues who assemble news programs from individual items *(implementing the product)*. In between, reading processes *(source reading* and *product reading)* interact with writing processes on various time frames and scales (from *grapheme* to *text* version levels). In the

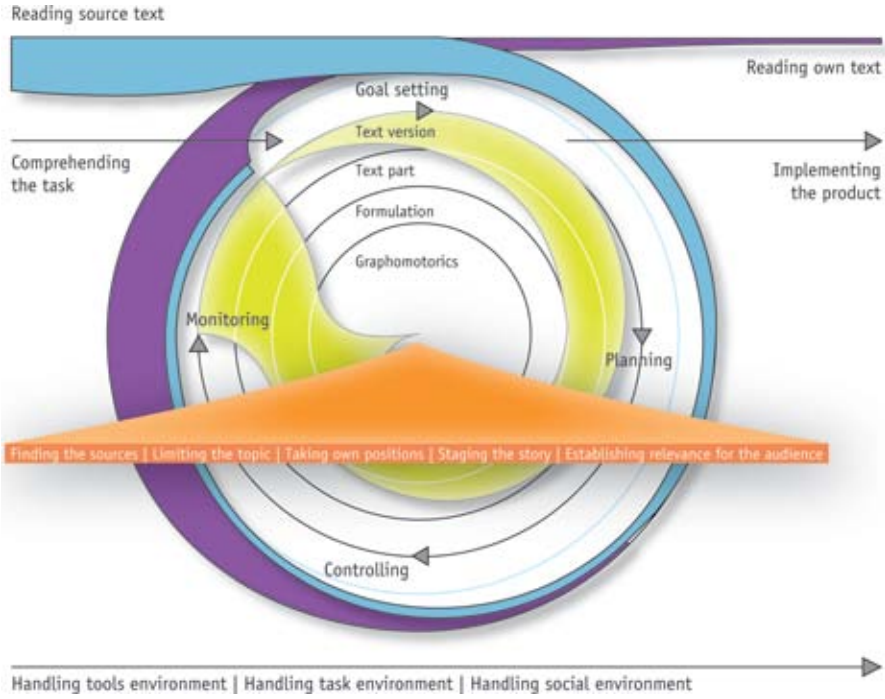

Figure 5. The dynamic system of situated text production

inner circle of the writing process, four phases recur and overlap, each dominated by activities which contribute, on their specific levels, to the incremental production of the text. *Goal setting* typically focuses on the text as a whole, planning on sequences of text parts such as paragraphs, and *controlling* on the formulations under construction. *Monitoring*, in contrast, traces the results of the production process throughout all of the levels.

However, DST can be more than a useful metaphor in scientific approaches to writing processes. Research can also proceed heuristically, starting with assumptions instead of data. In this case, the processes of change in a dynamic system are reconstructed through dynamic models: simulations and analogies which are tested against reality for best fit. The outcome of a computer simulation is compared with observations of the real-world system under investigation. Relations are redesigned and parameters adjusted until the model behaves like the observed reality. The dynamic model simulates change through iteration of algorithms: rules are applied in loops where the output of one loop is the input for the next. Thus, the mechanisms of change in the model are exactly known and can be taken as metaphors for the principles of change in the real world system.

Based on data of hundreds of cases similar to the Lebanon case, models of writing phases have been extracted and are being tested. In Modeling Writing Phases, an interdisciplinary research project subsequent to Idée Suisse,[9] writing phases will be modeled as time periods with predominant activities. These phases are identifiable in the data throughout scales and time frames by more or less homogeneous (predictable) time series dynamics between critical states (with rather unpredictable ends). First findings show, for example, that the two dominant progression types of the Lebanon case, linear writing (Phase A in Figure 3, above) and chiseling (Phase E) support a prediction of successful text production in terms of coherence, whereas chaotic jumping back and forth as dominant phase would allow for predictions of coherence gaps.

Thus, changing one single word, depending on the context, can take the dynamic system of writing to strong symbols and leitmotifs—or to weak cohesion and coherence. It's a tricky, a complex matter, and that's what makes writing research and DST a promising couple.

NOTES

1. As the purpose of writing research is to explain processes and thus dynamics, I prefer the term Dynamic Systems Theory (DST) to other widespread terms which focus on other key properties of such systems, such as complexity, nonlinearity or adaptivity.

2. The research project Idée Suisse: Language Policy, Norms, and Practice as Exemplified by Swiss Radio and Television was funded from 2005 to 2007 with EUR 120,000 by the Swiss National Science Foundation. It is part of the National Research Program 56, Language Diversity and Linguistic Competence in Switzerland, 2005-2010. Outlines and reports of the program and its projects (in German, French, and Italian) can be found on http://www.nfp56.ch. For a discussion of the project see, e.g., Perrin (2011) and Perrin (2012).

3. tsr_tj_070212_1220_guillet_frame, lines 16-18: "c'était déjà pour la télévision, pour une émission qui s'appelait la course autour du monde, c'était pendant mes études de lettres"

4. tsr_tj_070212_1220_guillet_frame, lines 36-39: "et après dix ans à la rubrique internationale où j'ai fait passablement de voyages, de reportages à l'étranger, pendant dix ans ça fait pas mal de séjours et reportages à l'étranger"

5. tsr_tj_070214_1230_guillet_libanon_review, lines 946-954: "moi je fais une photographie de ce qui se passe pendant la matinée, puisque ce premier sujet passe à douze heures quarante cinq. au liban cette manifestation, elle draine une foule immense, comme on le voit sur les images, et je dois montrer que cette foule répond à un certain

nombre d'aspirations, et je dois donner les clés pour la personne qui n'y connaît pas grand chose"

6. tsr_tj_070214_1230_guillet_libanon_review, lines 985-987: "je fais attention vraiment aux images, par exemple je ne m'attendais pas à voir ces bateaux, ça je savais que j'allais le mettre"

7. tsr_tj_070214_1230_guillet_libanon_verbal, lines 180-185: "j'aime bien cet adjectif parce que pour l'instant, les mots ils résonnent dans la tête des gens, tranquille c'est pour l'instant le point de cette manifestation, elle est plutôt bon enfant pour l'instant, parce qu'il n'y a pas eu de heurts, donc je mets la voie tranquille"

8. tsr_tj_070214_1230_guillet_libanon_review, lines 1019-1024: "mais dans toutes les images que j'ai vues pour l'instant, c'est une manifestation qui ne dégénère pas, donc si je peux saupoudrer le texte de mots qui résonnent justes par rapport à ce qui a l'air de se passer sur place, je les garde"

9. The Modeling Writing Phases project, funded from 2011 to 2013 by the Swiss National Science Foundation, is to statistically model and explain writing phases as temporal procedural units. The project attempts to overcome limitations of traditional writing phase concepts that are based on introspection or single case studies. On the methodological level of the project, DST-informed statistical techniques beyond those normally associated with corpus linguistics are developed. For a discussion of initial results see Perrin & Wildi (2010) and Perrin, Fürer, Gantenbein, Sick, and Wildi (2011).

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