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Silence in Interdisciplinary Research Collaboration: Not Everything Said is Relevant, Not Everything Relevant is Said

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ABSTRACT *Solving publicly important issues asks for the development of socio-technical approaches, which demands collaboration between researchers with different perspectives, values, and interests. In these complex interdisciplinary collaborations, the course of communication is of utmost importance, including the moments when people, consciously or not, keep silent. In 2012, an interdisciplinary group of water management engineers and scientists collaborated to explore how the university's separate water management research fields could fit better in today's socio-technical trends. Studying the interactional process revealed that during the collaboration many issues were not said by various parties at various times. Results show that, in particular, engineers and scientists stayed silent to secure group performance, to keep disagreements from surfacing, and manage conflicts of interest in the bargaining process. Although silence served various interactional functions, it also shaped the course of interaction in ways that were not intended, resulting in the development of a latent conflict. It is concluded that the concept of silence adds a relevant dimension to our understanding of interaction among engineers and scientists participating in interdisciplinary collaboration that is currently absent in existing literature on scientific collaboration.*

KEYWORDS: silence, collaboration, positioning, university, communication, situational analysis

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Introduction

Solving today's publicly important issues such as electricity provision, transport infrastructures, medical care, and cyber security, requires the development of socio-technical approaches. This means that collaboration between researchers from different disciplines, as well as changes within universities that connect researchers within the institution around these challenges, must be encouraged (Gibbons *et al*., 1994; Simakova, 2012). In the light of these challenges, it becomes important to analyse and understand the process through which collaboration comes about in interaction.

Previous studies have deepened our insights into the workings of research collaborations, showing how they can ignite interdisciplinary work and solutions, but are also extremely demanding to accomplish in everyday practice (Farrell, 2001; Hackett, 2005; Shrum *et al*., 2007; Sonnenwald, 2007). Several studies argue that, under the veil of solidarity, there are enduring tensions in research collaboration, which can arise at various levels and phases, and have diverse causes and outcomes (Hackett, 2005).

These tensions are related to the discrepancy between the labour- and time-intensive character of interdisciplinary projects and their low priority in academic circles (Cummings and Kiesler, 2005; Stokols *et al*., 2008; Bukvova, 2010). Other scholars have noted that tensions have to do with differences in disciplinary orientation, motivations and professional interests (Shrum *et al*., 2007; Sonnenwald, 2007). For example, working on interdisciplinary research projects requires the integration of research into innovative projects and working towards a shared identity, whereas disciplinary obligations require the guarding of existing disciplinary fields of inquiry that took years to develop (Hackett, 2005).

Given these challenges, the ability to constructively communicate is seen as a precondition for resolving many of these tensions (Jeffrey, 2003; Bukvova, 2010). Scholars of scientific collaboration, as well as those studying collaboration in closely related domains (Pearce and Littlejohn, 1997; Wenger, 2000; Lewis *et al*., 2010; van Oortmerssen *et al*., 2014) have pointed out that constructive communication can help to clarify roles and task requirements, increases trust and psychological safety, resolves disagreement and conflicts, and contributes to developing new frameworks for solving problems (Jeffrey, 2003; Stokols *et al*., 2008).

Salient issues, however, do not necessarily make it to the meeting table. Under certain conditions, scientists may choose to temporarily stay silent about tension-filled incidents or perceived differences in interaction with their peers, or may never bring them up at all. As of yet, the meaning of silence in interaction has not been identified as a key component of academic collaboration. This article addresses this glaring absence in the literature and explores silence in the context of interdisciplinary collaboration aimed at accomplishing institutional policy designed to fulfil social responsibilities.

We build on earlier studies that have highlighted the importance of understanding silence in other interactional contexts. We specifically respond to Jaworski's (2005) call to examine the significance of silence in institutional contexts such as criminal justice systems, classrooms, or hospitals, where communication is generally thought of as a prototypical activity. Jaworski also notes that, in these contexts, silence is often more important than initially thought and has unforeseen consequences for people's willingness to achieve stated institutional goals. Following this line of inquiry, this article poses three questions:

(1) Which specific functions of silence can be identified within interdisciplinary research collaboration aimed at developing socio-technical approaches to solve today's public issues?
(2) What are the unforeseen consequences of these silences for course of the collaboration process?
(3) What are the practical implications for overcoming such silences and thereby avoiding their consequences?

These questions take on heightened importance because of the international competitive research context in which communication has become crucial in igniting and supporting the overall strategic orientation of universities (van der Sanden and Ossewijer, 2011).

To guide our research question, we begin with a review of existing studies of silence in social interaction. Drawing on these studies we then discuss the significance of silence in a university-wide research collaboration between scientists from various disciplines and faculties geared towards developing socio-technical approaches to public problems in the area of water management. The findings are based on empirical work undertaken during an ethnographic case study examining the effect of moments of silence on the course of interaction between the water management researchers in the process of consolidating the leading position of their parent university. After outlining the findings, we end with a discussion on the practical implications for overcoming silence and facilitating constructive conversations in interdisciplinary collaboration.

Conceptual Overview: Silence in Social Interaction

Silence is a complex concept that can be explained in many different ways. Just like verbal communication, it has significance at different levels of interaction between actors. It can mean consent, but can equally signify doubt, defensiveness or even resistance, depending on the interactional context. In well-facilitated collaboration, silence may have a positive virtue, being a moment of reflection that allows for clarification of motives or consideration of alternative possibilities for oneself and alternative interpretations of what others are doing (or not) (Schuman, 2006).

Many interdisciplinary collaborations, however, come about in a much more messy manner. Hence, in this article we focus on silence as the absence of any type of verbal communication in collaborative interaction where that communication would normally be expected to enable coordination, collective action, and planning and time management. Consequently, we assume that silence serves interactional functions when perceived through the eyes of the involved researchers, but can also have unforeseen consequences for achieving shared goals (Jaworski, 1993; Krieger, 2001). These functions and unforeseen consequences of silence are examined in relation to three overlapping levels of collaborative interaction: (1) securing group performance; (2) dealing with relationships within the group; and (3) managing conflicts of interest.

These dimensions are often distinguished and studied in the collaboration literature (e.g. van Oortmerssen *et al*., 2014). The first dimension refers to the consensus-seeking interactional process that takes place in relation to relevant outside constituencies and demands. The second dimension refers to the processes internal to the group. The third dimension refers to the way group members manage and solve conflicts that emerge in interaction as a result of colliding interests. In the next section, we discuss these three crucial dimensions of collaboration in relation to silence.

Silence and Securing Group Performance

In relation to securing group performance, scholars frequently focus on how actors use verbal communication to deal with the demands of organizational work, revealing how it relates to coordination and collective action, planning, and time management. In addition to verbal communication, silence is also relevant. As Goffman (1969) noted, members within a group are likely to attune their behaviour towards one another and prevent contradictions. When working in projects, he wrote, 'each participant is expected to suppress his immediate heartfelt feelings, conveying a view of the situation which he feels the others will be able to find at least temporarily acceptable' (Goffman, 1969, p. 4). In interaction, participants give lip service to matters raised by others, allowing everybody to raise ideas and opinions in exchange for the courtesy that others do not contradict or criticize what they have to say on the issue.

Bringing the theory of Goffman (1969) to the field of science and technology, Hilgartner (2000) demonstrates how selectively presenting some things in public while hiding others backstage, plays a key role in the process by which scientific advisory bodies produce, contest, and maintain scientific advice. Hilgartner's work illustrates how the credibility of science consists of strategic impression management by team members and deliberate control over what is said and what is not. Further studies have shown how concealing disagreements keeps research teams from splintering into competing groups. In her empirical study of a scientific team that develops land remediation for coal waste disposal sites,

Castán Broto (2011) illustrates how emphasizing mutual dependence rather than differences plays an important role in incorporating the concerns of diverse team members and constructing a common front.

Moreover, participants are most likely to stay silent about dissension within the group when they face demanding external situations that put pressure on the group, or when they have to operate under significant time constraints. At the beginning of new projects, group members still have to align their behaviour to come to terms with the demands of external stakeholders. Interaction is still relatively uncertain and prone to bargaining of all kinds (Bok, 1989). Ideas and strategies still have to be developed. The pressure created by external threats makes it all the more likely that group members will keep silent about certain ideas or aspects of emerging plans within inter-professional interaction. Especially when people have to achieve things fast, they may feel the need to get on with the task and will postpone certain discussions (Perlow and Repenning, 2009).

Although silence makes interaction smoother and helps team members manage the achievement of a shared objective (Castán Broto, 2011), it can have unforeseen consequences for the nature and course of interaction, for example causing that unjustified assumptions and beliefs are not critically examined and discussed. When silence keeps group members from sufficiently sharing and debating their plans with relevant stakeholders in the group, this shuts out criticism and feedback and prevents the exploration and articulation of potential differences (Bok, 1989). Especially under time pressure, people may revert to established routines that proved successful in the past. They start relying on shortcuts and quick fixes to solve complex problems that instead require discussion and debate (Dörner, 1996; Henriksen and Dayton, 2006).

Silence and Dealing with Internal Relationships

Silence does not only emerge as a result of reaching an internal consensus because of high external stress. Relationships internal to the group can also provide a stimulus for members to stay silent about certain problems or issues. When group members have to interact, interpersonal exchanges can give rise to problematic or even threatening situations. In these situations, staying silent is often preferred over talking about them.

Argyris (1980) has shown that highly skilled professionals are prone to use silence to protect themselves when threatened by the prospect of having to critically examine their own role in the organization. They do this because they fear embarrassing, and being embarrassed by, others. Silence is not only used to avoid risky talk and conversation that would affect their position, status or image. Saying nothing about precarious issues or problems can also reflect cooperative motives such as not wanting to damage colleagues or future partners (van Dyne *et al.*, 2003).

Morrison and Milliken (2000) describe embedding silence in wider organizational routines and processes as a collective organizational phenomenon that results from not wanting to damage relationships and lose relational currency that can lead to career advancement. They assert that individual-level silence reflects wider concerns about protecting one's social capital, which employees need in order to perform their job effectively. Employees who address salient issues are, for example, perceived as troublemakers, and this can lead to their exclusion from social networks and compromise organizational performance.

Perlow and Repenning (2009) also argue that individual employees do not fully express themselves when they perceive differences. In their study of a Silicon Valley Internet company, they show how the company's founders and managers fail to discuss interpersonal relationships because they are concerned that it might damage their relationship and ultimately the success of their company.

Although silence is used to protect professional identities and sustain relationships, an unforeseen consequence may be that it damages these same relationships in the long term. In addition to the personal costs associated with silence such as stress, dissatisfaction and cynicism, scholars have pointed to its disintegrative effect on group and organizational processes like jeopardizing cooperation and organizational buy-in (Morrison and Milliken, 2000). Perlow and Repenning (2009) explain that when the fear of damaging the relationship increases, initial acts of silence lead to more pressure to keep silent in the future. This results in a downward spiral that increases silence and corrodes the relationships on which organizational performance depends.

Silence and Managing Conflicts of Interest

Silence is also used to manage conflicts that arise in organizations. Most conflict resolution models suggest that conflict management involves reaching a mutually acceptable solution through engaging in open and verbal exchange and confrontation. However, not all conflicts attract public attention. Conflicts are often a perennial feature of organizations. They are 'present in the crevices and crannies and just below the surface, bubbling up occasionally as disputes in certain places and enacted in accord with particular conversions and rules' (Kolb and Bartunek, 1992, p. 10). Silence contributes in keeping conflicts implicit.

Arguing from a negotiated order approach, Strauss (1978) explains that when two members have a vested interest in resolving conflict they may resort to silent bargaining rather than talking about the issues. Strauss wrote that:

> Some negotiations may be very brief, made without any verbal exchange or obvious gestural manifestations; nevertheless, the parties may be perfectly aware of 'what they are doing'—they may not call this negotiation bargaining, but they surely regard its product as some sort of worked out agreement. Other negotiations may be so implicit that the respective parties may not be

> thoroughly aware that they have engaged in or completed a negotiated transaction. (Strauss, 1978, pp. 224–225)

The bargaining process is thus shifted into the background. Frictions are resolved by keeping them out of open discussions. They are settled implicitly through tacit agreement. For example, in his study of *Time* magazine journalists' approaches to investigating and covering policy processes within their own organization, Turow (1994) reveals how both journalists and superiors avoid coverage of salient issues because they implicitly agree that it is better not to address professional interests. The journalists fear for their jobs, and their superiors fear extreme organizational instability. Respecting each other's stakes, both parties implicitly agree that it is in both their interests to not open the topic up to wider discussion. This study thus shows that silence is associated with preventing conflicts from entering formal meeting rooms and official negotiations and keeping them far away from public scrutiny.

A consequence is that conflicts are rarely resolved by keeping things from public discussion or debate; they often reappear again in new, redefined and unexpected ways (Kolb and Bartunek, 1992; Zerubavel, 2006). People who engage in silent conflict management do not really communicate with each other, but accommodate the situation by respecting each other's vested interest. As a result, key issues that need discussion are not addressed (Kolb and Bartunek, 1992), and it becomes extremely difficult to change existing structures and systems. The result is that the status quo is often maintained.

The literature on silence thus shows that the way actors deal with differences and conflicts involves both verbal communication and silence. In particular, it reveals that silence is associated with the external and the internal dimension of the collaboration, and with managing the emergence of colliding interests. In the rest of the article, we use these three identified functions of silence to examine how researchers deal with the tensions and conflicts they have to confront in collaborative interaction. In particular, we believe that by focusing on silence we can get a clearer understanding of the way latent conflicts develop within these collaborative processes.

Below, we examine each of these three functions of silence, and their consequences, in the context of a study that investigated a large-scale interdisciplinary collaboration undertaken to reposition a university institution in relation to social challenge in the area of water management.

Background to the Case

Examining everyday realities of academic collaboration requires an approach that pays attention to situation and context. To this end, we have used a case study design, which is useful for obtaining information on complex, context-dependent phenomena (Flyvbjerg, 2006). This case study explored the effect of moments of

silence on the course of interdisciplinary interaction between researchers from water engineering in the context of consolidating the leading position of their parent university in the area of water management.

Water management is a vital issue in the Netherlands. The country is one of the lowest lying and most densely populated countries in the world. More than half the land is below sea level, making the future of water safety and liveability one of the country's greatest social challenges. The country also has a long history of innovatively dealing with water safety issues, in which priority is traditionally given to technical-engineering solutions to flooding, such as building dikes and dams. This fighting-the-water approach, as it is often called, was shaped by an epistemic community of civil engineers, employed at Rijkswaterstaat (The Department of Public Works), consultancies, construction firms and research institutes (van den Brink, 2009). Many of the engineers occupied positions at the university described in this article. This community was able to sustain the technocratic policy monopoly for decades, and it was largely responsible for the construction of the country's famous storm surge barriers (Bijker, 2002), but the balance of power shifted in the second half of the twentieth century.

Several intertwined developments caused this change. These include the rise of ecological awareness—partly triggered by the declining quality of nature and ecological issues created by the colossal dikes in the second half of the twentieth century—the decreasing authority of Rijkswaterstaat (van den Brink, 2009), and the introduction of new and democratic policy concepts that give voice to other groups such as scientific, governmental groups and private firms in decision-making processes about water management (Wiering and Immink, 2006).

Scholarship on Dutch engineering demonstrates that the relation of engineers towards politicians has come under great tension (van Rijswoud, 2013). Although engineering expertise is still considered essential in preventing flooding, a key challenge for engineering experts is to ensure that their specialist engineering knowledge remains authoritative as the dominant policy frame (p. 87). This means that the role of technocratic engineering approaches needs to be reconsidered in accordance with demands of openness, transparency and legitimacy in policy-making under democratic conditions (van den Brink, 2009). Given the need to adapt to new societal demands, it has become important to develop a common platforms and outlook between independent researchers from the university such as hydraulic engineers, spatial planners and policy and management experts to explore and integrate their different perspectives, values, and interests. In short: to shift the focus to working with water, rather than fighting it.

In recent years, a number of university-wide initiatives have been undertaken to construct such a platform and outlook. In our study, we investigated a high profile initiative to connect water engineering research to the policy challenges as posed by the Dutch Delta Program. This initiative is part of the broader integration of diverse water management research fields within the university, for instance shaped by workshops, lectures, partnerships, and scientific research projects.

The Delta Program is initiated to develop long-term water policies for the Netherlands in response to expected climate change impacts on society (Vreugdenhil and Wijermans, 2012). It supports the implementation of the second Delta Plan, which is meant to secure the liveability of the Dutch Deltas in the twenty-first century (Jong and van den Brink, 2013). The aim of the Delta Program is to incrementally elaborate, develop, and implement, an interdisciplinary vision on water management between 2011 and 2014. In the program, policy-makers and experts are brought together to explore and develop decisions and preferred strategies for meeting future challenges in water management. This vision is based on integral solutions that are multidisciplinary by their nature and combine safety, economic, nature, tourism and recreational dimensions of water (Vreugdenhil and Wijermans, 2012).

The launching of the Delta Program provided momentum for water management scientists and engineers within their employing institution to strengthen relationships with stakeholders in the policy domain. In particular, the empirical research examined the university-wide collaborative process that preceded the hosting of a large national conference for the Delta Program in 2012. The aim of this conference was to engage diverse groups of water management experts, professionals, and practitioners working in the Dutch water sector to explore the role of science in determining new and productive ways of solving the country's long-term water management problems.

The water management research collaboration can be considered as particularly interesting when aiming to study silence. In its strategic focus on exploring how the university's separate water management research fields could fit better in today's socio-technical trends, it required more commitment and change than, for instance, working collaboratively during a single meeting or research project (Schuman, 2006). The creation of a common outlook required substantive discussion about values, beliefs, and interests. The collaborative activities also had an explorative character. Kaats and Opheij (2014) write that explorative collaborations are difficult to realize because actors join out of free will, they are not exclusively bound together and collaborate on an equal footing. They also attract parties that are not able to add any additional professional value or do not plan to do so (Kaats and Opheij, 2014). Neither is there a natural compulsion to determine the rules of the game. Initiatives often result from unplanned self-organization and are not well facilitated in terms of discussing group's tasks and roles. Given the unconventional combination of scientific fields, these collaborations are also less certain of locating funding niches in which to compete for funds, and a result is that actors may view each other as potential competitors (Shrum *et al.*, 2007). Considering the collaboration's complex and explorative nature, our case study provides a unique opportunity to examine silence in the context of discussing, elaborating and bargaining how to collaboratively stage the importance and credibility of water management research.

In the next section, we outline our methodology. We then turn to the findings and describe several moments of silence in the nature and course of collaborative interaction through which the researchers tried to deal with the tensions they faced in repositioning water expertise. We subsequently show how silence influenced the development of latent conflict.

Methods and Analysis

To collect data, an ethnographic study of the collaboration was undertaken using an interpretative approach, which presumes that social realities are intersubjectively constituted and contextually situated, and can only be understood from within (Yanow, 2006). Customary ethnographic data collection techniques were used such as close observation, interviews, informal conversations and document analysis.

The interactions between scientists and other academics were studied by observing 25 meetings (see Figure 1) over a period of 7 months between 2011 and 2012. These meetings consisted of (1) working group meetings; (2) board meetings of the university's profiling platforms; and (3) preparation meetings. The working group meetings (8) brought together scientists from the faculties of civil engineering, architecture, and policy and management. In these meetings, we examined the collaborative interaction underlying the development and implementation of the strategic plans for the conference.

In addition to the working group meetings, we observed the board meetings (12) of 2 university-wide platforms that supported the collaboration financially and functioned as external advisory committees. In these meetings, we examined how the plans developed by the working group were discussed and aligned with other actors involved in shaping policy. Finally, in the preparation meetings (5), we observed how strategic plans were presented and discussed with people such

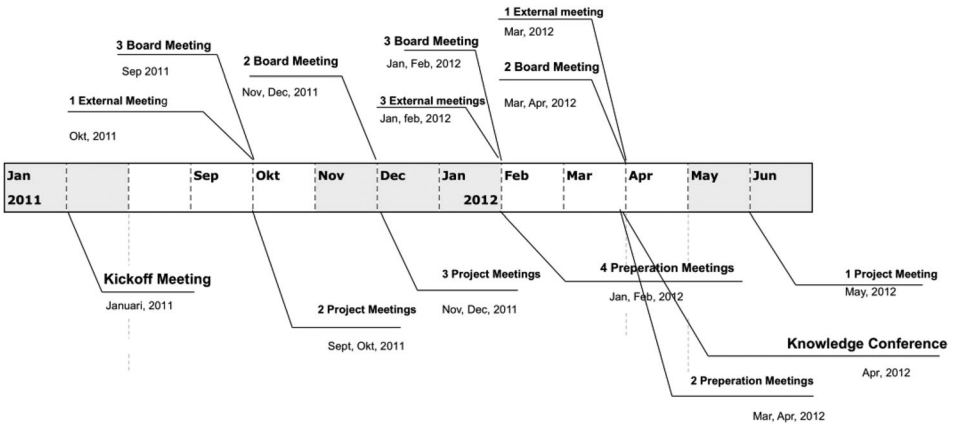

Figure 1. Overview of meetings per two months.

as conference session leaders, representatives from the university's communication and policy department, and policy-makers from the Delta Program.

All meetings were attended and observed by the first author, who has a background in anthropology and is familiar with ethnographic data collection. Because of the relatively closed and confidential nature of the meetings, the researcher could not audio-record all field notes (e.g. Jarzabkowski and Seidl, 2008). Special importance was therefore given to producing written accounts of interactional detail; this was done through systematic jotting down and writing-up observation notes of meetings, as described by Emerson *et al*. (1995).

In-depth interviews were held with members of the working group, board members of the profiling platforms, important sounding boards, and professionals from the policy and communication staff. The informants (14) were interviewed before and after the conference. The chain referral method of snowballing was used to identify relevant informants. Interviews, which were audio-recorded and immediately transcribed, lasted an hour and took place at the informants' departmental offices. A topic list guided the interviews, which systematically explored the collaboration between the university and the Delta Program, actors' roles in it, and the interaction within the group. The interviews addressed the moments of silence that we observed in interaction.

In addition, there were lots of informal conversations—before and after meetings, during lunch breaks, at conferences—where we further queried informants about the process. Through informal contact, the researcher gained trust and broke down barriers, making it easier to talk with informants about specific occurrences and events. The informal conversations were less structured than the interviews, usually addressed one specific issue and provided opportunities for gaining in-depth understanding of what was going on (Denzin, 1991).

As regards the document analysis, we had access to formal and informal email exchanges relating to the project, which generated detailed information on issues that were negotiated outside of common meetings and thus gave insight into what was not addressed in the meetings. We finally worked through an extensive set of strategic plans, policy documents, mission statements, presentations, newsletters and other relevant material relating to the case. These were analysed in order to get a picture of official versions of the collaboration's progress and revealed what actors did and did not share about their plans with other actors within the university.

For our study, we contrasted the diverse findings to identify moments of silence from the material. Through our method, we could capture and contrast what was not being said in meetings and was spoken about outside of them, or only revealed to the authors (as in e.g. Gardezi *et al*., 2009). To analyse the material more deeply for silences, we used Clarke's (2005) situational analysis. This approach makes it possible to visibly show unexpected and often-overlooked aspects of such differences, controversies, absences and silences. Situational analysis is particularly useful 'to articulate what we see as the "sites of silence" in our data. What

seems present but unarticulated?' (Clarke, 2005, p. 85). Situational analysis can be compared to conventional grounded theory, using similar techniques such as coding, memo making and sensitizing concepts, but takes the whole situation rather than the individual as the main unit of analysis. The analysis involves an iterative process of appraising and re-appraising the data, and mapping the relations, concerns and controversies between various elements, thus capturing the situation's complex, contextual dimension. Carrying out this situational analysis of the collaborative processes allowed us to identify more clearly the moments that could be analysed with the help of theory.

In the results section, we present these findings by relating them to the three functions of silence discussed previously. We do this by contrasting data from observations, interviews, conversations, email exchanges and documents. Our intention is not to give a streamlined account of the collaboration, but only to highlight several important moments at which silence emerged in interaction and identify its functions, and unforeseen consequences for interaction, in these contexts.

Findings Section

Silence and Group Performance

In this section, we discuss the initial working group meetings in which scientists explored possible scenarios for the conference. The collaboration started with a large kick-off session in which a delegation of the university's top professors and researchers in water management and representatives from the Delta Program jointly agreed on the importance of bringing science and policy closer together.

After this large kick-off session, a smaller working group was put in charge of strengthening further relations between the program and the university, consisting of scientists from the university's faculties of civil engineering, spatial planning, and policy and management. The group's effort was also anchored in two university-wide boards, which supported and facilitated the group and functioned as an advisory committee.

Looking first at the working group meetings, we found that members generally spoke positively about one another and the joint initiative, which was seen as a response to external changes and challenges that required the support of all members. One of the group's engineers expressed the importance of achieving a shared objective in an interview as follows:

> We are making a big investment to come closer to the Delta Program because there are social questions to which we can contribute . . . They won't come to you by themselves even though we have the tools that could very well fit their needs. Action is needed in the direction of the program . . . we are all behind it.

In the conversations we observed, we found that participants focused mostly on understanding the realities external to the meetings. Group members usually discussed the increasing uncertainties they faced, speculating about motivations of competing parties, who was close to the money supply and which projects would produce the most tangible result. In contrast to these discussions about external challenges and dilemmas, less time and energy were invested in exploring internal opportunities and challenges within the working group, such as for instance how to balance and integrate values and expertise and build on each other's strengths during the conference.

A striking feature was that group members rarely questioned group tasks, individual roles, or each other's reasons for participating in the group. The question of how to present their joint expertise at the conference was also only raised on two occasions during the meetings. On these occasions, some researchers emphasized the importance of presenting and debating the relevance of scientific approaches, while others were of the opinion that it would be best to demonstrate real-world technical innovations that were in the process of being developed at the university to their audience. While everybody was allowed to raise their ideas and opinions, differences in perspective were rarely explored or debated during interaction. After group members shortly conveyed their perspective on the situation, the others were silent and did not take the discussion any further. Rather than asking for clarification, the chair generally moved onto another topic without seeking substantive agreement.

Personal conversations similarly suggested that internal consensus about the project was assumed rather than debated. When we asked informants why they did not talk more extensively about their expectations and perceived purpose of the conference, they downplayed the importance of differences in this process claiming that they did not need further discussion and everyone agreed on the chosen course. A policy scientist put this rather clearly when she replied that, 'We do not need to talk about our differences. Everybody wants the same thing. That's obvious'. Another told us that 'not everything always needs to be discussed'.

Observation furthermore revealed that time pressure was a factor in avoiding difficult issues. Several senior members were committed to the project, but also had to deal with very tight time schedules. During the meetings, it was explicitly stated by several senior scientists that the meeting was interrupting other important work and that they should get on with the meeting as quickly as possible. On one occasion, the chair opened the meeting by stating, 'Let's get this thing over with as quickly as possible'. The members were not expected to prepare themselves for the meetings. Interaction during the meetings was often interrupted by phone calls and conversations about other unrelated projects. Meetings also often ended abruptly, leaving insufficient time for decision-making. Generally, the interaction at meetings was very collegial and friendly, and was strongly

oriented towards behaviour that did not lead to disagreements between participants.

The consequence of this was that the project gained a forward-looking character. Getting the task done as expeditiously as possible was seen as crucial, and talking about differences would slow down the pace of the project. As one of the engineers said, 'Talking too much doesn't get you anywhere. We shouldn't make things too complicated'. Another scientist echoed this feeling, stating that the burden of having to discuss differences potentially slowed down the process. A policy scientist mentioned that they were particularly good at completing tasks as quickly and efficiently as possible: 'Doing things, and not talking about them too much, that is the way we typically do things around here, stop rambling—just do it, that's our motto'.

In brief, this section has shown that an external challenge provided impetus for the scientists to turn towards one another to pursue the common goal of creating an appealing, interdisciplinary image of engineering research at the conference. In this early phase, all the participating group members supported the selected course of action and individual differences scarcely made it to the table of group meetings. When they did, nobody explored them in detail. Topics that were disused instead focused on issues that everyone appeared to find at least temporarily acceptable and were consonant with the assumed goals of the group (Goffman, 1969). Although this gave the initiative an uncomplicated, forward-looking and externally oriented character, it also prevented profound exploration of differences in visions and perspectives that often underlie complex interdisciplinary collaborations. In short: substantive agreement was not sought.

Surfacing Differences

Despite the shared sense of unanimity that existed within the group in the initial phase, differences within the group started to surface as the collaboration moved towards its implementation phase, and actual decisions about the content of the conference (sessions, speakers, formats and so on) were required. When the collaboration shifts from outwards to inwards, members move from criticizing authorities and the external world—their common nemesis—to developing their own internal visions (Farrell, 2001). This can bring about new and unforeseen differences that bring to light potential tensions (Sonnenwald, 2007).

An important source of friction in the relationship was observed between the scientists during group meetings. As the conference drew closer, differences in disciplinary vision that had not been discussed in the early meetings emerged. An illustrative disagreement concerned a spatial planning member's proposal to include a keynote speaker without a technical background to provide a talk on the history of water management to emphasize the socio-technical rather than just the technical scope of the conference.

One of the civil engineers objected to the idea, suggesting that such an opening lecture would conflict with the technically oriented engineering disposition on flood safety and security and would give the wrong impression because it contradicted the values and mission of a technical university. This remark was ignored and received no further attention at the meeting. Interpersonal differences were not examined within the group, but the interviews reveal that disagreement lived on beneath the surface and created negative sentiments between the respective group members. As the engineer explained:

> I did not mean to say that the professor could not participate at the conference. I raised the issue to discuss whether the speaker corresponded with the mission and image we as a technical university want to get across ... The team silenced my contribution in the discussion ... Even though you have good intentions, and join the group in addition to your own activities, you are always confronted with these negative stereotypes about engineers as ecologists' enemies.

In contrast, the spatial planner referred to the incident in personal correspondence as evidence that civil engineers tended to view problems through a technical lens:

> Inviting a historian to give a talk immediately means that you are seen as nostalgic ... that she talks about our water tradition over the last 300 years does not mean that it has no value in the present ... My analysis is that engineers are sometimes narrow-minded.

This incident shows that group members began to agree less and less on the course that the collaboration was taking, but still remained silent about differences experienced in vision and perspective. Despite the silence in the working meetings, specific actors did voice their concerns outside of the meetings in more informal, backstage conversations, where they were often explicitly cynical about the course of the collaboration and expressed their discontent with the way things were going, eventually causing the engineer to leave the group. When the engineer and spatial planner met each other again in a later stage of the collaboration, in the context of a preparation meeting to discuss the content of the session the engineer would host, the silence was again maintained. Neither scientist addressed the disagreement in the meeting, nor why he had retreated from the group.

Escalation of the Conflict

Differences thus surfaced at several junctures, but extensive discussion did not take place in joint meetings. As the collaboration evolved, brewing disagreements became more prominently visible and important at interactional levels beyond that

of the working group. At a certain point, ideas have to be integrated into the wide institutional context (Jarzabkowski and Seidl, 2008). The network expands, and new actors and voices become involved in the collaboration.

When projects enter this phase, giants who have been dormant are often woken up. In our study, such a giant was one of the board's chairpersons, who gave voice to the latent sentiments that were already present in the collaboration. The professor, a known spokesperson for classical engineering and defender of the fighting-the-water approach, and a well-known critical observer of current policy changes (van Rijswoud, 2013), did not make a secret of his doubts about the program in an interview:

> As I see it, nothing will come out of the Delta Program . . . Those from the policy faculty are interested in it, because it is apparently about policy and decisions . . . and they therefore consider it important, but the engineers know that it is powerless.

His active involvement marked a turning point in the process. As chairman of one of the university-wide boards that supported the initiative, the professor's support was needed to back up the project financially. Faced with decisions that contradicted the disciplinary interests of his own field, the professor demanded more of a say in decision-making about the content and format in exchange for funding the conference through his board, leveraging manoeuvring pace for positioning his research agenda at the conference. In an email, he informed the group: 'I only want us to discuss serious solutions for the Netherlands . . . I do not want to give room to romantic issues like "living with water" . . . this university stands for feasible and practical solutions'.

The group members did not approve the request, and their response was expressed by a chairman of similar seniority who immediately responded to the email by instead accentuating the strategic and inclusive character of the undertaking:

> I think that it is more difficult than that . . . this conference is all about moving strategically. We are trying to move the pendulum towards ratio and engineering, but we will not succeed by kicking it as hard as we can or by stepping on the brakes.

As conflicting visions about the goal of the conference became tied to specific actors and vested disciplinary interests, internal parties were placed diametrically against one another. Several of the working group members did not agree with the classical engineering professor. For example, one of them in a conversation mentioned being annoyed about the professor's interference in the process, who in her opinion overplayed his task as an advisory committee board member. She referred to the professor stating that: 'the boards are interfering with the process, where

they should facilitate it'. Despite disapproving of his course of action, she did not say anything on the issue during the meetings of the working group or communicate her discontent to the members of the respective boards.

Similarly, two other working group members, who were responsible for informing the board members about the group's progress, did not address the issue during the board meetings, even though they grumbled about it after meetings. As a result, the conflict never made it to the meeting tables where all involved actors were present. Open confrontations were avoided and the conflict remained latent, even though most of our informants knew that others did not agree.

Personal conversations also illustrate that nobody wanted to openly debate the issue. One informant told us that discussing the issue with the professor was futile; another that it was better to let 'things naturally resolve themselves', subtly pointing to the professor's upcoming retirement.

Similarly, another member explained how the professor had previously complicated efforts, and that everyone had grown tired of debating with him on crucial issues: 'this is what always happens, we have become accustomed to it'. The board member of equal seniority echoed this difficulty of addressing longstanding disciplinary differences:

> The difficult thing is that, without pointing fingers, our board differs from theirs in many ways . . . they have entirely different disciplinary concerns and tasks, and this difference surfaced in the process. And yes, one can try to coordinate that . . . But I also think that there are some real differences that are not easily bridgeable. Putting all this effort into trying is not worth the energy . . . It seems better to just continue under our own flags.

Despite the fact that they disagreed, nobody thus felt the urge to openly address the conflict. After a short email correspondence, the professor was informed by the group that several of his demands would be granted, in return for his support for the initiative and silence on the issues important to them. Nobody bothered to sound him out and find a more productive solution. Here silence is explicitly demanded in a bargaining process; it is used to create a situation in which the issues could be resolved without having to address each other's stakes in the process.

Once the issue was settled, things quickly got back on track: the original conference program was rewritten, and more emphasis was placed on autonomous research agendas and well-known disciplinary perspectives. All partied were given an equal say in the matter and were allowed to host their own session, even though this was contrary to the aim as defined at the beginning of the project to create an interdisciplinary approach to the conference. They started working alongside one another and minded their own projects, without contributing to an overall vision. Once the working group proceeded with the organization

of the conference, no further problems occurred, so the conference could be held and attracted some 1,500 professionals from the field.

Initially, the informants were enthusiastic about the conference, but in retrospect they mentioned that the event had not entirely met their expectations. An engineer, who had functioned as a flywheel for the group, explained rather cynically that he was disillusioned with the effort and had gradually lost his initial enthusiasm. Two senior scientists mentioned that they had not succeeded in conveying the university's shared strength, noting that it did not have a strong, integrated character.

Although informants expressed concerns in informal conversations, these concerns again did not attract much debate in the evaluation meeting held several weeks after the conference. During this working group meeting, the participants referred to the events as a success, measuring this success by the attendance at the conference in general, or at their own sessions and contributions. The question of whether they had accomplished shared goals was consigned to silence.

Conclusion: Functions and Consequences of Silence in Interdisciplinary Collaboration

This article began with a broader set of questions about the role of silence in interdisciplinary collaboration geared towards developing socio-technical approaches to public problems. To gain more insight into these questions, we analysed empirical material from a case study examining collaboration in water management, in which scientists from different fields and faculties and with a strong own agenda had to work towards a consensus and represent the agenda of their close colleagues and group. This collaborative challenge required discussing deep-seated differences and the reconfiguration of pre-existing relationships between actors, even though there were often insufficient opportunities and resources to facilitate a serious time commitment.

The case study demonstrates that, when scientists from different fields and faculties collaborate around university-wide challenges, relevant issues are kept from the common meeting table and are only talked about within we-groups, even though discussing important issues and problems would add to the quality of decision-making (Dörner, 1996). Building on the theoretical section of this article (Morrison and Milliken, 2000; Perlow and Repenning, 2009), we identified three functions of silence in collaborative interaction: securing group performance, dealing with relationships within the group, and managing conflicts of interest. These silences furthermore have unforeseen consequences for collaborative interaction.

Considering first the group performance function, the case study suggests that silence is associated with maintaining within the group the solidarity needed to ensure a workable situation. Getting scientists from previously independent parts of the university to collaborate around challenges in their external

environment is notoriously difficult; it requires the involvement and commitment of multiple actors of roughly equal status that are not exclusively bound to one another (Kaats and Opheij, 2014). When participants collaborate to work towards common achievements, silence may be used to create a 'working consensus', a modus vivendi for everyday interaction (Goffman, 1969). As our study revealed, during group meetings scientists do not openly question or contradict each other's perspectives, regardless of different outlooks they may have on the positioning of their research. Differences internal to the group are temporarily kept out of exchanges to reach a consensus. This consensus is not based on candid and open discussions between participants and does not denote substantive agreement. It instead relies on silence in that participants conceal their own perspectives in the benefit of the group's shared objectives and interests (Castán Broto, 2011).

This silence is strongly encouraged by the performance pressure of this type of collaboration, in which lack of time and resource vulnerability causes researchers to become task-focused. Under high pressure and time constraints, researchers will not take the time to properly address difference in perspective or will not see it as their core task, thereby profoundly influencing the internal exchange and examination of ideas and differences.

Second, with regard to the management of disagreements within the group, our findings show that, when differences in vision and perspective present themselves more forcefully in interaction, researchers may still not move towards openly addressing and examining them. Collaboration is an unpredictable and uncertain process marked by continuous change (Shrum *et al*., 2007; Sonnenwald, 2007). If the process takes new and unexpected directions, researchers can be confronted with differences in interaction, and suddenly have to explain where they stand, which can feel like having to defend their position. People, however, generally dislike social disapproval (Aarts *et al*., 2011). They may feel vulnerable or fear being misinterpreted. In order not to lose face, they withhold their full expression about the issues and try to regulate the impression they make on others (Goffman, 1969; Argyris, 1980).

Although this keeps interaction conflict-free and relaxed (Aarts *et al*., 2011), a consequence is that people feel that they are not heard in interaction and start to experience initial agreement as a burden. As shown in our study, not exploring one's own perspectives or inquiring into the thinking behind those of others leads to negative attitudes about one another, reinforcing stereotypes. When people keep negative feelings to themselves, uncertainty increases, and people are no longer sure what others really think and what will be talked about or not (van Woerkum and Aarts, 2008). This has a disintegrating effect on group relations, pulling collaborators in opposing directions where mutual understanding is needed. As our study points out, not discussing differences causes important group members to silently drop out of the process as a result of which potentially valuable knowledge and input is lost.

Regarding the third dimension—the role of silence in the management of conflicts—we illustrated that scientists will not explicitly confront colleagues who put conflicting interests on the table, but will respect one another's stakes and resolve the issues by silencing their differences. Collaborations that have a strong explorative character are especially prone to attract parties that will step up and use their authority to prioritize disciplinary interests that run counter to shared goals (Shrum *et al*., 2007; Sonnenwald, 2007; Kaats and Opheij, 2014). When influential actors revive old disputes, others will find it difficult to oppose them and resolve their differences by means of discussion because this can damage the position of their own department and relations with other departments and professors, or at least could make them considerably more difficult. Given the largely voluntary nature of participation in such collaboration, and the absence of financial incentives, it is unlikely that scientists will become involved in heated discussions with colleagues in specific departmental and hierarchical relationships. As a result, conflicts will often remain invisible (Kolb and Bartunek, 1992).

Although silencing conflict is an important way of dealing with relational pressures (Perlow and Repenning, 2009), an unintended consequences can be that it closes off discussion about deep-seated issues and problems that require open and reciprocal interaction between old and new parties. As our case study shows, during the crucial phase of the collaboration, differences were silenced and new goals were redefined that no longer reflected the initial purpose of highlighting the joint relevance of water research from a socio-technical perspective (Pahl-Wostl *et al*., 2007). Instead it supported well-known and established interests and agendas. Ironically, silence undercut the very objectives that people set out to reach in the first place by erecting interactional barriers to solving urgent social problems.

Following from this, we suggest that a self-reinforcing cycle is involved in silence in collaborative interaction. When used to protect group performance, silence prevents researchers from challenging one another's views and perspectives. As a result, internal differences at the heart of the collaboration are not explored, making it exceedingly difficult to address them if they arise in later stages. As conflicts from the past become apparent and gain more weight, it is usually already too late to adequately address them, and a deep gap will emerge between parties. As conflicts flare up, researchers will quench them with more silence, and this will further add to polarization. Differences are magnified and it becomes even more difficult to resolve issues and problems the next time parties meet. As Zerubavel (2006, p. 84) notes, 'The deeper the silence, the thicker the tension that builds around it'.

Although functional from different perspectives and for several reasons, our analysis thus suggests that the longer differences remain undiscussed, the more silence will influence the course of interaction and increase the probability that latent conflicts develop. Seemingly unimportant everyday silences in the end shape collaboration in ways that no one may have intended. This conclusion

offer an interesting new look at interdisciplinary collaboration, yielding new insights into the process of everyday management and accommodation of tensions and conflict (Hackett, 2005; Shrum *et al*., 2007; Sonnenwald, 2007).

Finally, the study has several implications for the management and organization of interdisciplinary collaborative processes. Collaboration requires that researchers accept differences and diversity and are ready to openly discuss diverging viewpoints and underlying assumptions and interests. Many authors acknowledge and emphasize the importance of having productive conversation about difference in this process (Pearce and Littlejohn, 1997; Wenger, 2000; Jeffrey, 2003; Bukvova, 2010; Lewis *et al*., 2010; van Oortmerssen *et al*., 2014).

In order to engage more effectively with differences in interaction, it is necessary to take into account that the choice between speaking up and staying silent makes a difference and needs to be addressed. This can for instance be done by giving special emphasis to designing the structure of and organizing the conversational process so that the participants effectively engage in collaboration (Schuman, 2006; Taylor and Szteiter, 2012). A well-facilitated collaboration process can encourage listening actively to each other, foster mutual respect, and elicit more insight into each other's perspectives (Stanfield, 2002).

Facilitators can also play an important role. According to Hanson (2006), a facilitator is a nonvoting member that can preside over the forum in which the exchange of ideas takes place, ensuring that all voices are heard. Hanson (2006) writes, 'a facilitator has a great deal of influence in his or her most invisible and silent role'. Facilitator can for instance keep a common and publicly accessible record, create safe interactional forums to discuss important issues, and ensure that the right types of conversations are held in different social contexts (Ford, 1999).

Externally facilitating the process, however, is not enough. Academic leadership also plays an important role in empowering other scientists to share and communicate collaborative visions and achieve higher forms of performance (Sonnenwald, 2007; Stokols *et al*., 2008). However, as the present study suggests, scientists that occupy leading positions may not always address difficult conversational issues, sometimes unintentionally undermining the goals they seek to achieve. In part, this may be because they are not well equipped to engage in and facilitate these conversations. Although scientists might consider themselves experts in communication —a significant part of their work entails explaining their research to other scientists,—they may not necessarily be good at discussing how to integrate distinct visions or interests or know how to solve conflicts that arise in complex collaborative settings. In the light of the above, is seems advisable to develop initiatives to improve the conversational skills of scientists in general, and scientific leaders in particular, so that they can constructively discuss, negotiate and resolve tensions that are likely to arise in the course of collaborative interaction.

We have offered some initial ideas on the role of silence in collaboration. Further studies may benefit from examining more directly its role in the development of latent conflicts. An important avenue for research would be to define the critical points at which different functions of silence interact and begin to reinforce each other. Such research might respond to Perlow and Repenning's (2009) call to determine the tipping points in which 'silence shifts from being a productive response to isolated differences to a self-reinforcing pathology that can significantly reduce organizational performance' (Perlow and Repenning, 2009, p. 216). In terms of further research, it would also be useful to investigate functions of silence in relation to the different types of forums (from email to workshops) in which interdisciplinary collaboration occurs.

The study also opens up some interesting questions with regard to our ethnographic reflexivity; in other words, our own silence. In designing the study, we did not set ourselves the goal of intervening directly in the research collaboration process, as is for instance emphasized in action research (Taylor and Szteiter, 2012). We did not encourage participants to reflect more systematically on what they were saying and not saying during interaction. Nevertheless, we emphasize the value of transparency in the research process and the importance of giving back conclusions to research participants. In our research, we have been transparent about expectations and research objectives from the start, for example explaining to participants that we were not part of the collaboration.

In terms of engaging with the social dimension of our research, we conveyed our experiences and findings in the form of a symposium on the topic of silence, during which we reflected on and discussed its significance for ongoing and future projects together with research participants and other relevant institutional actors and stakeholders. Through this symposium we have made an initial step towards opening up a forum within the university for creating a dialogue around the topic of silence in scientific collaboration. Given the conclusion of our research, it seems wise for universities to facilitate safe spaces for scientists to talk about and share their perceptions of and experiences with silence in ways that enrich their understanding of its role in the everyday practice of collaborating.

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