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"There really is a lot of shared understanding, but there are also differences": identity configurations in science communicators' professional identity

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Abstract   Science communication is a relatively new field of practice, shaped by a diverse group of professional science communicators and the way they make sense of their work. A distinguishing feature of these professional science communicators is the organisational context they work in. Based on a typology from an organisational theory framework, this study explores the perspectives of 15 German science communicators through qualitative interviews. It seems that while they tend to draw on a common set of building blocks, they use them to construct individual professional identity configurations partly influenced by their organisational context.

Context   Science communication, understood as the "communication about scientific knowledge, methodology, processes or practices in settings where non-scientists are a recognised part of the audience" [Horst & Davies, 2016, p. 4], has been gaining importance in recent years. In light of the many challenges societies are currently facing (e.g. climate change or the coronavirus pandemic), universities, scientific organisations and individual scientists are increasingly required to engage with different non-scientific stakeholder groups [Scheufele, 2022]. At the same time traditional science journalism is on the decline in many countries [Guenther, 2019] and is thus losing importance as the traditional gatekeeper of public science communication. In this situation, a steadily growing community of professional science communicators is establishing itself. This community encompasses a variety of different actors [e.g. bloggers, press officers, staff at science centres or science comic creators, Davies & Horst, 2016] engaging in diverse activities.

The heterogeneity of actors in the field has sparked debates about the extent to which there is a shared understanding of "science communication" as a profession

[Metcalfe, 2022; Trench, 2017]. Professions are special types of occupations that are characterised by formal criteria such as a common knowledge base, a code of conduct and formalised vocational training [Freidson, 2013; Trench, 2017]. In addition to that, professions are defined by shared values, norms, and ideas, often referred to as professional identity [Goldenberg & Iwasiw, 1993]. This identity is constituted by different themes with varying expressions across professional groups, referred to as identity configurations [Bayerl, Horton & Jacobs, 2018, p. 177]. These are highly dependent on the context of a profession, especially its organisational work context [Vähäsantanen, Hökkä, Eteläpelto, Rasku-Puttonen & Littleton, 2008]. Research exploring the professional self-understandings of science communicators tends to find feelings of uncertainty and ambiguity [see e.g. Watermeyer & Lewis, 2017; Leßmöllmann, Hauser & Schwetje, 2017; Schwetje, Hauser, Böschen & Leßmöllmann, 2020]. In addition to that, the field is not shaped by communicators alone but also by organisations such as universities pursuing their own science communication agendas [Fähnrich, Kuhnhenn & Raaz, 2018; Raupp, 2016]. All this makes science communication an intriguing case for an exploration of professional identity.

This article therefore asks: is there a collective professional identity among science communicators across different organisational contexts and if so, how can it be characterised? To explore this, a typology was developed that distinguishes science communication professionals according to the organisational context of their work and concepts of professional identity were applied to the field of science communication. To answer the research question, qualitative interviews were conducted with 15 science communication professionals in Germany.

In doing so, the study contributes to existing research in the following ways: first, the organisational typology allows a systematic conceptualisation of actors in the field of science communication and extends existing work in this field [Rödder, 2016, 2020]. Second, by focusing on a broad spectrum of different communicators, the study offers insights into currently existing professional identities of science communicators and lays the groundwork for future systematic explorations. This will allow a more profound understanding of the perspectives of science communicators and shed light on their struggles to define themselves professionally. Third, the transfer of concepts from professional identity theory contributes to theory building in the field of science communication. Overall, the study integrates new theoretical approaches and thus contributes to a better understanding of the degree of heterogeneity with regard to the professional self-understandings of science communicators. It also provides insights into the degree of professionalisation of the field and its potential impact on public debates.

A typology of organisational contexts of science communication

To systematically analyse professional science communication, the study extends a typology from organisational sociology [Rödder, 2016, 2020] that scrutinises the structural impact of organisational environment on science communication. The original typology is modified to include freelance science communicators who do not work in the context of any formal organisation[1] (see Table 1).

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[1]The professional identity of journalists has already been explored [e.g. Olausson, 2016] and to avoid overextending the scope of this study science journalism was excluded. Given that the focus here is on full-time communication professionals, full-time scientists who communicate were also excluded.

Table 1. Three organisational contexts of science communication, adapted from Rödder [2016, 2020].

Type of organisational context	I No formal organisation	II Organisation system		III Subsystem of a larger organisation	
Organisations	Free-lance communicators	Science communication organisations/ agencies	Museums/ science centres	University/ research institute press/ communication offices	Visitor centres/ open labs
Science communication orientation of the organisation	Yes	Yes	Yes	No	No
Science communication orientation of the subsystem	–	Yes (as most subsystems)	Yes (only some subsystems)	Yes (as the only subsystem)	Yes
Goals	Personal science communication goals	Science communication and strategic organisational goals		Strategic organisational goals	Strategic organisational goals

The columns distinguish the three organisational contexts, and the second row names typical organisations in each context. Row three indicates whether the whole organisation is dedicated to science communication, row four indicates whether the subsystem the science communicators work in is focused on science communication and row five highlights the type of goals predominantly pursued in each context. The contexts are of course ideal types, and in reality many science communicators work in contexts located somewhere on a spectrum between them.

Theory: professional identity

Professions are characterised by shared meanings [Ibarra, 1999], referred to as *professional identity* [Nelson & Irwin, 2014; Pratt, Rockmann & Kaufmann, 2006].[2] It describes how members of a profession are bound "by similar principles of operation, not only through common regulatory bodies [...], but also due to implicit agreements regarding their profession's standards, values, and goals" [Bayerl et al., 2018, p. 169]. On a collective level, professional identity is the predominant way in which professional groups understand themselves and their work [Reay, Goodrick, Waldorff & Casebeer, 2017]. Science communication as conducted by professional communicators is a relatively young field of practice, its origins stretching back around 40 years [Trench, 2017]. Emerging professions are an especially intriguing subject of analysis as they allow an insight into the formation of new collective identities [e.g. Deuze, Martin & Allen, 2007]. This quite often includes a process of *othering*, "whereby groups frame a collective professional identity in contradistinction to other occupations" [Cohen, 2020, p. 139].

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[2]There is no uniform use of terms in the literature on work-related identities. Scholars have used the terms 'professional identity' [Pratt et al., 2006], 'occupational identity' [Cohen, 2020] and 'work identity' [Nordhall & Knez, 2018] often interchangeably in meaning. From here on the term 'professional identity' will be used.

As Bayerl and colleagues [2018] have argued, professional identity is not the uniform idea of a profession but is rather composed of several different *building blocks* [p. 177]. They posit that while most professional groups draw on the same set of building blocks, they still arrive at different *identity configurations*, "referring to systematic differences in the prevalence of topics and themes in the collective self-understandings of professional groups" [Bayerl et al., 2018, p. 177]. These identity configurations vary across but also to a lesser extent within professions especially due to context-specific differences (e.g. national context) [Bayerl et al., 2018, p. 177]. Key in this regard is the organisational context [Vähäsantanen et al., 2008]. Ashforth, Harrison and Corley [2008, p. 330] highlight three central types of building blocks, first, the *core of identity*: who are we, (as science communicators), second, *the content of identity:* what are our values, goals, skills and experiences (as science communicators) and third *behaviour* that is in line with the identity.

Core.   Many studies have focused on the self-understandings of professional science communicators and the roles they identify with. In their study on freelance science comic creators Collver and Weitkamp [2018] found they had ambiguous feelings about their professional self-understanding and struggled to define themselves as either educators and/or entertainers [pp. 3–4]. In a 2015 study, Brown Jarreau, used a typology developed for science journalists [Fahy & Nisbet, 2011] to survey the self-definition of science bloggers. The original typology outlines nine different roles, namely conduits (i.e. translators), public intellectuals, agenda setters, watchdogs, investigative reporters, civic educators, curators, conveners and advocates [Fahy & Nisbet, 2011]. Brown Jarreau found science bloggers identified most frequently with the roles of explainers of science, educators and public intellectuals [2015, p. 18]. Science communicators working in science communication organisations were studied by Tlili [2008] who demonstrated how different professional identities were integrated into the common view of science centres as facilitators of access to knowledge [p. 311]. Most studies, however, have looked at science communicators working in subsystems of larger research organisations. In the tradition of organisational sociology, these professionals have been referred to as *boundary-spanning units* [Luhmann, 1999, in Rödder, 2020], working at the interface between the organisation and its environment. A large-scale study of communicators working at German higher education institutions by Leßmöllman and colleagues found they identified with six different roles [2017, p. 33]. While the translators make scientific content understandable to lay audiences, mediators negotiate between science, society and politics. Service providers support other organisational units in the university and administrators ensure the functioning of the institution. Finally, gatekeepers direct the flow of information between the university and society and popularisers garner interest in science (and the institution) [Leßmöllmann et al., 2017, p. 33]. In an analysis of the interviews conducted in the same study Schwetje and colleagues [2020], furthermore, showed that the communicators felt they switched between two or more of these roles daily [p. 201].

Goals.   The aspect of goals can further be distinguished into *goals* themselves as the ultimate purpose that is to be achieved by communication and *objectives* as the short-term targets that contribute to reaching the goals [Besley, Dudo & Yuan, 2017, p. 710]. Objectives are differentiated by the type of attitude communication aims to influence. Social psychology categorises attitudes according to three components,

cognition, affect and *conation* [Ajzen, 1989]. *Cognition* encompasses knowledge or beliefs about something, *affect* describes feelings and emotions, and *conation* describes the expression of behavioural intentions [Fishbein & Ajzen, 1975, p. 12].

In a study on the goals and objectives pursued by science bloggers, the authors found they pursued mostly objectives related to increasing knowledge among their readers as well as fostering excitement and debunking misinformation [Yuan & Besley, 2021, p. 218]. They further found that the science bloggers pursued some personal, but mostly societal goals, such as increasing overall science literacy [Yuan & Besley, 2021, p. 217]. A study by Riesch and colleagues [2016] also highlighted benefits for science, the public (especially literacy) and society as overarching goals of science communicators. Analyses of the goals pursued by research organisations, on the other hand, identify the maintaining of organisational legitimacy as the overarching organisational goal [Schäfer & Fähnrich, 2020]. In line with the discrepancy that becomes apparent here, it has been suggested that for communicators working in subsystems of larger organisations tensions might arise from reconciling the overarching strategic communication goals of their organisations with their personal science communication goals [Raupp, 2016].

Values. As of now there is little to no empirical data on the values that are endorsed by science communicators. It has, however, been argued that a body of shared norms and values is emerging but not yet widely established [Davies & Horst, 2016, p. 92]. Value guidelines created by practitioners exemplify this as they largely constitute non-binding agreements. A case in point are the "guidelines for good science PR" in Germany [Siggener Kreis, 2016]. These guidelines specify a set of eight foundational values for science communication: truthfulness, benefit to society, transparency, openness (on the part of the scientists), self-criticism, willingness to change and independence on the part of the science communicators, willingness of all stakeholders to cooperate and the principles of good scientific practice [2016, p. 3]. However, while they have been endorsed by some associations and institutions [Serong et al., 2017], they are not binding and include no sanctioning mechanisms.

Due to the exploratory nature of this study, the science communicators' skills, abilities and behaviour were not covered extensively in the interviews as these were deemed to be more accurately detectable through observations or quantitative studies.

Methodology

Germany is an interesting case in point for an exploration of professional science communication. Organisations like *Wissenschaft im Dialog* (WiD) or the *National Institute for Science Communication* (NaWik) are but two examples of science communication organisations in Germany. Further institutions and associations cater to specific subcommunities of German science communication, such as the *Bundesverband Hochschulkommunikation* (BVHK), the association of German science communicators at higher education institutions. German science communicators regularly meet at a variety of different gatherings. Especially notable is the *Forum Wissenschaftskommunikation* (organised by WiD), which self-proclaims to be the "largest conference of German-speaking science communication" [Wissenschaft im Dialog, 2022]. WiD and the BVHK also organise the *Siggener Kreis,* a small

gathering that publishes proclamations intended to inspire the science communication community [Bundesverband Hochschulkommunikation, 2022]. Science communication also enjoys a relatively high political standing especially since the Federal Ministry of Education and Research (BMBF) set science communication on the political agenda in 2019 [Bundesministerium für Bildung und Forschung, 2019]. All these institutions, associations and political decisions have turned Germany into a vibrant environment for science communication, a trend which has only been intensified throughout the coronavirus pandemic [Bromme, Mede, Thomm, Kremer & Ziegler, 2022].

Purposive sampling was employed to gather a sample of 15 science communicators [Etikan, Musa & Alkassim, 2016] with five communicators from each organisational context (see Table 1). Within each context high variability between science communicators was ensured. For freelancers, communicators specialising in different types of formats (e.g. science comics, podcasts) were selected, for science communication organisations, different kinds of organisations (e.g. science shops, science centres) and for communicators working in subsystems of larger organisations, institutions of varying sizes. Table 2 contains an anonymised list of all interview participants specifies the background and specialisation of the interviewees. The science communicators were contacted via email or Twitter DMs. Whenever an interview was declined, a suitable replacement that conformed to the same selection criteria was contacted. The qualitative semi-structured interviews were conducted by one of the authors on Zoom between 14th of October and 4th of November 2021, recorded and transcribed. An interview guide including open-ended questions on all dimensions of professional identity as outlined above (core, content: goals, objectives, values) was developed jointly by both authors.

The transcripts were coded in a structured content analysis [Mayring, 1991] by one of the authors in Atlas.ti. The coding scheme [Mayring, 1994] encompassed deductive theory-based structuring dimensions and their expressions based on the theory of professional identity. The deductive structuring dimensions for the coding of the self-understandings included the roles described by Leßmöllman and colleagues [2017], those for goals and objectives built on Yuan and Besley [2021] and those for the values on the German guidelines for good science PR [Siggener Kreis, 2016]. During the first round of coding, the codebook was amended with further inductive codes that emerged from the interviews. Coding decisions for disputable cases were discussed among the two authors and consensus decisions were made. A second round of coding followed to ensure that all inductive codes had been applied to all interviews [Mayring, 1994].

Results

The presentation of the results follows the conceptual approach laid out in the theory section. The main sets of building blocks of professional identity are explored, beginning with the core of identity and then moving on to the content of identity, looking at goals and objectives, as well as values.

Core of identity

The science communicators gave a striking array of answers when asked about their profession. Many were indeed doubtful whether "science communicator"

itself is a profession: "No, I don't really see it yet. Because there is no standardised education and there is no fixed job description[3]" [ROP9]. For others, science communication forms part of their job, but is not an accurate description of all that they do:

> "I would say it is a big part of what I do, but whether it's the core of my work... I don't know. Maybe it depends on the day. I am a part-time science communicator I would say." [SOP13]

However, some communicators also argued that the job of a science communicator exists: "I think it's not a classic skilled occupation [...] but it is a profession that can be very multifaceted" [SOP3].

Regardless of whether the interviewees called themselves science communicators or not, they were asked about the way they viewed themselves professionally. The emerging self-understandings (i.e., their core of identity) were clustered into four themes: selection of topics, presentation of scientific content, boundary function and assistance. Within each theme different roles were distinguished (indicated in italics). Importantly, none of the roles were shared by all science communicators, but everyone embraced a combination of roles from various if not all the four themes and most of them were shared across the three organisational contexts.

In the first theme, the selection of topics, the role of *agenda setters* is distinguished from *gatekeepers*. The *agenda setters* are the ones "who seismographically explore where there are interesting topics" [SOP6]. The *gatekeepers*, on the other hand, explained that they choose what to communicate from a range of topics presented to them by others:

> "I first want to really understand what the scientist found out: what were his methods, who else was involved in the project and what relevance do the results potentially have for society. Those are central aspects I try to tease out [...] and on that basis I decide whether we are going to make a press release or not. Because this gatekeeper function is part of my job, we do get a lot of mails and proposals by the faculties and we simply cannot report everything." [ROP1]

In the second theme, the presentation of scientific content, four prevalent roles were identified: *translators, popularisers, contextualisers* and *advocates*. Being a *translator* was mostly about making information understandable to different types of publics:

> "It will always be about me receiving a topic and then I see how I can work with it and prepare it so that it becomes understandable and so that the research interest of the person becomes understandable." [ROP12]

The *popularisers* can be characterised as employing different ways to make information "tangible" to the public [NOP5]. Some used stories to do so [ROP1], others employed humour:

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[3]All interviews were conducted in German and quotations were translated by the authors. The shorthand in square brackets indicates the type of organisation and the participant the quote belongs to, e.g. NOP5 (explanations to be found in Table 2).

> "I find humour extremely important, and that it has a benefit beyond the basic benefit of communication, because I believe that when [...] you make someone smile with the work you do, then you have already won." [NOP7]

The *contextualisers* can be described as those who link information "to the everyday reality of people, or to contextualise it in light of current affairs" [ROP15]. Finally, *advocates* refers to science communicators who consider themselves changemakers, "I would not say to make the world a better place, not that but maybe make it a more diverse one, regarding opinions, or insights" [ROP12].

The third theme concerns the position of science communicators. As suggested by organisational sociology [Rödder, 2020], the science communicators indeed thought of themselves as situated at the interface of different systems in the sense of *boundary-spanning units*. This sentiment was not only shared by communicators working in higher education organisations but also by those in the other organisational contexts. They all saw themselves at the boundaries between different systems: academia, different scientific institutions, different publics, or the political system at a local, regional or national level. The boundary function is expressed in the role of the *mediator*:

> "It is interesting what you can achieve when you bring together unlikely collaborators [...]. There are really interesting things that come about [...] and there I really see us as those who create the links." [SOP4]

The last theme concerns the way in which science communicators assist others in doing science communication. On the one hand, some science communicators can be characterised as *multipliers*, "I basically give other people information on how to communicate science and then they communicate science and themselves reach society" [SOP3]. On the other hand, many science communicators saw themselves as *service providers*. This involves conceptual work [SOP6], but also providing support to scientists:

> "A scientist doesn't have to say for example I want an Open Day and then has to take care that first responders are on site, that tickets are being sold, that all the imaging licences are valid, but the scientist should primarily be there as a communicator and not have to take care of all the support things and the structural environment is the main task of the science communicator." [NOP11]

Content of identity: goals and objectives

Science communication goals are the area in which the interviews most explicitly reveal tendencies for differences specific to organisational context. Contrary to science communicators from the two other contexts, most science communicators working in subsystems of larger organisations said they tried to promote both the reputation of their organisation and of individual scientists:

> "I want curiosity for science, for the institution because that is my employer after all, but also curiosity for the people behind it because they are the ones who deserve it in the end." [ROP9]

Also embraced by almost all science communicators working in subsystems of larger organisations was the goal to fulfil a duty towards society:

> "In the end, what counts is that we are a publicly funded institution, we are being massively funded by tax money and I feel it is our social and societal duty to communicate in a transparent way." [ROP8]

The other goals, embraced across organisational contexts, are not focused on reputation but rather concern the relation between science and society. The communicators spoke about their desire to create an "appreciation for science in society" [NOP5], to bring science and society closer together [e.g. NOP7] and to contribute to opinion-formation in society in which "scientific perspectives or scientific expertise should be included" [SOP4].

A large variety of objectives of science communication was discussed (here divided by their reference to cognition, affect and conation). Among the cognitive aspects, providing access to information was a recurring topic:

> "I don't think you can force anyone and that is why it is all the more important to communicate so that all the initiative can come from inside, so that it's more like opening a door than to put up a sign saying, do this or do that." [NOP5]

Further objectives included increasing knowledge about "how science approaches problems, the methods of science" [ROP15], or "what the current state of science is" [NOP14]. Many science communicators quite extensively addressed the objective of enabling the public:

> "It always affirms my belief that this [what we do] is necessary in the world, that you have the feeling you can contribute to people making informed choices and have informed discussions and work together constructively." [NOP4]

This must be distinguished from the objective of empowerment, which essentially seemed to be about giving people confidence to get involved in speaking about or taking part in science:

> "The concept of science is fundamentally defined by questioning authorities and statements and not just to accept them but to question. That is the embodiment of science and I think that you have to empower people outside of academia as much as possible to also take part in that." [ROP9]

The science communicators also often spoke of wanting to make the public think [SOP2]. With most of these objectives they seem to want to equip the public with the necessary knowledge, information and skills but ultimately let them make their own decisions. However, some communicators also expressed a wish to actively influence people's opinion:

> "So that they don't get caught in conspiracy theories so much, but that they can contextualise everything and that we so to speak counteract this scepticism towards science." [ROP15]

Concerning affect, the science communicators spoke about the importance of increasing fascination for and interest in science. As one communicator explained:

> "If we take really abstract research in molecular biology as an example, the communication is, irrespective of how we have done it, perfect when people are interested in the end: what type of research is it and what societal relevance does it have?" [ROP9]

Conation mostly concerned behavioural intentions related to science and research, for example initiating a dialogue between science and the public:

> "When it is actually about discussing topics, so just to say 'ok, so there is research on this side and other [research] on the other' and to say like 'ok, it's not always… Finished this process, this insight is final' but always this view that it is a process that is constantly developing […] and with these topics it's not so important that they are proven […] but that you just initiate a discussion about it." [SOP2]

In addition to that, encouraging public input into science and research was emphasised [ROP9]. Behavioural intentions not related to science and research were discussed less often and mostly regarding "sustainability topics" [SOP2] or "environmental topics" [NOP5].

Content of identity: values

The values embraced by the science communicators were inductively distinguished into three themes: the relationship between science and society, the content and the publics of science communication. Regarding the relationship between science and society, the science communicators believed that science communication should built on an openness of science towards the public:

> "Of course you have to confront yourself with that, that maybe someone says these topics should not be researched at all or researched differently. Of course that's part of it and you just can't entrench yourself behind the argument that we are the experts and no one else is allowed to have a say… that just doesn't work." [ROP9]

Closely connected to this was the idea that science and research should be approachable, "to show that scientists are really just normal people who you can talk to, who you can ask" [ROP15]. Also mentioned was tolerance in the sense of accepting that "people can have a completely different opinion than me" [NOP14]. Furthermore, they talked about the independence of science communication for example from political interests [e.g. NOP6], about "critical faculties" among science communicators [SOP3] and the moral and ethical foundations of science

communication [e.g. SOP4]. Only science communicators working in subsystems of larger organisations spoke of recognising the authority of scientists as a key value [ROP12].

Regarding values connected to the content of science communication, by far the most frequently mentioned value was truthfulness:

> "An absolute paradigm in this job is not to lie, communication that is based on a lie might be useful in the short-term but brings lasting damage not only to the institution but to all of science communication." [ROP8]

Transparency is another key value that was understood in different ways by the communicators. Some thought of it as the duty to point out uncertainties in science and research:

> "To also clearly highlight the uncertainties that exist or specify the degree of certainty and that I make clear: is that scientific consensus, is that the current state of research that I am talking about or is that an approach, a school of thought in the field." [NOP14]

For others, transparency was about explaining "why some topics are set so prominently" [ROP15], "to make clear is this an opinion or is it an informative article" [SOP3] and to make sure that "as soon as an opinion is voiced it has to be attributed" [ROP12]. The third key content-related value is the benefit of science (communication) for society, which was quite broadly defined:

> "I really think scientists should always ask themselves, this what we are researching, into which type of benefit can it be converted and if the benefit is only insight than that in itself is a benefit, that is exactly the cultural question if I resolve an aesthetic equation as a mathematician that is really just aesthetic then that has value in itself, just like a painting." [NOP11]

The two other content related values were the clarity of communication [e.g. ROP9] and adhering to the principles of "good scientific practice" [NOP10].

The theme of values related to the publics of science communication consists of two core values. On the one hand, the science communicators spoke about the importance of communicating with the public at eye-level:

> "Eye-level of course when I talk about a discipline, I will know more about it than the people who are listening, but they are not stupid, they maybe have objections [...] so I must be open and especially when it's about norms, value-based opinion formation I don't have any advantage over them." [NOP14]

On the other hand, they addressed the issue that science communication should give everyone an equal chance to take part:

> "I also think the question [. . .] who benefits from our work, is it only those who go to museums anyway or go with their kids to museums or [. . .] how do we maybe reach those who [. . .] don't do that." [SOP4]

The science communicators were also asked whether they ever experienced any conflicts, concerning the goals, objectives and values of their work. Science communicators working outside formal organisational contexts unanimously claimed never to have experienced any such conflict: "when there was a topic that I didn't feel I could stand behind, I simply didn't do it" [NOP5]. Communicators working in science communication organisations also said they rarely experienced conflict and if anything, this concerned their ability to comply with operative objectives, such as "administrative efforts" [SOP6].

This is fundamentally different for science communicators working in subsystems of larger organisations. All of them spoke about conflicts related to goals, objectives and values. These conflicts sometimes seemed to originate from a lack of clearly defined communication goals and objectives by the organisation's management:

> "For us, everything is unspoken, because there isn't even a concept for public relations or communication and then it's basically irrelevant, everyone can do whatever they want. . . There are no requirements because nobody has developed any requirements. . . It sounds absurd [. . .] and our colleagues laugh as well, you can't even talk about it because everyone just shakes their head, but that is what it's like." [ROP9]

But there were also science communicators who seemed to struggle precisely with fulfilling the requirements once they had been spelled out:

> "[T]here are always conflicts between what you of course personally perceive as being important or relevant or whatever. . . And what you must communicate, what matters to the university or to the current university management." [ROP15]

This hints at the problematic discrepancy between the strategic goals prioritised by the organisation and the societal goals prioritised by the communicators themselves [Fecher et al., 2022].

Finally, the communicators were asked whether they felt that there is a (professional) community of science communicators and whether they belonged to it. Some readily agreed, but others doubted whether such a community exists:

> "[T]here is of course this group of communicators that you feel you belong to. . . But if that is such a uniform picture that you say, I mean you don't meet regularly. . . There is a gathering in Siggen each year with a select group of participants but there are also journalists that are invited and the group of I don't know 15 people who are invited is really very diverse I find. . . There are freelancers, scientists, who produce a podcast or something as communication or things like that or a blog, there are people from press departments and it is all really inconsistent, you do feel you belong as a group that is working on something but it's. . . It's a good question because I never asked myself this before." [ROP9]

Many communicators were cognizant of existing associations and gatherings: "I am always at the *Forum Wissenschaftskommunikation*!" [SOP13] one communicator enthusiastically affirmed. However, this was not always positive, one communicator in particular was quite critical, saying "It's no use at all, I haven't had any benefit of it" [NOP10]. In general, a mixed picture emerged, summarised by one communicator: "there really is a lot of shared understanding, but there are also differences" [SOP13]. This is why it was argued that various subcommunities had developed:

> "So I would say there is a community, but I would also say that there are clear yes…Subcommunities so that it is more differentiated […] so there is the area of journalism and the area of PR and I would say there is this area I come more from — a communal perspective or I rather do public engagement." [SOP4]

This directly relates to the science communicators' efforts to distinguish themselves from other professional groups, especially science journalists and people working in science PR. Many counted science journalists as science communicators, however, also took pains to emphasise that they themselves were not science journalists. A reason for this distinction was for example the choice of topic: "I don't choose my topics according to my target group but according to what I know and what I want to tell others and then I will find my audience" [NOP10]. Another science communicator mentioned that "in science journalism you don't work on behalf of an institution, and you have the obligation to be neutral and as a science communicator you don't necessarily have that" [NOP11].

Overall, the science communicators were quite unified in their agreement that they do not engage in science PR and much less often named science PR as part of science communication:

> "A person who is working in a press department and only writes press releases and contributions for websites is doing science PR, there is nothing wrong with science PR, but it is important that that person is employed and thus dependent and their main job is to do science PR for that institution — this person is not doing science communication." [NOP10]

Discussion: identity configurations in professional science communication

The aim of this study was to analyse whether science communicators across different organisational contexts share a collective professional identity and if so, how it can be characterised.

The results reveal the multifaceted nature of science communicators' professional identity. Just as described by Bayerl and colleagues [2018] they indeed seem to use similar building blocks, but each construct individual professional identity configurations characterised by different cores (roles), but also different content (values, goals and objectives). In fact, all the roles described by Leßmöllmann and colleagues [2017] but that of an "administrator" came up during the interviews. Beyond that, four additional roles were mentioned namely agenda-setter, contextualiser, advocate and multiplier. Also, as highlighted by Schwetje and colleagues [2020], the science communicators did all identify with several roles simultaneously and these were endorsed across the three organisational contexts

which suggests that identification with these roles is not restricted to certain types of communicators. The same seems to hold true for objectives and values, which were all shared widely across organisational contexts. The science communicators' goals in turn are the only area that explicitly showed tendencies for organisation-specific differences. Strategic organisational goals were particular to science communicators working in subsystems of research organisations. Furthermore, as has been suggested previously [Raupp, 2016], science communicators in this organisational context indeed struggled with reconciling the strategic goals of their organisation with their own societal goals. These societal goals, on the other hand, in line with Yuan and Besley's [2021] as well as [2016], were very popular among all science communicators.

The resulting variety of identity configurations is striking in so far that Bayerl and colleagues [2018] proposed that identity configurations may vary greatly across professions but less within one professional group. Particularities of organisational context might indeed be one explanatory factor. After all, science communicators working in subsystems of larger organisations claimed to experience conflicts not only related to goals, but also related to the objectives and values of their work. However, identification with the majority of the building blocks seemed to be independent from organisational context. This rather suggests that organisational context makes choosing certain building blocks more likely, yet choosing others not impossible, just harder. The fact that all communicators identify with different roles might also reflect the diversity of their everyday professional life, which is typically characterised by many different tasks. Specifically communicators working in the subsystems of larger organisations are additionally confronting the challenge that there is often (still) no uniform understanding of science communication at the level of the organisation. In this respect, science communication is often merged with other more general communication and marketing activities — specialisation and differentiation still pending at the organisational level. To test these hypotheses and explore whether organisational context does indeed have an influence on the identification with certain building blocks and identity configurations, quantitative studies relying on larger samples of professional science communicators are needed. These can explore whether and why certain identity configurations are more common than others. Using the organisational typology of science communication will allow a systematic tracing of the influence of organisational context on professional identity.

Another explanation for the variety of identity configurations is the relative "youth" of the profession. Given the fact that science communication as a field of practice has sprung into being so recently, with roughly 40 years of formation as a profession [Trench, 2017], it is fundamentally different from the professions classically analysed in terms of their professional identity, such as medical doctors [Pratt et al., 2006]. One effect of this might be the uncertainties surrounding their professional identity. As discussed previously many science communicators were doubtful whether they form part of the profession "science communicator", confirming the ambiguities that previous studies have identified [Collver & Weitkamp, 2018; Watermeyer & Lewis, 2017]. Another effect might be their desire to distinguish themselves from other professions [Cohen, 2020]. While the science communicators saw themselves as professionally closer to science journalists than to science PR, they clearly emphasised that they did not consider themselves to "be" science journalists. Interestingly, the roles embraced by the science

communicators show significant overlap with the roles of science journalists explored by Fahy and Nisbet [2011]. Indeed, only the identifications as multipliers, service providers and advocates do not appear in their typology of science journalists' roles. The science communicators themselves seemed to feel their job was somewhat "like" the job of science journalists, but they affirmed that science journalism was a different profession. With people working in science PR, on the other hand, they shared some essential values. Many science communicators explicitly quoted the guidelines for good science PR and all mentioned a number of values from the guidelines when they spoke about the ethical foundation of their work. While on the whole they clearly wanted to distinguish themselves from both professions, they do appear to share essential building blocks with both. This could not be further explored here but would be interesting to pick apart more meticulously in future studies by considering the perspectives of science communicators, science journalists and science PR persons. The theory of professional identity introduced here will offer a basis for exploring this systematically by considering which building blocks are shared, how these are understood as well as how this is reflected in the identity configurations typical for each profession.

From a theoretical perspective, it has been shown that transferring concepts from organisational sociology and psychology to the context of science communication can make fruitful contributions to science communication research. In addition to that, new roles were identified as part of the exploratory approach. These should be considered and quantitatively examined in future studies. Of course, the study comes with limitations: the qualitative exploratory design does not allow to draw conclusions about science communicators in general, but instead offers in-depth insights into the perspectives of the 15 communicators interviewed. Germany is an interesting case in point, however, analysing only one country naturally restricts the scope. Extending this exploration to other countries would allow cross-national comparisons and shed light on the prevalence of building blocks as well as identity configurations across national contexts. Interactions between national and organisational context given country-specific organisational conditions, such as funding requirements or institutional structures, might provide further captivating insights.

The study offers an in-depth insight into the multifaceted nature of professional identity among science communicators in Germany. The breadth of roles, goals, objectives and values that emerged from the interviews expands current knowledge about how science communicators view themselves and their work. The multiple roles with which communicators identify themselves particularly seem to reflect their diverse everyday professional and organisational life. Hopefully these insights can inspire future research on the complex professional identities of science communicators. Nonetheless, the study also confirms the uncertainties characterising science communication practice as it slowly moves towards establishing itself as a profession. Science communication has gained importance and yet science communicators still lack a unified understanding of their role, the goals and objectives they pursue and the values that guide them. Finding a common understanding will not only bring science communication closer to being a profession but also to fulfilling the crucial role it plays for society.

Appendix A. Information about interview participants

Table 2. Overview of interview participants.

Organisational context	Participant Number	Science communication background
No formal organisation (NO)	P5	Science comic creator
	P7	Science author and illustrator
	P10	Podcaster and live video moderator
	P11	Freelance event organiser and science writer
	P14	Science writer for a YouTube channel and TV show
Science communication Organisation (SO)	P3	Countrywide science communication organisation
	P4	Local public engagement organisation
	P6	Science shop
	P13	Science Centre (exhibition focus)
	P2	Science Centre (education focus)
Science communication subsystem of research organisation (RO)	P15	Midsize university (<10.000 students)
	P8	Large university of applied sciences (<20.000 students)
	P9	Large university (<20.000 students)
	P12	Small university of applied sciences (>10.000 students)
	P1	Midsize university (<10.000 students)

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