A JOURNAL BY SISSA MEDIALAB

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ARTICLE

Who supports STEM early career researchers' active science communication? A qualitative ego-network-analysis

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Abstract

Early career researchers (ECRs) are increasingly socialised in professional environments where science communication is seen as part of their academic role. ECRs respond to these expectations differently, shaped in part by social relationships within and beyond academia. This study uses ego-network interviews with 24 highly communicative STEM (Science, Technology, Engineering, Mathematics) ECRs in Germany to examine how social relationships influence the importance as well as the integration of science communication in their professional identity. Results show that recognition and support often come from private contacts and the science communication community, while workplace environments are perceived as less supportive and formative. Moreover, different formats and processes of science communication seem to be tied to distinct networks and underlying communication motives.

Keywords

Professionalism, professional development and training in science communication; Scholarly communication; Bridging research, practice and teaching

Received: 28th April 2025
Accepted: 15th November 2025
Published: To be published

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1 ▪ Context

Active science communication is increasingly becoming part of the professional roles of researchers [Peters, 2021], including early career researchers (ECRs). Following Milojević et al. [2018, p. 12620], we define *early career* as the "initial years of a researcher's presence in the field" (approximately five years). In the context of this definition, and depending on the national academic system, different academic groups fall under this category: for example, early-stage researchers immediately after completing their structured Ph.D. studies (as in the United States), as well as Ph.D. students who, in some countries, are employed by universities as scientific staff for research activities after completing a structured master's degree — e.g. in the German academic system.

Empirical large-scale studies conducted in some countries — for example within the German science system where this study takes place — indicate that ECRs are less involved in certain science communication activities compared with tenured professors [e.g. Ziegler et al., 2021, p. 10]. However, there are also ECRs who implement various communicative activities with a particularly high level of commitment and intrinsic motivation [e.g. AbiGhannam & Dudo, 2022; Adrian, 2022; Roedema et al., 2021]. At the same time, ECRs are being socialised in professional structures in which there is an expectation that science communication is an associated role of their profession — in addition to established roles such as research or teaching [Banse, Hendriks & Taddicken, 2025; Bennett et al., 2025].

Early professional socialisation (e.g. while pursuing a Ph.D.) strongly shapes researchers' views on their core professional roles [Hamann & Velarde, 2025] and their attitudes towards communicative activities [Bennett et al., 2025]. Social relationships with specific individuals or groups (e.g. supervisors, mentors, community of practice) appear to have a particularly strong influence on the formation of professional self-images in this phase [Baker-Doyle, 2013; Bennett et al., 2025; Zhang et al., 2023]. Only within such influential relationships is it possible for frequent social interactions to shape what is externally perceived as central to one's professional self. Accordingly, foundational theories on (professional) identity formation emphasise the critical role of networks of significant social relationships in shaping individuals' *professional role identity*; i.e. the way in which a person perceives themselves in their professional roles [Serpe et al., 2020].

In the context of growing demands, changing academic structures, as well as increasing motivation of ECRs to engage in science communication, it remains a central question how their social networks shape their identities as *communicating scientists* [Banse, Hendriks & Taddicken, 2025]. To answer this question, this study employs qualitative ego-network interviews [Hollstein et al., 2020], which aim to identify patterns in the structure and quality of ECRs' social networks. We interviewed 24 STEM ECRs in Germany regularly engaged in science communication and asked about their socialisation experiences, communication motives and social networks regarding support, expectations and appreciation for their science communication activities. The goal was to identify how social relationships within and external to the academic system shape their role identities as communicating scientists. In this way, this study aimed to derive theoretical and practical implications for the design of support and reward structures in scientific organisations and the broader academic system.

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2 ▪ Theoretical background

2.1 ▪ *Science communication of early career researchers*

There is now a large body of empirical research on science communication by scientists. However, few empirical studies have explicitly focused on ECRs' science communication [e.g. Adrian, 2022; Bennett et al., 2025; Riley et al., 2022]. In some countries (e.g. Germany) studies show that ECRs tend to communicate less actively than experienced tenured professors [e.g. Ziegler et al., 2021, p. 10]. Professors do not only possess greater externally perceived expertise due to experience and job title, but also larger networks within and beyond academia [Savage, 2013]. ECRs report a number of barriers to communication, including a self-perceived lack of skills or confidence in science communication, alongside fears of public failure or making mistakes [Adrian, 2022; Riley et al., 2022] and — similar to senior researchers — limited resources, time constraints and the low prioritisation of science communication in their professional contexts [AbiGhannam & Dudo, 2022]. For them, academic cultures continue to emphasise research-based, quantifiable success metrics for career advancement and recognition [Hamann & Velarde, 2025; Riley et al., 2022; Savage, 2013]. Financial incentives are perceived as insufficient [Bennett et al., 2025] and many ECRs report an absence of institutional support or suitable opportunities for engagement [Mason & Merga, 2022; Riley et al., 2022].

However, science communication may be perceived and taken up differently by ECRs compared to established scientists. For example, qualitative studies indicate that they tend to be more open to the possibilities of direct science communication via (new) social media platforms [Sanz Merino & Tarhuni Navarro, 2019], as well as to dialogical communication formats in general [Cerrato et al., 2018; Riley et al., 2022]. In addition, ECRs seem to value science communication somewhat more than established researchers [Rose et al., 2020], but do not yet strongly integrate communicative activities as part of their professional self-image [Adrian, 2022; Riley et al., 2022].

2.2 ▪ *Theoretical framework: role identity theory*

A useful theoretical framework for the described context is the *role identity theory* [Serpe et al., 2020]. *Role identity* here refers to the subjective, internalised relationship that an individual has established with a social role they have assumed (e.g. scientist, communicator, etc.) [Serpe et al., 2020]. Through social interactions in a wide variety of contexts, people internalise many different role identities over the course of their lives and it is argued that these are reflected in a psychologically represented dynamic overall system. For example, a scientist has typical professional roles that are prescribed by structural conditions and requirements, such as "researcher" or "higher education teacher", which are linked to specific task areas of the profession [Banse, Hendriks & Taddicken, 2025]. Role identity theory focuses on the subjective level and asks whether and how individual researchers understand these different professional roles as part of their professional identity. In line with this, a recent empirical study demonstrated that experienced STEM researchers have partially internalised the increasing expectations regarding active science communication as a (partial) role identity within their professional identity [Banse, Hendriks & Taddicken, 2025].

Identity prominence [Brenner et al., 2018] refers to the subjective importance that a specific role identity holds for an individual's self-concept, thereby indicating which roles are

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particularly central to their self-understanding [Serpe et al., 2020]. In the same study, researchers attributed lower identity prominence to their role identity as "communicating scientist" compared to established role identities such as "researcher" or "teacher/lecturer" [Banse, Hendriks & Taddicken, 2025]. However, some considered it more central to their own professional self-image when it was understood as integrated with particularly prominent professional roles (researcher, teacher/lecturer) [Banse, Hendriks & Taddicken, 2025]. This is consistent with studies on broader role identities of scientists, in which activities perceived as congruent with the goals of prominent research roles are more highly valued by ECRs [McAlister et al., 2022].

According to the theory, identity prominence is strongly linked to *networks of relationships* with social contacts relevant to a certain role identity [Burke & Stets, 2022]. It is only in interactions within social relationships that it is repeatedly reflected which behaviour of a person in a certain role is considered appropriate by their environment in a certain situation [Serpe et al., 2020]. This structural influence can operate through multiple mechanisms. Classical role theory suggests that perceptions and behaviours within roles are significantly shaped by (anticipated) *expectations* of significant social contacts toward the role-holder [Anglin et al., 2022] — for example, regarding which behaviours are considered appropriate or obligatory when occupying a specific social role (e.g. conducting methodologically sound research in the profession of a scientist). Role identity theory also argues that *appreciation* from such contacts for role-specific behaviours consolidates the individual's core understanding and meanings attributed to that role [Stets et al., 2020]. More specifically, if a role occupant perceives that their enacted role behaviour is met with approval and positive responses (e.g. praise) from relevant others, this reinforces the belief that such behaviour is appropriate for the role assumed in that situation [Stets et al., 2020]. Third, and beyond mere recognition, *active support* (material or immaterial) from key relationship partners facilitates role enactment, thereby positively influencing identity prominence [Brenner et al., 2018; Burke & Stets, 2022]. In this context, support refers to the perception that relevant others actively facilitate or promote the achievement of the focal role occupant's behavioural goals (e.g. through collaboration, the provision of necessary resources, or the active removal of structural barriers).

Empirical findings support the notion that relationship networks influence which professional identities emerge and how centrally or prominently they are represented in the professional self-concept of ECRs [Carlone & Johnson, 2007]. Particularly during the early socialisation of ECRs, relationships with significant contacts within the immediate academic system — especially supervisors and/or academic mentors — exert important influences [Jensen & Jetten, 2015; Merga & Mason, 2021]. While relationship partners from traditional academic contexts (e.g. other researchers, supervisors, mentors) appear to be linked to a classical "research scientist identity", science communication-related role identities seem to be shaped by more diverse relationship networks, such as family and friends, as well as science communication professionals and organisations [Bennett et al., 2025].

However, it remains unclear how science communication-associated relationship networks are structured and what specific influences they exert on science communication-related role identities. Based on the three influence mechanisms identified in role identity theory, we ask:

RQ1: *What influences do social (appreciation, support and expectation) networks have on formation and identity prominence of communicative role identities among ECRs?*

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Recent empirical studies have suggested that different communication contexts (e.g. personal digital communication versus public appearances on behalf of an institute) can lead to distinct role and identity conceptions in the context of scientists' science communication [Banse, Hendriks & Taddicken, 2025; Horst, 2013]. In the early phase of our analysis, it became apparent that similar patterns might also be present in our data. Following the qualitative research paradigm, which understands in-depth analyses as iterative processes [Ritchie et al., 2014], we decided to add an additional, initially unformulated, research question:

RQ2: *Which distinguishable role identity types can be identified among communicative ECRs and how are these linked to different relationship networks?*

3 ▪ Methods

We conducted 24 ego-network interviews between November 2023 and June 2024. This is a method that allows to identify significant relationship partners (*alteri*) in the context of a specific role or situation as well as the individual importance and characteristics of the relationships with these people from the perspective of a focal individual (*ego*) [Hollstein et al., 2020].

We interviewed ECRs in STEM disciplines from German research universities. Focusing on a single national context allowed us to exclude potential influences of varying science systems. Germany is particularly interesting case for this analysis, as it has only recently begun a strong institutionalisation process promoting science communication as part of researchers' professional roles [Weingart & Joubert, 2019]. In Germany, key political institutions have emphasised the importance of science communication in recent years [BMBF, 2019] and research funding bodies and academic institutions appear to be adapting accordingly. Thus, Germany provides a suitable context to empirically examine the impact of ongoing institutionalisation processes on researchers' communicative role identities.

3.1 ▪ *Recruitment*

The study specifically focused on German doctoral students in STEM disciplines, ensuring they were still in the formative phase of their careers, where professional identities are more dynamic. All participants were officially enrolled as doctoral students at German universities at the time of the study. In the German academic system, there is generally no formal milestone comparable to the US concept of "candidacy". From the start of their dissertation work, doctoral students typically engage directly in their research, often with employment contracts as research staff at university departments [Fabian et al., 2024]. Hence, in this study, following our initial definition, we regard them as ECRs.

Additionally, only persons regularly involved in external science communication were included. This ensured that participants a) had an internalised communicative role identities and b) could identify relevant social contacts influencing their internalised communicative role identities. Recruitment targeted platforms showcasing regular engagement in science communication, e.g. websites featuring science communication awards and competitions for ECRs, pages of science slams and event organisers and social media platforms such as Instagram, X, YouTube and TikTok. Efforts were made to achieve diversity in disciplinary

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backgrounds and gender distribution (see Table 1). Suitable participants were recorded in a recruitment list and contacted either via publicly available professional email addresses or through direct messages on their active social media accounts.

Recruitment was conducted in two waves. Since the effect of gender — especially on digital science communication by scientists — is a recurring topic of discussion [Huber & Baena, 2023], we aimed for an equal distribution of male and female perspectives in our sampling. Research disciplines can also be related to researchers' motivation for science communication and role orientation [e.g. Besley et al., 2013; Ho et al., 2020]. Hence, the second goal was to achieve an equal representation of different STEM disciplines. The first (main) recruitment wave took place in November 2023, during which a total of 51 individuals were invited to participate in the interviews. Of these, 24 agreed to take part (response rate: 47%). After 20 interview dates had been confirmed, the distribution was, as intended, reasonably balanced across the disciplines of biology ($n = 3$), biotechnology ($n = 3$), geosciences ($n = 3$) and chemistry ($n = 4$). There was a surplus of interviewees in physics ($n = 6$), while there were too few in engineering ($n = 1$) and informatics/computer science ($n = 0$) as well as mathematics ($n = 0$). The four potential interviewees who agreed to participate later than the others belonged to physics and chemistry, so conducting additional interviews would not have led to a more evenly distributed sample. For this reason, these four interviews were omitted.

During the analysis of the initial 20 interviews, the patterns of role identity types related to specific format contexts (RQ2), presented in the results section, already began to emerge. However, at that point, the sample included only four interviewees with high-reach social media accounts, who represented one of the types identified (see results section). The other two identified types showed repeating patterns indicating theoretical saturation [Ritchie et al., 2014], owing to their higher numbers of assigned cases, whereas this remained open for social media communicators. Therefore, a second recruitment wave was launched in June 2024. This time, only ECRs with active social media presences were recruited until theoretical saturation was also reached for this group.[1] We identified ten such ECRs using the method described above and contacted them. Six agreed to participate (response rate: 60%). Two of these confirmations, however, arrived only after the analysis of four further interviews, which had already demonstrated theoretical saturation for the third analytically identified type. Consequently, the remaining two interviews were cancelled, as they would not have improved either theoretical saturation or disciplinary distribution. This resulted in a final sample of 24 ECRs. While the goal of gender balance was achieved, this final sample included interviewees from three of the four major STEM disciplines, but no ECRs from the field of mathematics could be recruited (see Table 1).

After providing informed consent and agreeing to data protection conditions (see form in Supplementary material), participants were interviewed digitally via the Webex video conference software by the second author and a student assistant.

1. In the second recruitment round, aiming to achieve theoretical saturation in type formation, the focus was primarily on ECRs who independently managed digital communication channels with a broad reach, particularly on social media platforms. In the first recruitment phase, ECRs from mathematics and computer science had been notably underrepresented. We therefore deliberately sought interviewees from these disciplines. While the second recruitment phase succeeded in recruiting two interviewees from computer science, no ECRs could be identified who belonged to the discipline of mathematics and met our selection criteria (Ph.D. student at a German research university; visible social media profile).

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Table 1. Sample description ($N = 24$).

ID	*Discipline*	*Gender*	*Years since start of Ph.D.*	*Science communication activities*
1	Biology	male	3.5	own social media; science communication events; digital communication in work context;
2	Geosciences	female	3.3	own social media; digital and analogue communication in work context; internal science communication
3	Biotechnology	male	2.5	science communication events; award;
4	Physics	male	3.5	science communication events; educational outreach; science communication in work context;
5	Chemistry	female	4.5	own social media; digital communication in work context;
6	Biology	female	2.8	science communication events; digital and analogue communication in work context; internal science communication;
7	Biochemistry	male	3.0	science communication events;
8	Physics	male	3.0	science communication events; internal science communication
9	Physics	female	4.0	own digital video format; science communication events; educational outreach;
10	Physics	female	5.3	analogue and digital communication in work context;
11	Chemistry	male	3.0	science communication events;
12	Engineering	female	4.0	own social media; educational outreach; digital and analogue communication in work context;
13	Physics	male	2.0	analogue communication in work context; educational outreach; other (development of an outreach app)
14	Geosciences	female	3.0	own podcast; own social media; science communication events;
15	Geosciences	female	4.0	own podcast; own social media; analogue and digital communication in work context; internal science communication;
16	Chemistry	female	0.5	own podcast;
17	Biotechnology	female	2.5	science communication events; educational outreach; analogue communication in work context;
18	Physics	male	2.0	science communication events;
19	Biology	male	4.0	science communication events;
20	Biotechnology	female	2.5	own social media;
21	Engineering	male	2.0	own podcast; own social media;
22	Computer Sciences	male	4.0	own podcast; own digital video format; own social media;
23	Biology	female	3.5	digital communication in work context; own media work; internal science communication;
24	Biology	male	3.0	own social media;

3.2 ▪ *The participants*

All participants were between 25 and 34 years old and have been working on their research for an average of 2.8 years ($SD = 0.90$, $min = 0.50$, $max = 5.30$). The interviewees came from 19 different research institutions located in nine different German federal states in four regions into which Germany is often divided: North ($n = 5$), South ($n = 6$), West ($n = 6$), East

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($n = 7$). They came from different typical organisational contexts of scientific organisations in Germany, including general universities (n = 12), technical universities ($n = 8$), non-university state research institutions ($n = 4$), medical universities ($n = 1$) and universities of applied sciences ($n = 1$). Overall, the sample can be considered broad enough to identify different perspectives on typical structural conditions of research professions. Table 1 illustrates disciplines and further demographic data.

37.5% engaged in active science communication at least once a week, indicating an above-average engagement frequency. Their communication activities ranged from collaboration on the digital presence of their own research institute, regular participation in science slams or public events to very wide-reaching personal social media accounts or podcasts, some of which have many thousands of subscribers. From the participants with personal science communication social media accounts ($n = 11$), four had 400–1000 followers, five had 1000–3000 followers and two had more than 10.000 followers. Of participants with personal YouTube channels ($n = 3$), two had more than 10.000, one more than 180.000 followers. The five participants with personal podcasts all had more than 200 listeners per episode, with two of them reaching more than 2000 listeners with each episode.

3.3 ▪ *Interview procedure*

Prior to the interview, participants completed a brief questionnaire capturing socio-occupational demographics, science communication activities and communication frequency. To assess role identity prominence, respondents rated their identification with three key professional roles — "researcher", "teacher" [the most relevant for early-career researchers; McAlister et al., 2021] and "communicating scientist" — using an established four-item instrument [Brenner et al., 2018] on 5-point agreement scales (1 = "*strongly disagree*", 5 = "*strongly agree*").[2] The short questionnaire with all full items formulations is available in the Supplementary material.

The interview guide (see Supplementary material) was divided into two main sections. The first section explored participants' science communication activities, their initial engagement motivations and the goals and motives that sustained their involvement. The second, more structured section followed the approach of ego-network interviews [Crossley et al., 2015; Hollstein et al., 2020]. Using network generators [Crossley et al., 2015], participants identified key contacts within four predefined dimensions, namely individuals or groups who:

(a) support their science communication,

(b) expect such activities from them,

(c) explicitly express appreciation for their engagement, or

(d) assert other influences that the participants considered to be important.

Participants could list as many contacts as they wished, but to maintain interview consistency, those who named more than three per dimension were asked to identify their three most

2. Since the identity theory chosen here as a theoretical framework focuses on individuals' purely subjective associations with social role categories [Serpe et al., 2020], we deliberately did not provide strict definitions for each of the three roles.

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important contacts. In the subsequent interview phase, various relationship descriptors [Crossley et al., 2015] were explored for each network dimension, systematically rotating the order across interviews. For up to three contacts per dimension, participants provided detailed information about their relationship partners and their influences on their science communication role identity. Questions covered aspects such as relationship definition and label, frequency and type of contact, how appreciation, expectation and support were expressed, the anticipated motives of the named contacts and their impact on the participants' identity as a communicating scientist. This process was repeated for all mentioned relationships. At the end of the interview, participants were asked to identify which relationships — across all dimensions — they considered *most influential in shaping their science communication role identity* and to explain their reasoning.

All interviews were conducted digitally via Webex, recorded and automatically transcribed using f4x. On average, the interviews lasted 52.5 minutes (*SD* = 12.23, min = 30.09, max = 74.47).

3.4 ▪ *Analysis*

The analysis employed a combination of thematic analysis [Braun & Clarke, 2006] and qualitative ego-network analysis [Crossley et al., 2015] and was carried out in MAXQDA, a CAQDS software for qualitative research. First, the interviewees' significant social relationships and their influence on science communication were reconstructed. Initial codes, aligned with the interview guide (e.g. "appreciation relationship", "support relationship", "expectation relationship", "type of contact", "perceived influence on science communication"), were incorporated into a coding scheme. The first author and a student assistant pre-coded the material, followed by independent open coding to develop inductive categories, which were refined through discussion and testing before being finalised (see results section and coding scheme in the Supplementary material). Both coders then applied these codes to the full dataset, discussing any potential misalignments.

The result was a list of typical influence relationships, which were subsequently assigned during final coding to all relationships mentioned by participants in the interviews (see Table 2). Using MAXQDA, the following ego-network analysis (see Supplementary material for more details) identified the number, structure and subjective influence of relationships within four network types (expectation, support, appreciation, other). Through interpretative thematic analysis (with several discussion rounds in the research team), we then identified overarching themes linking different role identities to distinct relationship networks.

Intersubjective comprehensibility was ensured throughout all analysis phases.[3] During deductive pre-coding, initial codes were tested for overlap in MAXQDA by both coders. Once finalised, the inductively generated codes underwent an inter-coder reliability test [O'Connor & Joffe, 2020] designed for qualitative studies, yielding satisfactory results (see coding scheme in Supplementary material).

3. The concept of *intersubjective comprehensibility* refers to the (qualitative) shared understanding of codes and their application among researchers, achieved through ongoing discussion, joint review of coded segments, and iterative refinement of the coding scheme. We complemented this qualitative quality assurance measures with a *quantitative reliability test* for the final coding scheme (see appendix) to empirically demonstrate that the final coding was based on codes that were intersubjectively comprehensible. This additional test is important as it provides an explicit, measurable indicator of coding consistency.

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4 ▪ Results

4.1 ▪ *Descriptive results: identity prominence*

All interviewees identified very strongly with their communicative roles. For many of them the prominence value measured in the questionnaires for the role identity *communicating scientist* ($M = 3.96$, $SD = 0.57$, $min = 3.00$, $max = 4.75$) was similarly high or even higher than the values of the more traditional academic roles of *researcher* ($M = 4.20$, $SD = 0.80$, $min = 1.50$, $max = 5.00$) and *teacher* ($M = 1.86$, $SD = 0.90$, $min = 1.00$, $max = 4.00$).

4.2 ▪ *Descriptive results: network size*

A number-based comparison of the individual network sizes along the three generator dimensions (expectations, support, appreciation regarding science communication) with the identity prominence values of the interviewees initially showed no clearly recognisable connections. One reason for this may be that the interviewees (for exploratory reasons) were allowed to name both individual persons (e.g., supervisor) and groups of unspecified size (e.g., followers), but both were counted as one named contact. The distribution of mentions along the various network generators in Table 2 showed that relevant contacts from all of four identified domains (direct work context, broader academic system, science communication system, interviewees' private sphere) were mentioned. While these first three columns reflect absolute counts irrespective of the attributed importance or meaning, the fourth column ("Mentioned as important (%)") indicates the percentage of interviewees who named a given relationship type in response to the specific question, "Which contacts have a particularly important influence on your science communication role?" The table thus captures both the quantitative and the perceived qualitative aspects of the identified influence relationships.

Participants reported the largest networks in response to the appreciation question, with a mean size of $M = 5.21$. Support networks were slightly smaller on average ($M = 3.67$). In contrast, only few contacts were perceived to expect science communication from the participants, reflected in a notably small average network size ($M = 1.17$).

4.3 ▪ *RQ1: appreciation networks*

The following paragraphs on the influences of the different network types should be understood as "average patterns" that apply to most of the interviewees — regardless of their more specific communicative role identity type which is reported in the section describing findings for RQ2.

Appreciation originated primarily from the interviewees' **private environment**. *Family* and *friends* showed interest by asking questions or receiving the activities themselves and subsequently gave praise and recognition. Overall, many of the interviewees found this perceived recognition to strongly reinforce their performed communicative role identity. While they also perceived positive feedback from the **direct work context**, especially from *direct colleagues* and *superiors/supervisors*, some regarded this appreciation as superficial, often feeling it having limited relevance for reinforcing their communicative identity:

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Table 2. Identified relationship types (ordered by social domains) with absolute mentions along the four network questions across all interviews ($N = 24$).

Domain/Relationship type	*Expectation**	*Support**	*Appreciation**	*Other**	*Mentioned as important (%)***
Direct working environment (Sum)	*18*	*37*	*43*	*3*	
Professional communicator	4	9	4	0	16.67%
Supervisor	5	13	17	2	12.50%
Direct colleagues	2	9	13	1	33.33%
Employer organisation	7	6	9	0	16.67%
Broader academic system (Sum)	*1*	*4*	*7*	*0*	
External researchers	0	1	3	0	4.17%
Funding bodies/financiers	1	3	4	0	8.33%
Science communication system (Sum)	*5*	*16*	*25*	*17*	
Scicomm community	0	3	4	3	4.17%
Scicomm organisations	1	8	4	2	25.00%
Communication-Buddy	0	3	2	0	8.33%
Journalists/media representatives	1	2	2	1	8.33%
Audience/Followers	3	0	13	3	33.33%
Role model(s)	0	0	0	8	12.50%
Private sphere (Sum)	*4*	*29*	*45*	*6*	
Family	0	7	16	3	20.83%
Friends	0	11	20	2	41.67%
Life partner	0	11	9	1	33.33%
Interviewees themselves	4	0	0	0	0%
Other	*0*	*2*	*5*	*1*	4.17%
Average network size (per interviewee)	**1.17**	**3.67**	**5.21**	**1.13**	

Note. * The numerical figures refer to the total number of contacts mentioned across all interviews that are assigned to the respective categories. In the table, they are shown divided according to the four network generators: Support, Expectation, Appreciation, Other Influence; ** Important Contact = proportion of interviewees (%) who named contacts in the respective category as having a particularly important influence on their own role identity as a communicating scientist.

> When I feel that the feedback is more along the lines of, 'Oh, it's great that you're doing this', implying something like 'Then I don't have to do it myself,' [...] it can sometimes be quite frustrating, because it means that what I do and the amount of effort involved isn't truly recognised at work. (I-10)[4]

A few interviewees were in loose contact with *science communication organisations* that organise workshops as well as community meetings. They also perceived recognition and praise from a currently growing *science communication community*. In some cases, this was considered particularly important, as the people in the community were often considered as being able to provide useful feedback. However, by far the highest importance was the

4. All interviews were conducted in German. The analysis was also carried out using the German interview transcripts. All quotations in the text have been translated into English for international comprehensibility.

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recognition they experienced in direct interaction with their *target groups/audiences*: "What I enjoy most is actually the feedback from the people who listen to it. Really seeing that even people who are completely new to this topic, that they are enthusiastic and see valuable contributions to their lives." (I-03)

The interviewees often directly observed such impact of their own role performance, for example, in the context of appearances at science communication events such as science slams but also via (high reach) digital channels, e.g. podcasts or social media offerings. Although the interviewees communicated about science on highly diverse channels and with sometimes vastly different audience reaches, the analysis clearly revealed that any form of direct audience engagement was perceived as highly influential in shaping their own communicative role identity — regardless of the topics communicated or the specific channel used. The positive feedback from the target groups — be it via digital likes, shares or comments or via applause and laughter at event — was the main reason for most of them to continue to perform their communicative roles and therefore the core driver for the further development of communicative role identities: "They are the reason I do this; without their feedback, my motivation would probably vanish very quickly." (I-17)

4.4 ▪ *RQ1: support networks*

Interviewees affiliated with *science communication organisations* — for example, by adopting formats on their behalf, participating in competitions/awards organised by them, or appearing or moderating at events upon their request — benefited primarily from opportunities for public exposure, specialised training, informational resources and sometimes financial compensation. The broader **science communication community** primarily supported them through increased visibility and networking opportunities. For some interviewees, the exchange and mutual support within relevant communities provided new inspiration for their own science communication activities, while simultaneously fostering a sense of belonging: "They provide me with a certain sense that I belong. When everyone gathers after a science slam to have a beer or something, it creates a real feeling of community." (I-08) However, several interviewees perceived such an active science communication community as only gradually emerging in Germany.

From their **private sphere**, *friends*, *family* and *life partners* provided emotional encouragement and frequently served as test audiences, offering technical help or valuable audience-perspective feedback to refine communication practices: "Often, they provide feedback about what works and what doesn't, where something was confusing, where it was easier to follow, or where perhaps things moved too quickly." (I-03) *Life partners* (e.g. wives/husbands, girl-/boyfriends) also provided essential understanding and personal space for these additional responsibilities: "This allows me to work extremely flexibly and occasionally prioritise my own personal interests." (I-20)

Support from networks within the **immediate work context** was perceived and evaluated very differently by interviewees. For a significant portion, *direct colleagues* reviewed content prior to public appearances or publications upon request and provided scientific feedback regarding the accuracy and relevance. Although often described as colleagues, these individuals were typically informal, friendship-based contacts, calling into question whether such support truly belongs exclusively to the professional context. Apart from this informal support, interviewees generally reported limited active support from their professional

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environment. Only a few maintained regular contact with *professional communicators* within their organisations, who occasionally assisted them with the planning and technical implementation of specific communication formats: "I provide the scientific input or ideas for content pieces that could be used in science communication. In return, she is highly skilled, for instance, in design and layout." (I-01)

The interviewees relatively frequently mentioned their *direct supervisors* as support relationships. However, the reported support in most cases referred merely to supervisors accepting communication activities without actively obstructing them: "My supervisor doesn't really influence what I do; he simply doesn't put obstacles in my way." (I-14) While some interviewees genuinely appreciated this passive form of support, the analysis revealed a clear separation for many — particularly those highly engaged in science communication — between their professional identities as traditional academic researchers and their communicative role identities [see Bennett et al., 2025]. Interviewees partially attributed this disconnect to the lack of integration of their communication activities within organisational processes of the academic system: "More generally, the university environment and our graduate school provide few incentives for engaging in science communication, I can't see any real integration." (I-23)

4.5 ▪ *RQ1: expectation networks*

In general, many participants noted that they perceived little to no direct expectations regarding their active participation in science communication. Accordingly, several interviewees indicated that their motivation arises more from **internal drivers** — such as personality traits, including a self-identification as a communicative person — rather than from external demands. For some, they themselves were the ones who placed the highest expectations on their communicative work:

> It happens almost subconsciously, because I know in the back of my mind that I haven't posted anything in a week. There are certain formats where I have this internal clock telling me, 'Okay, it's time again', sometimes on a weekly rhythm. (I-01)

When external expectations were perceived, they primarily originated from the interviewees' **immediate professional environments**. Several participants described science communication activities as officially assigned tasks within their *organisation*. For them, institutional science communication was considered part of their formal work duties: "Everyone must contribute something to the institute community, whether it's teaching, outreach, or other projects. [...]. It's an unwritten law, so to speak." (I-10)

When such responsibilities or implicit expectations were set by *supervisors* or the *employing organisation*, participants frequently reported experiencing implicit or even explicit pressure. A similar perception was expressed when science communication activities were financially supported by *funders*, *scholarship providers*, or *external organisations* — often accompanied by a perceived obligation to produce communicative output in return. These officially framed expectations, closely tied to their core scientific work, tended to foster a stronger integration of the academic-professional identity with that of a science communicator.

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Moreover, several interviewees who operated high-reach social media accounts reported that they felt a growing sense of responsibility toward their *followers*, who expected regular and high-quality content. While this perceived external pressure can serve as a motivating force to continue engaging in communication, a few participants also noted that these ongoing demands can become a source of stress: "Sometimes it's actually a bit stressful, especially when I know I'm going through a super busy phase, and I still want to meet these expectations — both those from my followers and from myself — to publish at least one post a week." (I-05)

4.6 ▪ *RQ1: other/additional networks*

In addition to listing contacts along the three deductively derived network generators, interviewees were given the opportunity to name additional relationships they perceived as influential to their communicative role identities. Here, one additional relationship type emerged clearly across several interviews: the influence of *role models in science communication*. Many participants reported that, even before becoming active themselves, they regularly engaged with the content of other researchers who were already successfully practicing public science communication. These role models fulfilled multiple functions: they illustrated available formats and audiences for science communication, showed that there was a public demand for such kind of communication, inspired ongoing engagement and, for some, exemplified how academic and communicative identities could be successfully integrated and recognised:

> A friend of mine pointed out to me that there are podcasts like this. [...]. That's when I realised that there was something outside of university, outside of traditional school learning. That was the thing that made me realise: 'Hey, cool. There's something going on, maybe I can do it myself.' (I-21)

4.7 ▪ *RQ2: different science communication processes and networks shape diverging communicative role identities*

During the analysis, it became evident that the influence of social relationship networks on the communicative role identities of the interviewees varied systematically depending on the type of science communication they primarily engaged in. Based on their responses on questions concerning their initial contacts and experiences with science communication, the circumstances under which they began, their core activities and their main motivational drivers, we identified *three clearly distinguishable types of communication engaged ECRs*. While the themes reported in the previous section generally apply to most of the interviewees, regardless of their specific role identity type or the science communication activities they engaged in, the role identity types presented in the following section are conceptualised as *ideal types*. That is, they describe patterns in the interview material that reflect certain characteristics consistently observed among interviewees assigned to one of the three types. The themes reported within each type are largely specific to that type. As these types are constructed as ideal types, individual interviewees could possibly be assigned to one, multiple, or none of them.

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Science event entertainers (EE) showed a pre-existing interest in communication (even before starting their Ph.D. studies), but specifically in face-to-face and performative formats. Their entry into science communication typically followed informal invitations or suggestions from colleagues or institutions, often through formats such as local science slams or events. These, in their perception, had low entry barriers because they took place in environments perceived as "friendly" and "safe", such as the own institute or research centre (with mostly known faces in the audience). While their interest was already present, the decisive motivation to act came through these external opportunities:

> I have been interested in the topic [science slam] for a long time. I have always enjoyed talking to people about science in a general context. And then this opportunity came up very spontaneously. This science slam was advertised within the department because that's where it took place. And that was the trigger for it being advertised in our department, where I know the people anyway. So, I said to myself then: Okay, I enjoy doing this anyway, I'd like to get more involved. And so, I seized the opportunity and took the plunge. (I-04)

They strongly valued audience feedback and the direct experience of impact, particularly the emotional resonance of entertainment based live interaction. Their motivation remained predominantly intrinsic, cantered around enjoyment and personal expression. Due to the episodic nature of the event formats, their communication frequency was concentrated in a few, but very intensively experienced, event-based occasions. Their *communicative role identity* was closely linked to specific event- and entertainment-based formats and environments. Even if the communication of scientific content was also a partial motivation, their role identity was more closely linked to their self-image as an "entertaining person" (I-13). Since the events were often organised by specific science communication organisations, these organisations played one of the most important roles for this type. In addition, a strong science communication community orientation was evident here, which lead to a particularly strong sense of belonging through intensive shared experiences in the context of recurring events: "I now simply have the feeling that I belong there." (I-20)

Work-place communicators (WP) entered science communication primarily through formal or informal dynamics within their institutional environments. In many cases, they were identified as communicative by supervisors or communication officers and were encouraged to participate in science communication activities as part of their professional tasks. While some also expressed intrinsic enjoyment or societal motivation, their engagement was often linked to implicit expectations and professional responsibilities. Their *communicative role identity* was more functionally embedded within their core academic role. Hence, it was shaped by collaboration with scientific colleagues, professional communicators and supervisors, rather than being rooted in personal channels. Their motivation was more externally contextualised and their communication activities were typically integrated into broader institutional communication strategies. Of all three types, their communicative role identities were thus most strongly integrated with core work roles in the academic context: "Because it is part of academia. It is how we all see ourselves." (I-15) The interviewees here predominantly identified as communicative actors of their organisations. Although these interviewees strongly integrated their communicative role identities with their identities as

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academic researchers and were generally motivated to pursue a scientific career, they also ranked the role identity of a communicating scientist relatively high in the short questionnaire. This suggests that a strong identification with communicative roles is not limited to intrinsically motivated young scientists who view science communication primarily as a personal hobby but can also be found among those who regard it as an integral part of their academic work.

Science influencers (SI) were characterised by an early and often self-initiated interest in both scientific and communicative activities. This type often began engaging with popular science communicators on social media platforms and was inspired by these role models to explore digital science communication themselves. Their motivation was primarily intrinsic, rooted in personal enjoyment of communication, creative expression and, in some cases, the perceived societal relevance of their research. This group typically launched their own formats — such as podcasts, Instagram accounts, or YouTube channels. Their *communicative role identity* was strongly individualised and closely tied to their personal platforms and audience feedback, which reinforced both motivation and self-concept as a communicating scientist. They communicated very frequently and predominantly outside formal institutional structures. Since they were able to achieve success with their communication activities very autonomously, they linked their communicative identity very strongly to themselves as private individuals. Confirmation and appreciation mainly came digitally from followers and other people in the (digital) science communication community. Support (if any) was provided by committed people from the private sphere, sometimes content-related advice from scientific colleagues and, in some cases, co-hosts (science communication buddies) of the specific formats. This type identified very strongly with their communicative role but separated it very strictly from their core work role as an academic researcher: "The podcast only comes from me [...]. And that's why I actually try to stick to myself as much as possible and just do it the way I think is right." (I-10) Hardly any relevant influence was perceived from the institutional environment of the academic system; in some cases, the interviewees even reported barriers:

> When we started the podcast, university communication was initially against it. We were then allowed to do it, but with very, very severe restrictions. So, we couldn't do it the way we wanted to. I rather have the feeling that institutions are restricting us a lot. (I-14)

5 ▪ Discussion

We explored how different types of social relationships shaped the formation and subjective prominence of communicative role identities among German ECRs engaged in science communication. Drawing on role identity theory [Serpe et al., 2020], the qualitative ego-net analysis allowed insights on appreciation, support and expectation networks as key influence dimensions. In line with previous research [Bennett et al., 2025], our findings show that communicative role identities among ECRs are shaped by broad and diverse social networks, more so than traditional academic identities, which are typically rooted in research-centric relationships. Instead, in our study, private relationships (friends, family and life partners), connections to Germany's evolving science communication community [Fischer & Schmid-Petri, 2023], and particularly audiences were cited as most influential for shaping and maintaining a communicative role identity. The findings hold several theoretical and practical implications, which are presented and discussed in the following section.

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5.1 ▪ *Shifting support and expectations towards communication-motivated scientists*

Notably, interviewees across all three identified communication types (SI, EE, WP) expressed strong identification with the communicating scientist role. Especially notable was that such identification was similar to, or even higher than identification with the traditional academic roles "researcher" and "teacher", even among those ECRs planning to remain in academia. This may reflect the purposive sample of highly engaged communicators. However, it nevertheless indicates that communicative and academic identities can be integrated even within the formal academic context [Bennett et al., 2025]. These findings suggest that policymakers and research institutions might consider targeted support toward those ECRs who already self-identify as communicative individuals and have high intrinsic motivation for science communication. Support programs (e.g. dedicated fellowships, micro-grants, or mentoring schemes [Bennett et al., 2023]) could offer recognition and resources for science communication without the inclusion in formal performance requirements.

5.2 ▪ *Facilitating collaboration and support relationships within organisational contexts*

Institutional actors, especially supervisors, were not perceived very influential in the formation of communicative role identities. While sometimes appreciation was acknowledged, it was often perceived as superficial and tied to reputational interests. Very few participants experienced active institutional support or role modelling [Baker-Doyle, 2013; Boyd et al., 2021]. These findings reflect a lack of structural integration of science communication into the everyday academic work of ECR, already shown in earlier studies [Adrian, 2022; Riley et al., 2022]. They also show a broader institutional tendency to favour conventional performance indicators, i.e. publication numbers and teaching [Hamann & Velarde, 2025], whereas public engagement remains perceived as an additional activity. In contrast, those interviewees who had access to dedicated professional communicators within their institutions reported more meaningful and structured support. These individuals often served as strategic partners [Banse, Fischer & Hendriks, 2025; Koivumäki et al., 2021], assisting with planning, technical execution and format design. Such collaboration was perceived to enhance the communication quality and to strengthen communicative role identities; at least when researchers were involved in shaping central content and strategic aspects of communication. From a relational perspective, these kinds of partnerships could be central to overcoming the commonly seen divide between communicative and academic identities [Bennett et al., 2025]. Incorporating ECRs into current communication infrastructures — i.e. through residency or internship programs in university communication departments [Hendriks et al., 2023] — could facilitate skill development, provide direct feedback experiences and increase mutual understanding.

5.3 ▪ *Institutionalising communities of practice among communicative researchers*

Where institutional support was absent, participants often turned to informal or semi-formal science communication communities. These communities — comprising peer networks, event formats and dedicated organisations — were repeatedly described as providing emotional validation, practical help and opportunities for creative exchange. Drawing on the concept of "communities of practice" [Wenger, 1998], these findings suggest that identity development in science communication can be encouraged by communal practice, informal mentorship and the feeling of belonging to a community [Fischer & Schmid-Petri, 2023].

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This could be formalised by research institutions through provision of practice groups, peer networks, regular meetups or thematic exchange forums for communication-interested ECRs [Hendriks et al., 2023].

5.4 ▪ *Translating impact experiences into institutional learning*

For many interviewees, direct audience feedback — whether at live events or through digital formats — was the most meaningful affirmation of their role as science communicators [Stets et al., 2020]. This supports prior work linking identity salience and prominence to the frequency and intensity of role-related interactions [Serpe et al., 2020]. Audience recognition reinforced participants' intrinsic motivation [Deci et al., 2017], enhanced their self-efficacy and validated their communicative "impact identity" [Risien & Storksdieck, 2018]. However, interviewees with few institutional or peer connections often reported feeling isolated or overly self-reliant. In such cases, their role identity became decoupled from professional norms and was instead rooted in personal initiative and follower engagement. Similar patterns of autonomy have been observed in recent studies with senior researchers, suggesting that without institutional anchoring, communicative roles risk remaining external to the academic identity system [Banse, Hendriks & Taddicken, 2025]. Given the powerful identity-shaping effect of direct audience feedback, institutions could explore building opportunities for gathering experiences with public audiences for ECRs. Structured formats — such as public labs, or moderated digital communication — could be embedded into Ph.D. and training programs for researchers to provide ECRs with meaningful interactions and reflective tools, possibly fostering long-term motivation and identity alignment.

5.5 ▪ *Towards a more differentiated analysis of science communication processes*

Finally, the study highlights that science communication is not a monolithic activity but encompasses distinct formats, motivations and identity types [Bennett et al., 2025; Banse, Hendriks & Taddicken, 2025]. The three identified types — science influencers, science event entertainers, workplace communicators — not only differ in communication formats and outlets, but also in the relational networks that shape their communicative identities. These divergent paths are tied to different norms, values and support systems and suggest the need for differentiated approaches to studying and supporting science communication, as proposed by Davies and Horst [2016]. Treating "science communication" by researchers as a single, unified category risks obscuring this diversity. Future research should therefore disaggregate science communication processes and examine which identity dynamics and relational constellations are associated with each type.

6 ▪ Limitations & conclusion

The findings of this study need to be interpreted in view of several limitations. Most importantly, the sole focus on the German academic context limits the generalisability of the results. The expectations and support structures for ECRs' science communication can differ significantly across different national contexts. While considering relations between social networks and communicative role identity development need to be reflected in light of national systemic, institutional and organisational settings. Future research should ensure generalisability by considering different national contexts. Similarly, a focus on STEM fields

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restricts transferability to other areas of academia, where communication culture and identity processes may be different. Secondly, the qualitative study design and the small, purposive sample were appropriate to the exploratory nature of the study but limited the scope of the quantitative analysis. Follow-up studies using larger-scale quantitative survey data could help examine the extent to which particular types of support or expectations systematically influence communicative role identities or motivations among researchers. Third, to identify communication-active ECRs across institutions, participants were primarily recruited via platforms featuring public science events and digital outreach formats. It is therefore likely that researchers working in high-profile formats are overrepresented in the sample, which may have biased the identification of the three types of communication. Future studies should include scientists active in less publicly visible or institutionally embedded science communication contexts. In this way it could capture a more comprehensive range of relational influences across science communication practices. Furthermore, even in this rather highly communicative sample, the actual communication frequencies and audience interactions vary greatly in some cases. Since different communication platforms with different interaction options and ranges can potentially have very different effects on the perception of audience interactions (a key influencing factor on identity formation identified in this study), future studies could examine audience engagement on specific platforms in a more targeted manner and compare them if necessary.

Lastly, in the short questionnaire, participants rated their identification with different professional roles of scientists (researcher, teacher, communicating scientist) without being provided with explicit definitions of these roles. While this approach aligns with the theoretical perspective of role identity theory [Serpe et al., 2020] underpinning this study, participants may have relied on differing subjective interpretations. Consequently, the quantitative results may be biased and should be further examined in future research using predefined role categories with clear definitions.

Overall, this study offered a first systematic and exploratory examination of how social relationship networks across academic and non-academic domains shape the formation and prominence of communicative role identities among STEM ECRs in Germany. The findings show the importance of social environments for forming internalised identities and how these are linked to specific science communication practices. With this, this study highlights the substantial potential to further disentangle the diverse motivational, relational and identity-related dynamics that underlie researchers' engagement in public communication.

Acknowledgments

Funding statement. This research was conducted as part of the Junior Research Group "Communicating Scientists: Challenges, Competencies, Contexts (fourC)", granted to Prof. Dr. Monika Taddicken and Prof. Dr. Barbara Thies, TU Braunschweig, funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy — UP 8/1. The funders had no influence on the conceptualisation, data collection, interpretation, and reporting of this study.

Declaration of conflicting interest. The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Use of AI. A few parts of this manuscript were edited for language (spelling, vocabulary and grammar) using the tools ChatGPT (Version GPT-4o) by OpenAI and DeepL Translate (between January and April 2025) by DeepL SE. Prompts were used such as "Are the grammar and spelling in this section correct? If there are errors, make a correction." We declare that all conceptual and theoretical ideas were developed entirely by the authors and they take full responsibility for the contents of this manuscript.

Ethics statement. Ethical approval was not required for the studies involving humans because this study was conducted in line with the ethical guidelines of the International Communication Association (ICA; https://www.icahdq.org/page/MissionStatement) as well as the German Communication Science Association (DGPuK: https://www.dgpuk.de/de/about-us/ethikkodex-und-ethikausschuss), and the General Data Protection Regulation (GDPR; http://data.europa.eu/eli/reg/2016/679/oj) of the European Union. We did not ask for formal ethical approval because the following conditions were met: (1) We did not collect data on vulnerable groups. (2) We did not deceive participants (no experimental conditions) or withheld information from them. (3) No questions were asked on particularly sensitive topics (e.g. religion, politics, ideology, sexuality). (4) The participants were informed that they could exit the interviews at any time without any consequences. (5) We comprehensively informed participants about the study, the data collection, the planned publication and data protection measures and asked them to provide explicit informed consent before data were collected. (6) The study was conducted in accordance with the local legislation and institutional requirements. The procedure as well as the consent form (see Supplementary material) was approved by the Data Protection Officer of the Technische Universität Braunschweig. The participants provided their written informed consent to participate in this study.

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How to cite

Banse, L., Heinke, F. and Hendriks, F. (YYYY). 'Who supports STEM early career researchers' active science communication? A qualitative ego-network-analysis'. *JCOM* 25(01), A02. https://doi.org/10.22323/1566202511150647 27.

Supplementary material

Available at https://doi.org/10.22323/1566202511150647 27

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