Talking about the Big Bang:
An exploratory study of how Russian science communicators use social media

Valeriia Rudneva
Science communication in Russia has been developing fast during the last several years: new popular science projects, educational programmes for science journalists and science communicators, new media channels have appeared. Social media play a significant role in this process because of its unprecedented capacity to bring science closer to the public. This study is aimed at providing an understanding of how leading Russian science communicators, often famous science journalists and lecturers, manage their VK and Facebook profiles. Content and discourse analysis were used to examine communication strategies and to find patterns in the communication of those responsible for public science promotion. The investigation provided an understanding that 2 out of 5 science communicators devote about 50% of all the content on their pages to science or science popularization domain and miss "a rich opportunity to discuss science with the nonscientists in their networks by actually posting [scientific materials]" (McClain 2017: 4). Analysis of subscribers' likes, comments, and shares demonstrated that people are ready to consume scientific content: the most liked and shared posts on several analyzed pages are connected to these topics.

Semi-structural interviews opened up to science communicators' own views of science communication development in Russia and the role of social media in science communication. Interviews confirmed that science communicators comprehend the difference of VK (more suitable for communication with a wide audience) and Facebook (space for communication with other scientists and foreign colleagues). Moreover, they stated that they had strategies for communication with their subscribers in social media, but their number is quite modest.

Previous studies focusing on a Russian context have been connected to the contemporary evolution of science communication in Russia. However, these studies rarely analyze the modern market. This thesis aims to bridge the gap and to deepen the understanding of Russian science communication development.

**Nyckelord/Keywords**
Science communication, social media, science popularization, science in media, popular science
Acknowledgments

I would like to thank the Swedish Institute (SI) and to express the deepest appreciation for the support during the Master's programme. This research and my studies in Stockholm University overall have become possible thanks to SI.

I would also like to thank my supervisor Jörgen Skågeby for the support and attention during the work on this study. Lastly, I am extremely grateful to each of the science communicators who found time and agreed to give an interview for this research.
# Contents

**Introduction** ........................................................................................................................................... 5  
**Background: Science communication in Russia** .................................................................................. 6  
**Theoretical framework** ......................................................................................................................... 12  
  *Main concepts and goals of science communication* ........................................................................... 12  
  *Intercultural communication theory* .................................................................................................. 19  
**Literature review** ..................................................................................................................................... 20  
  *Science and the media* ......................................................................................................................... 21  
  *Science communication online* .......................................................................................................... 22  
**Research questions and aim** .................................................................................................................. 25  
**Methods and materials** .......................................................................................................................... 26  
  *Pilot study* ........................................................................................................................................ 27  
  *Content analysis* ................................................................................................................................. 27  
  *Discourse analysis* .............................................................................................................................. 30  
  *Semi-structural interviews* ................................................................................................................... 31  
  *Ethics in online research* ................................................................................................................... 32  
**Interpretation of the results** .................................................................................................................... 32  
  *Content analysis: analysis of VK and Facebook profiles* ..................................................................... 32  
  *Discourse analysis: communication strategies of Russian science communicators* ...................... 41  
  *Interviews: view of science communicators* ...................................................................................... 46  
  *Intercultural science communication and results of the study* ......................................................... 53  
**Conclusion** ............................................................................................................................................... 54  
**References** ............................................................................................................................................... 57  
**Appendix** ................................................................................................................................................ 61
1. Introduction

Science communication is a developing field, where during the last three decades the number of activities, courses, and practitioners has been increasing (Burns et al. 2003: 183). Scholars have been searching for efficient tools for building a dialogue between scientists and the public, which is essential because, as Shelley Batts et al. (2008) noticed, when scientific information flows into the public field, it "nurtures the development of an informed public who understand the value of funding basic research and making evidence-based voting decisions" (2008: 1837). It has been a question of what role media play in facilitation of such a dialogue. Most often, science journalists are seen as the key players in bringing science closer to people. They are thought of as the experts whom people could trust. However, researchers were not satisfied with the content produced by journalists, and journalists themselves were having troubles in finding a connection to the scientific community. Moreover, with the appearance of social media, everybody can become a recognized content producer: scientists, as well as their great enemies – pseudoscientists, journalists, and amateurs. The audience can easily get lost in the information flooding the Internet. Thus, we are in an era where there is a great need for professional science communicators, who can guide people through the informational chaos and correct miscommunication between scientists and journalists in order to provide high-quality content, and to help people to increase their scientific literacy and critical thinking skills.

An increasing number of studies examining the development of science communication have been conducted, the majority of which are dedicated to Europe and the USA. There have also been studies connected to national case, such as Colombia (e.g., Parales-Quenza 2004), Nigeria (e.g., Ekanem 2003), and India (e.g., Dutt & Garg 2000). All those studies have been necessary in order to comprehend science communication development on both local and international levels. However, despite the today's agenda of creating the global community and cosmopolitanism development, scholarly attention still mostly focuses on Western cases, with key science players, like Russia, still missing from this picture. Science communication is growing in modern Russia, but there are just a few studies examining the current situation and available to an international audience.

Within the frames of this study, the author argues that there is a great necessity for an analysis of Russian social media and its role in building a dialogue between the scientific community and the public. The author particularly proposes an analysis of profiles of 5 the most published and read science popularizers in Russia. Thus, the aim of the thesis is to analyze Russian science communicators, their Facebook and VK profiles and communication strategies. It is suggested to
pay attention to both VK and Facebook, which are similar in terms of being communicating and content-delivering platforms but are different in audiences and purposes of usage.

As was mentioned above, professional science communicators can be the key to building efficient conversation between academics, journalists, and the public. However, we need to know what science communication consists of and how we can measure and increase effectiveness of communication formats and tools. In the world where Internet has become the main source of information for most of the people, we still miss a comprehension of what content is needed and how it should be created for science communication development. To support such a normative ambition, the author believes that it is necessary to examine how science communicators use social media and deliver information to the public.

2. Background: Science communication in Russia

In this section, the author will provide a quick overview of how science and its popularization have been developing in Russia.

The science popularization movement started its way in Russia in the eighteenth century when scholars in the Academy of Sciences understood how important it was to spread scientific ideas among the public (Andrews 2003: 170). In the late nineteenth and early twentieth centuries, the Russian Empire was a country where the citizens' level of education was behind that of the developed European states, and science promotion became connected to the system of education. The Government launched a large-scale campaign to popularize science, which "resulted in Russian experts being considered some of the best ones during the soviet period" (Balashova 2016: 11468).

Until the beginning of Soviet history of Russia, enlightenment initiatives were mainly ruled by patrons of different social status, who established workers’ enlightenment societies, people’s universities, and people's houses (Balashova 2016: 11468). When the revolution broke out, science popularization became regarded as a way to develop class consciousness, and a critical and active attitude towards the reality of the proletariat (Balashova 2016: 11473). The motto was "the tsarist past as scientifically backward, as the socialist future is radiant and technologically advanced" (Andrews, 2003: 171). Bolshevik leaders Lenin, Lunacharskii, and Petrov supported the concept of science popularization and creation of programs at the federal level (Andrews 2003: 171).
Thus, in Soviet times the system of scientific popularization was organized at a high level and operated very efficiently (Balashova 2017: 57). Promotion of science took its important role and was performed in different formats: popular science press, more precisely – popular-science magazines, "regular basis first in encyclopedic and then in the classical large-volume magazines" (Balashova 2016: 11472), TV shows, books etc. To comprehend the scale of the movement, it is worth noticing that by 1980th every 20th book was popular scientific and that before the collapse of the USSR there were 218,3 million copies of popular science books in circulation (Vaganov 2016: 71).

However, being strongly supported by Soviet ideology, science in the new post-Soviet period moved to a level "much lower in social and political priorities" (Graham & Dezhina 2008: 35). The science domain was experiencing a number of difficulties: in 1992, the total expenditures on science from all sources witnessed a twofold decrease, so that by 1994 the level of financing Russian science was almost six times lower than that in developed Western countries (Graham & Dezhina 2008: 36).

The market of popular science press, books, and other projects also was on the edge of survival. In his article "Market of popular science magazines. Analytical overview"1 (2012) Igor' Yakovenko clearly states that this market does not exist in modern Russia: there are some journals with similar content, but there is no one market with strong players, who are able to compete. The dramatic fall of the market can be demonstrated also by the fact that after the USSR collapse the number of copies of extremely popular science magazine like "Science and Life" became 85 times as small: from 3,4 million in 1980’s to 40,000 copies at the beginning of 2000’s (Yakovenko 2012).

Thus, it became clear that the science domain was in a great need for help. This help arrived in 1999 when Russian private philanthropy entered the scene (Graham & Dezhina 2008: 159). Several actors appeared, including the Vladimir Potanin Foundation, the Foundation for the Assistance of Domestic Science, the Dynasty Foundation, and the Alfeno Foundation. The Dynasty Foundation, opened in 2001, deserves a special attention due to its great role in science popularization in modern Russia.

*The Dynasty Foundation* was founded by Dmitrii Zimin, the president emeritus of Vimpelcom, Inc. (whose Beeline mobile network is one of the largest in Russia) (dynastyfdn.com 2018). One of the principal areas of The Foundation's work was the popularization of basic science in Russia. On its website, three specific goals are outlined:

---

1 The article was published in Russian. Translation was performed by the author of the current research.
• to promote an image of science as one of the most attractive forms of human endeavor;
• to popularize a scientific approach to the world around us;
• to spread scientific knowledge in a contemporary, accessible manner.

During more than ten years of work, The Foundation launched Enlightener Prize for educational non-fiction literature, created the Dynasty Foundation Popular Science Library, published the best contemporary books on the natural sciences, and organized a series of public lectures for a wider audience, as well as ran summer schools for scientists (dynastyfdn.com 2018). So, The Foundation played a significant role in revitalizing Russian science and its popularization field. In 2015, The Foundation was included to the Register of "Nonprofit Organizations Performing the Functions of a Foreign Agent" by the Russian Ministry of Justice and it was closed down. However, before its shut-down, it managed to move science popularization forward and contribute to the development of popular science projects' market in Russia.

After the Dynasty Foundation closed, science communicators, scholars, and activists founded the Evolution Foundation in 2015, which nowadays is the leading institution working on science popularization all around Russia, training science communicators, and creating a community of Russian science communicators. In this work, the author particularly analyzes journalists, scholars, and activists from this Foundation.

To move forward, an overview of how science develops in modern Russia should be made since it is important for the understanding of why science communication is of great importance for the country.

It is worth noticing that Russia has a range of challenges in financing, training, and providing auspicious conditions for scholars. UNESCO Science Report (2015) underlined inadequate intellectual property protection (p.344), low average citation rate for articles – 0.51 (p.348), and a rather small number of researchers – 1% of the labour force, or 0.5% (p.348): "The Russian Federation ranks 21st globally in terms of the number of people engaged in R&D per 10,000 employees but 29th in terms of the number of researchers" (UNESCO 2015: 350). A more detailed view was provided by HSE, which demonstrated the progress (or rather regress) of how many people have been involved in R&D.

---

2 Research & Development
Despite that, the Russian Government is trying to change the situation. For instance, in 2013, the 5/100 Programme was launched in order to raise the global competitiveness of Russian universities "to the point where five of them appear in the top 100 and the remainder in the top 200 of global university rankings" (UNESCO 2015: 352). Within the program, universities received circa $175 million (ibid.).

Another improvement was the creation of The Russian Science Foundation in 2013, which aim was "to expand the spectrum of competitive funding mechanisms for research in Russia" (UNESCO 2015: 352). The foundation received circa $764 million in the years 2013–2016. Research institutes could get funding for their large-scale projects in basic or applied research on a condition that applicants included young scientists in their project team and guaranteed that at least 25% of the grant was spent on the salaries of young researchers (UNESCO 2015: 352). This initiative supported a trend of increasing the proportion of researchers under the age of 40, which rose to more than 40% (UNESCO 2015: 350). UNESCO's Science Report 2015 also underlined that the education of highly qualified scientists is increasingly becoming a core mission of Russian universities (UNESCO 2015: 351). Thus, "despite the current complex economic and geopolitical situation, the Russian Federation has the firm intention of consolidating its national innovation system and pursuing international co-operation" (UNESCO 2015: 362).

As for professional science communication development, Russia is still at the beginning of this path. In 2013, Russian Ministry of Education and Science proposed to launch Master's programmes in Science Journalism in two Moscow universities MGIMO and MSU; in 2015 Moscow Polytechnic University created a Bachelor’s Programme in science communication; in 2016 ITMO University in Saint Petersburg introduced a Master's Programme in Science Communication (RVC 2017). Thus, it is possible to say that Russia started a new generation of science communicators with professional training.

Besides professionally trained science communicators, there are several flows of Russian science popularizers, who have taken a serious place in promoting science among the lay audience.
These people are science journalists, scholars, and amateurs who launch popular science projects, read public lectures, write books and blogs. Most often they do not have professional training in science communication, but they are still the best in this field. Among them are Asya Kazantzeva, Alexander Panchin, Alexander Sokolov, Stanislav Drobyshevsky, Irina Yakutenko, Evgeniya Timonova, etc. Despite the rise of science communication and popular science projects in Russia, there are still no proper studies describing the progress of what has been done. The only document providing a comprehension of the market was created by RVC and ITMO University – "Dynamics of science communication domain's development in Russia 2016-2017"³ (RVC 2017), which describes science communication activity in Russian universities and research institutes, development of popular science projects, events, museums and book markets. This document is of great value since it is basically the only source of knowledge about the current situation of the Russian science communication field.

Investigation of RVC and ITMO demonstrated a boost of the public interest in enlightening projects. For instance, the biggest Russian festival of science and technology, Geek Picnic, attracts an increasingly large number of visitors every year:

![Pic.1 Dynamics of growing number of Geek Picnic's visitors (RVC 2017: 162)](image)

Moreover, RVC and ITMO University identified that popular science projects like PostNauka continue to grow and attract new audiences via social media, while traditional media channels experience a decrease of readers (RVC 2017: 28). Additionally, there is a 4% increase in the number of science museums' visitors (RVC 2017: 168).

³The document was published in Russian. Translation was performed by the author of the current research.
Public interest in science and technology is harmoniously supported by media channels, which extend the numbers of publications dedicated to science (Pic. 2). The number of materials dedicated to natural sciences particularly increased by 22% (RVC 2017: 21).

Thus, it is hard to deny that science communication in Russia has been continuously growing over the last years. While the Russian Government aims at improving the education system, boosting development of research projects and increasing Russian universities' competitiveness on the global level, the public and science popularizers experience mutual interest and create more options for meeting with each other. Popular science events and projects are becoming an integral part of cities' lives, prices of tickets are growing, there is an oversaturation of lecturers in Moscow and Saint Petersburg, big projects develop franchising models in order to expand around the country (RVC 2017: 163).

**Pic 2. The number of publications about science in Russian media during 2014-2017**

(RVC 2017: 20)

In March 2018, the article "Five Faces of Russian Science Communication" was published. Written by Alexandra Borissova, co-founder of Russian Association for Science Communication (AKSON), and Dmitry Malkov, director of Center for Science Communication at ITMO University the paper is dedicated to science communication development in Russia. In their work, Alexandra and Dmitry discuss five main elements of the Russian science communication landscape: science journalism, corporate science communication, science museums and centers, popular science events, and celebrity scientists. Authors underline that "Russia has no sound policy in science communication and there is little to no attention paid to the issue from top government officials" (Borissova & Malkov 2018), but they are still optimistic about moving Russian science communication forward, because there are people in the domain who are "ambitious, ready to learn, active and passionate about what they do" (ibid.).
To sum up, there are positive trends in science communication development in Russia. However, there are possibilities to move forward since the percentage of people involved in popular science activities is growing, but in comparison with the whole population of Russia, it is rather modest. For instance, no more than 3% of Russians read popular science literature (RVC 2017: 170) and just 2.3% of people can answer questions from the school programme (Levada-Centre 2018).

From this perspective, there is a need for science communication development in Russia. One document describing common trends in not enough for understanding a complicated system of public communication of science, full of details, communication difficulties and lack of systematic governmental support. The author argues that more studies are a necessity in order to shed light on the discussion about the role of social media in science communication in Russia; to provide more scholarly and research-based views on how to create better communication within science community. With my work, the author intends to shed this light and to contribute to comprehension of how social media are used in public communication of science in modern Russia.

3. Theoretical framework

3.1. Main concepts

In this study, the author will apply two central concepts: science communication and science communicators/knowledge brokers.

Science communication has started its way centuries ago: already in 1686 Fontenelle "recognized the need to satisfy both "la gens du monde" and "les savants"" (Bucchi 1998: 1). However, up to these days it still raises a range of questions, many of which are connected to the definition of what science communication is, since it serves as an umbrella term for "multidimensional, interdisciplinary range of subjects, goals and practices" (Broks 2018). Despite that, there are variations of how we can determine what constitutes science communication. As Terry Burns et al. (2003: 183) stated, science communication is usually used as a synonym for public awareness of science (PAS), public understanding of science (PUS), scientific cultures (SC), or scientific literacy (SL). These are different, even though really close, terms. So, to provide a clearer picture, Burns et al. suggested a new AEIOU model (2003: 191), defining the purpose of science communication:

- Awareness, including familiarity with new aspects of science;
- Enjoyment or other affective responses, e.g. appreciating science as entertainment or art;
- Interest, as evidence by voluntary involvement with science or its communication;
- Opinions, forming, reforming, or confirming science-related attitudes;
- Understanding science, its content, processes, and social factors (ibid.).

In a situation where we still do not have an established definition, this model seems to attempt to provide the most detailed view on science communication. As for the clear definition, Chris Bryant attempted to explain what science communication is: it is "the processes by which the culture and knowledge of science are absorbed into the culture of the wider community" (Bryant 2002: 7).

As a synonym to science communication, the author will also appeal to such a concept as public communication of science. Based on the author's investigation, those terms can easily replace each other.

In addition to the above mentioned difficulties with finding a proper definition, it seems necessary to notice that scholars also were trying to find a suitable communication model for science communication. Until the 21st century, science communication was seen as a simple process of transmission (Nisbet 2008: 4). This approach was called the deficit model or as Massimiano Bucchi (1998) referred to it – the canonical account, which depicts one-way flow of science information from scholars to the public:

![Diagram](image)

**Figure 1.** The canonical account (Bucchi 1998: 5)

This approach met a lot of critique (Wynne 1992; Bucchi 2008; Burns et al. 2003; Sturgis and Allum 2004; Nisbet and Scheufele 2009) due to its limitations and impossibility to take into account a variety of details appearing in the communication between scientific community and citizens. Thus, scholars Wynne, Irwin, Latour, Collins, and Pinch, Jenkins, Layton, Yearley, McGill, and Davey (in Burn et al. 2003: 189) created another model, which became known as the contextual approach. This model recognizes the audience as active, and that public
understanding of science can be seen as "the joint creation of scientific and local knowledge", where ethical and political concerns are relevant (Burn et al. 2003: 190).

However, the 2 models may co-exist. As Bucchi (2008) noticed, "public/expert interaction with regard to a certain issue may move across models and their combinations: for instance, an emerging topic such as nanotechnology may lend itself to deficit-like communication in its initial stages, and later become the subject of public consultation/mobilization; knowledge produced on a rare genetic pathology in situations of intense interaction between experts and non-experts may subsequently become the focus of a deficit-like communication initiative" (Bucchi & Trench 2008: 70).

In this study, the author adheres to the contextual model, as science communication and its development in society depend on participation of both sides: scholars and the public. Scientists may provide information demanded by the society, while the society itself would not be able to function without those having a valuable product – knowledge. Today, we talk about the necessity of being scientifically literate and the need of having critical thinking in order to further develop democracy and to be citizens who can "effectively participate in public debates about science and hold government to account over the speed and direction of science policy" (Sturgis and Allum 2004: 55). Science communication assists in achieving these goals. Thus, the context matters because it provides a comprehension in what direction researchers and science communicators should work.

As for the concept of science communicators, the author relies on Morgan Meyer's work (2010) where the term "knowledge brokers" was proposed. This term has clear connections to science communicators: "Knowledge brokers can be understood as persons or organizations that facilitate the creation, sharing, and use of knowledge" (Sverrisson 2001 in Meyer 2010: 119). Their task is "to establish and maintain links between researchers and their audience via the appropriate translation of research findings (Lomas, 1997)" (Meyer 2010: 119). Meyer often refers to Árni Sverrisson (2001), who explained the role of knowledge brokers: "They are involved in a broad range of activities: articulation work, communication work, identification work, mediation work, educational work, and so on" (Sverrisson 2001 in Meyer 2010: 121).

Another category was introduced by David Kirby (2008) who discussed "boundary spanners" science consultants in Hollywood, whose work involves "the synthesis of information from the culture of science, the translation of that information into the culture of entertainment, and finally the transformation of the information into a finished cultural product" (Kirby in Cheng et al. 2008: 165). Working between science and entertainment demands special skills from
boundary spanners: inhabiting multiple social identities and acknowledging identities of different social groups with whom they work (Kirby in Cheng et al. 2008: 166-167).

In this thesis, the author argues that knowledge brokers and boundary spanners, in a Russian context, can also be referred to as science communicators. So, these are the synonyms for people working in the domain of science popularization and facilitating communication between the scientific community and the public through various means of communication: "They move back and forth between different social worlds. Not only are they transferring knowledge in one direction only, they are also engaged in an exchange of knowledge through moving between places" (Meyer 2010: 123).

To sum up, the following concepts are used in this thesis:

- Science communication = public communication of science = a social process involving different genres of communicative events in different media, intended to disseminate scientific knowledge, but also opinions and ideologies of scholars, to the public at large (Calsamiglia and Van Dijk 2004: 371)
- Science communicators = knowledge brokers = boundary spanners = mediators of communication between scientists and the public.

In various definitions of science communication authors usually discuss circulation of knowledge between scholars and the public. But scholars like Massimiano Bucchi (2008), Greg Myers (2003), and Danette Paul (2004) underline that there are not just 2 groups in public communication of science: researchers and the general public (in Luzón 2013: 432). Nevertheless, in academic works we meet the public, even though we do not know who authors are referring to when using this term. Several scholars have attempted to make the picture clearer. For instance, Michel Cloître and Terry Shinn (1985) and Stephen Hilgartner (1990) proposed the "continuity" model (in Bucchi 1998; Luzón, 2013) – four stages within the process of science communication (Figure 2). This model determines who can be the audience of science popularization projects and how these activities differ in their goals:

- intraspecialist level (e.g., papers published in specialized scientific journals);
- interspecialist level, which involves "interdisciplinary popularization" (e.g., papers published in journals like Nature or Science);
- pedagogic level (e.g., textbooks);
- and popular level, or popularization addressed at the general public, mainly done via mass media (e.g., science news in the daily press) (Luzón 2013: 433).
Figure 2. A continuity model (Bucchi 1998: 13)

In addition, Bucchi (1998) suggests that "the continuity model should […] be supplemented by a multi-level, multivariate perspective that accounts for mutual interactions and the permeable boundaries among different communicative practices" (p.21). He saw science communication as "a continuous sequence of expository levels, gradually shifting one into another with differences in degree and not in kind, mutually influencing one another" (Bucchi & Trench 2008: 66).

Another distinction between actors of science communication was made by Burns et al., who described six groups, each of with their own "needs, interests, attitudes and levels of knowledge" (2003: 184). The groups are:

- Scientists;
- Mediators (communicators (including science communicators, journalists and other members of the media), educators, and opinion-makers);
- Decision-makers (policy makers in government […]);
- General public (the three groups above, plus other sectors and interest groups);
- Attentive public (the part of the general community already interested in […] science and scientific activities);
- Interested public (composed of people who are interested in but not necessarily well informed about science and technology) (ibid.).

Thus, when discussing science communication, we need to specify what audience we keep in mind. In this thesis, I suggest turning to the popular level of the "continuity" model, i.e. the general, attentive and interested public in classification of Burns et al. However, the author will also sometimes mention other levels of science communication since my work is dedicated to social media, which serves as a channel for building communication with various audiences.
Being a relatively problematic field, science communication needs to be pinned down in terms of its theoretical background, goals, and plans for further development. There is much critique of this domain because public communication of science consists of a range of ambiguities: for instance, is it a field or object? (Broks 2018). However, as Peter Broks also confidently states: "We do have to use the language of educationalists, Pedagogic Content Knowledge. This may have many dimensions in the domains of practice, the range of subjects and the goals that direct us. It may be viewed through several different lenses or filters: politics, education, cultural studies. But it is there" (2018). Thus, the theoretical background of science communication needs to be further researched and developed. In the following, the author will provide different scholarly views on why it is important and why science communication itself matters. The author will particularly pay attention to goals of science communication since it seems the best way to illuminate the importance of the domain.

In academia, there are a great number of approaches to determining the goals of science communications. Albert Einstein even saw a spiritual function: "Restricting the body of knowledge to a small group deadens the philosophical spirit and leads to spiritual poverty" (Einstein in Gregory and Miller 1998: 84). But a more precise formulation of these goals was presented in the work of Maarten C.A. van der Sanden and Frans Meijman (2008: 90): (1) public awareness of science, (2) public engagement with science, (3) public participation in science, and (4) public understanding of science. Each of these goals needs to be explained since they represent various movements in science communication development.

Starting with the public awareness of science (PAS), J.K Gilbert, S. Stocklmayer, and R. Garnett (1999) saw it as "a set of positive attitudes toward science (and technology) that are evidenced by a series of skills and behavioral intentions" (in Burns et al. 2003: 186). PAS may be viewed as "a prerequisite […] of PUS [public understanding of science] and scientific literacy" (Burns et al. 2003: 187).

So, PAS brings the notion of the public understanding of science (PUS), which usually "covers a wide field of activities that aim at bringing science closer to the people and promoting PUS in the tradition of a public rhetoric of science" (Bauer in Bucchi & Trench 2008: 111). The simplest and, probably, the most often met approach was formulated by Jon Miller (1998), who defined PUS as "the level of understanding needed for scientific literacy to be sufficient to read and comprehend the Tuesday science section of The New York Times" (in Miller 2004: 274). Then Miller (2004) added that PUS can also be seen as the ability of a citizen "to follow and participate in public policy discussions of a scientific or technological issue" (p. 274).
However, a range of scholars did not agree that PAS and PUS were enough for building efficient communication with a wide audience. That is why, they suggested analyzing public engagement with science: "a shift from public understanding to public engagement with science has been characterized as citizen-oriented science or a more open, egalitarian, and participatory science" (Kouper 2010: 1). Public engagement with science was seen differently by various scholars. Researchers Phillips and Orsini (2002) described it as "interactive and iterative processes of deliberation among citizens and between citizens and government officials with the purpose of contributing meaningfully to specific public policy decisions in a transparent and accountable way" (in Powell and Colin 2008: 128). So public engagement is necessary for the political economy and "de facto governance" of science (Kearnes and Rip, 2009; Lave et al., 2010 in Stilgoe et al. 2014: 6).

Inna Kouper stated that audience can also be involved by "engaging in discussions, participating in data collection, experimenting, providing feedback based on their knowledge of local contexts and situations, contributing to policy-making" (Kouper 2010: 2). However, as Maria Powell and Mathilde Colin (2008) fairly noticed, "there are deep and systemic political, socioeconomic, and cultural barriers to meaningful citizen engagement in science and technology" (p.129) and we still lack of "institutional support for engagement is a key barrier to effective citizen engagement" (p.133). Thus, the question of how the public should be engaged with science is still relevant and needs to be asked in accordance with governmental policies.

The last, but not least, goal of science communication is public participation, which can be also reformulated as "knowledge co-production": "a notion […] to describe intense forms of participation of non-experts in the definition and accreditation of scientific knowledge – as when patients’ organizations actively contribute to defining the priorities of medical research, or when citizens’ groups gather epidemiological data that lead experts to rethink the cause of a certain pathology" (Brown and Mikkelsen 1990 in Bucchi & Trench 2008: 68).

To sum up, science communication can be seen as an umbrella term for various movements, formats, and activities. However, still there are several goals of science communication which can be seen as orientations for science communication scholars and specialists: public awareness of science, public engagement with science, public participation in science, and public understanding of science. These goals describe why science communication matters in the modern world and what purpose should be kept in mind while working in this field.
3.2. Intercultural communication theory

As was mentioned above, in this work, the author will examine science communication on a public level since currently it is a topic actively discussed among researchers and particularly among Russian specialists in science communication. It is connected to the fact that after the collapse of the USSR, the domain of science communication in Russia was on the edge of survival. Now specialists, educational, and governmental institutions are interested in making it 100% alive again. As we have seen in section 2, the progress is obvious. Despite that, the science community still needs to find a proper formats, projects, and models of communication for efficient dialogue with the public. Additionally, there is a great necessity for theories which would allow investigation of the complex communication universe that is full of nuances. Being a developing and growing field, science communication still has its difficulties in proposing what theories scholars may apply when discussing public communication of science. As Peter Broks (2018) stated, "there is no "mound" of theories that talk to each other. However, what we do have is an interdisciplinary moment when the availability of science to the public invites us (forces us?) to reflect on what kinds of theory we need". Thus, the doors for introducing new theoretical approaches to science communication are still open.

So, the question is from what theoretical perspective can we look at modern science communication? One option was proposed by Hans Peter Peters (in Bucchi & Trench 2008), who introduced intercultural communication theory (IC), which, for instance, can explain misunderstandings "caused by the cultural difference between science and journalism" (Peters 1995 in Bucchi & Trench 2008: 138). Kirby (2008) suggested to broaden the focus of IC and to apply it when examining communication between science and the public: "science communication is not merely communication from an expert community to a lay community but is more akin to intercultural communication" (in Cheng et al. 2008: 165). IC can be valuable in understanding science communication on different levels. Taking the public as one, based on IC, we should acknowledge differences in values and norms of scholars and the wide audience. Considering intraspecialist and interspecialist levels, IC recognizes cultural nature of any science (Western or otherwise) and subcultures of the audience (Aikenhead 2001: 38), which is necessary for effective communication.

Ron Scollon et al. (2012) suggested a helpful discourse approach to intercultural communication. It recognizes two problems of discourse systems – identity and membership (p.267). Authors emphasized that part of every person’s identity is "the discourse systems within which he or she participates" (Scollon et al. 2012: 267). So, participants of one discourse system find it
comfortable to communicate with other participants in the same discourse system (Scollon et al. 2012: 268). On the one hand, it provides people with a feeling of solidarity and security, but on the other – "it forms a boundary between ingroup and outgroup, and people who are not participants in the discourse system are rejected by participants and find it difficult to achieve even peripheral participation" (Scollon et al. 2012: 268). Scollon et al. proposed to see discourse systems as "toolkits" which contain various discursive tools (that is, ideologies and the interpretative frameworks they create, forms of discourse, and face systems and strategies)" (2012: 269). They particularly emphasized the importance of rhetorical strategies: "participants in an interaction are different from each other in their choice of deductive or inductive strategies for the introduction of topics, whether or not they are from different "cultures", they may find themselves confused as to how to interpret what is being said by the other" (Scollon et al. 2012: 277). Thus, from their point of view, it is more efficient to analyze "intercultural communication" as interdiscourse system communication (Scollon et al. 2012: 278), where "we […] must be aware of areas of difference between people which may potentially lead to miscommunication, but at the same time constantly guard against assuming differences that do not actually exist" (Scollon et al. 2012: 275). As an actual unit of analysis, Scollon et al. suggested "the person in the moment of taking social action with other people by drawing on the various discursive resources available" (Scollon et al. 2012: 278).

Here, we will proceed to consider science communication, which, as we have seen earlier, is also intercultural communication. Scollon's approach allows us to examine science communication as interdiscourse system communication. Thus, science communication will not be taken as a translation process but as recontextualization of scientific discourse into another domain (Calsamiglia & Van Dijk 2004 in Luzón 2013) since translation "would require structural equivalence of source and target languages, and a shared reality serving as background for making sense of information. There is neither an equivalence of scientific and everyday language, nor a shared reality. The worlds of modern science are esoteric and rather inaccessible to everyday reasoning" (Peters in Bucchi & Trench 2008: 139). So, science communicators are those people "taking action", who, Scollon et al. wrote, bring various discursive resources to develop science communication on different levels.

4. Literature review

As it was mentioned above, science communication is often used as an umbrella term for various activities. In this section, the author will pay attention to ones performed in media space and will give an overview of how researchers discuss science communication in media.
4.1. Science and the media

While science communication consists of various forms of how, in what direction and to whom information may flow, its development in media has most often been associated with science journalism, which has served as "a boundary-minder and intermediary between internal scientific spheres of communication and external public spheres" (Trench in Bauer & Bucchi 2007: 134). Science journalism has been known as the field full of uncertainties and questions about professionalism, quality, and future development. Scholars have underlined a range of problems with science journalists' training, among which is lack of science education. Sunshine Menezes (2018), for instance, paid attention to this issue in environmental journalism: "without […] educational foundations, it is much easier to produce stories focusing on political debate or drama related to environmental issues (Boykoff & Yulsman 2013), or to simply report two opposing viewpoints, than it is to produce illuminating reporting that accurately translates areas of scientific consensus and debate" (Menezes 2018: 2). Matthew Nisbet and Declan Fahy (2015) sharply described it as a journalism "dominated by voices representing the tail ends of opinion" (in Menezes 2018: 2).

Another problem, which is also connected to lack of scientific knowledge among science journalists, is accuracy: "…it is not uncommon to feel that the reporting of science in the news media is inadequate..." (Fjaestad in Bauer & Bucchi 2007: 123). Producing scientifically accurate information can be challenging for a writer who does not obtain scientific knowledge and is not familiar with the scientific research process. Thus, journalists depend either on scientists, or on science press officers who usually check the material if its creator cares about accuracy. Christopher Dornan (1990) pointed out that it has resulted "in science coverage that is more deferential to its subject matter and constituency than would be acceptable in other fields of journalism" (in Gregory & Miller 1998: 107-108). Moreover, because science journalists rely on the science press officers or researchers, they "tend not to go digging for stories as other journalists might, and so stories that might damage the image of science tend not reach the newspapers" (Gregory & Miller 1998: 109).

Menezes also added that framing, editorial disinterest, media ownership, and many other issues could be seen as problems in [environmental] reporting (Menezes 2018: 2). These issues can also be mentioned as ones challenging development of science journalism overall. Thus, it is hard to deny that science journalism has been developing, transforming, and experiencing "seismic shifts, environmental and social crises, such as climate change, economic instability, and global health pandemics, necessitating more complex and nuanced coverage" (Smith et al. 2017: 2). In a
new digital pluralistic media environment, science journalism yet again meets challenges: it is going online, where it loses its gate-keeping role and has to fight for audience's attention with bloggers, amateur science writers, and scholars themselves, who finally have an opportunity to communicate with the public directly – through social media. It has created "'overlapping information and communication space’ (Trench 2009: 167) in which scientists, journalists, advocates, and the people formerly known as audiences are all content contributors, each with varying knowledge, background and perspectives" (Fahy & Nisbet 2011: 782). The next section deals with how science communication develops online.

4.2. Science communication online

Fahy & Nisbet (2011: 784) provided a full comprehension of science media ecosystem in the new digital environment. They singled out the following actors: 1) legacy media in their print and online formats, including the Guardian and the New York Times; 2) science blogging and aggregation sites, most notably SEED’s Scienceblogs.com; 3) the news and blogging communities formed by journals, such as Science, Nature and PLoS; 4) the news and blogging communities formed by legacy science magazines including Discover and Scientific American; 5) science advocacy blogs and sites, such as Climate Progress and Climate Depot; 6) and reflexive and meta-discussions of science journalism at MIT’s Knight Science Journalism Tracker and the Columbia Journalism Review (Fahy & Nisbet, 2011: 784). Even though this understanding was built on the analysis of the USA and UK markets, it seems correct to say that this categorization may be generalized for English-speaking science media ecosystem overall. Despite the fact that it cannot be used when examining other local markets, which obtain their own specifics in science communication development, we still can find common trends in how science communication develops in the modern world.

Blogs are among the new formats which have become popular globally and are viewed "as having a potential to become a new model for science journalism" (Kouper, 2010: 2). Without the above mentioned editorial disinterest, media ownership, and lack of feedback issues, bloggers have a great number of advantages. For example, John Wilkins (2008) underlined that blogging "is more intimate and responsive" (p. 411), so people can come closer, comment, ask and contribute to the content. Blogging can also be thought of as a way to solve problems with information accuracy: researchers can easily create a blog, share scientifically accurate information, and comment on popular misconceptions. A number of scholars even think of bloggers as neo-journalists, "who challenge and renegotiate traditional journalistic conventions" (Matheson 2004; Robinson 2006; Wall 2005 in Walejko & Ksiazek 2010: 412). Gina Walejko &
Thomas Ksiazek fairly asked: "Could science bloggers, often individuals with advanced scientific training and connections to multiple scientific sources, change traditional science journalism sourcing practices for the better?" (2010: 412-413). Additionally, blogs give science writers themselves great benefits: "through back-channel forums, personal contacts, and commenting, an isolated researcher can become a part of a wider social network; [...] science bloggers can even find jobs via their blogging" (Wilkins 2008: 412).

Thus, it became obvious that there was a need to analyze the role that blogs play in science communication today. The most optimistic view on that role was formulated by Wilkins: blogs "contribute to the current practice and reputation of science as much as, if not more than, any popular scientific work or visual presentation" (Wilkins 2008: 411). There is little room for doubt that blogs took their place in science communication. After struggling with searching for a platform where the contextual approach in science communication can finally work, researchers met blogs with excitement as a new tool for public engagement with science (Batts et al. 2008; Shanahan, 2011; Mahrt & Puschmann 2014). Being available for reading and commenting by anyone attentive to scientific discussions, blogs have become a place "for the sharing and discussion of knowledge, where both experts and interested public can participate" (Luzón 2013: 430).

Currently, blogs are utilized by individuals, communities, and institutions as a means of sharing information about their projects, news, updates, or events. However, with the advent of social networks, blogs have stepped back and are now most often used when there is a need for publishing bigger pieces of text. Facebook and VK (particularly in Russia) have become the main platforms for communication with different audiences: ranging from colleagues to the lay public interested in science. These networks have become a must for anybody intending to work in the science communication domain: "if we are putting our time and resources into communicating science but we’re not on social media, we’re like a tree falling in an empty forest–yes, we’re making noise, but no one is listening" (Wilcox 2012: 87). There is a great variety of tools for creating, sharing, and discussing content, features for developing communities, interactivity and availability on any smartphone – and these are just some of the several benefits of social networks. Facebook and VK also have great analytic tools, which allowed science communicators to finally see who their audience is. These platforms also provide instruments for making educational content more interactive and attractive for the public. It is especially relevant for projects interested in working with students: "…both quantitative and qualitative data suggest that, far from the distraction it is often viewed as, social media use […] facilitates achieving educational goals" (Wilcox 2012: 86).
Social media play a special role in science communication since they provide an opportunity to cover almost all levels of communication mentioned in section 3.1. Kimberley Collins et al. noticed that "there is evidence that scientists are using social media for communicating specific aspects of their research, as well as science more generally, as a means of outreach to increase engagement and science literacy" (2016: 2). Moreover, social networks have all the necessary features to facilitate communication among scholars: "scientists will sometimes use social media for […] exchange of knowledge within and among scientific communities" (Collins et al. 2016: 2). Thus, "social media tools offer a powerful way for scientists to boost their professional profile and act as a public voice for science" (Bik & Goldstein 2013: 1).

Despite the obvious benefits of social networks in public communication of science, we still lack a clear comprehension of how these channels are used by researchers and science institutes, who the audience of popular science content is, and what formats and types of content work the best for educational purposes. However, in recent years, there have been some studies to find answers to these questions. For instance, one of the latest studies connected to social media and science communication was performed by Craig McClain (2017). He surveyed scientists in order to examine their usage and behavior on Facebook, including the network size and the fashion how they share science. He found that many academics (88%) indicated that they "regularly use Facebook for personal communication where science is shared with interested friends and family" (McClain 2017: 3). Moreover, many scientists are hesitant to engage other Facebook users to correct misrepresentations of science, with only 18% frequently doing this, and 40% occasionally posting corrections (Collins in McClain 2017: 4). McClain argues that "scientists are missing a rich opportunity to discuss science with the nonscientists in their networks by actually posting and engaging with their networks" (McClain 2017: 4). In this work, he underlined that Facebook is the new public forum where respect for individual expertise is well developed: people often ask their friends and colleagues for advice, recommendations, or they can post scientific questions. Thus, development of science communication in social media may have another purpose: vetting online content for scientific accuracy with help of academics (McClain 2017: 6), who can help us to survive in the era of fake news.

Thus, social media are the new channels of science communication with great potential to develop efficient communication on different levels. There are several studies attempting to examine the representation of education content in social networks and scholars' usage of platforms like Facebook. Nevertheless, there is still deficiency in studies investigating development of science communication on Facebook or VK. The author argues that in order to
find efficient formats and to produce high-quality content, we need to pay closer attention to these platforms, their users, and content creators.

Additionally, one must acknowledge that freedom, without any gatekeepers, comes at a price. It is crucial to underline that development of new online formats have become both a great achievement and a challenge for the scientific community, journalists, and the public. The science media ecosystem is becoming more diverse, social and collaborative: new content creators appear every day. Undeniably, blogging and other online formats can democratize and demythologize science (Mahrt & Puschmann 2014: 3) but they can also make us lost in all the new sources and actors. Who can we trust if virtually anybody can create a science blog? As Brian Trench puts it, "the more sources there are on a given subject and the greater diversity of those sources and of the information they provide, the greater the audience's sense of uncertainty is bound to be" (Trench in Bauer & Bucchi 2007: 137). If in the earlier days people could trust journalists, nowadays authority in the online world is no longer held solely by professional writers (Fahy & Nisbet 2011: 785). Therefore, we develop the need for coordination the chaotic online space. Professional science communicators could be those people curating the social media world, protecting it from pseudoscientific ideas, materials and writers, and popularizing tools, which could help people understand how to check sources, where to find scientifically correct information, and what to do when one finds fake news.

5. Research aim and questions

The goal of this study is to analyze Russian science communicators, their Facebook and VK profiles and communication strategies. The underlying purpose of the research is to examine the current situation in Russian popular social media in order to pinpoint the current trends and to understand whether or not science communicators use a rich opportunity of social media channels "to discuss science with the nonscientists in their networks by actually posting and engaging with their networks" (McClain 2017: 4).

The author of this thesis proposes three research questions:

RQ 1: What are the main topics of posts published on science communicators' Facebook and VK pages? What topics are the most popular (liked, shared and commented) among subscribers? Is there any difference in Facebook and VK usage?

RQ 2: What discursive strategies do science communicators use when constructing science posts to engage their readers and to tailor information?
RQ 3: How do Russian science communicators see science communication development in Russia? How do they define the purpose of Facebook and VK in their work?

6. Methods and materials

Due to the exploratory character of this research, the examination of science communication in Russia focuses on key figures of the domain of science communication. In this study, a mixed methods approach was used. This approach seeks "to capitalize on the complementary nature of qualitative and quantitative methods" (Lieber & Weisner in Tashakkori & Teddlie 2010). Scholars notice the complementary nature of qualitative and quantitative methods, which, when "employed simultaneously or sequentially, is of great value in bringing a wider range of evidence to strengthen and expand our understanding of a phenomenon" (Lieber & Weisner in Tashakkori & Teddlie 2010). Used separately, quantitative and qualitative methods have both strong and weak points, but when applied together, they complement each other (Denzin 1978: 302).

Thus, the combination of quantitative (content analysis) and qualitative (discourse analysis and interviews) methods will provide a more complex view of the development of science communication on Facebook and VK. What comes next shortly introduces Facebook and VK as these platforms are used differently in Russia in comparison to other countries.

The social media platform Facebook was founded in 2004 and has since then become one of the most popular websites in the world (Alexa Internet Inc., 2017). There are various types of content, one of which is educational. Over the last years, an increasingly great number of scientists have joined Facebook, which has become a platform both for communication with other academics and public interested in scientific issues. Facebook in Russia is known as one the main communication platforms for researchers from all around the country: it serves as a channel for developing professional communication both with foreign colleagues and those who work in Russia. In 2015, the Dynasty Foundation established by Dmitriy Zimin, the leading Russian organization working in science popularization domain, closed because the Russian government put it on the list of foreign agencies. Following that, scientists created a community on Facebook under the name Dynasty: Coordination of actions in an attempt to save the foundation. This case demonstrates how important Facebook is for the Russian scientific community.

When Dynasty finished its work, Russian scholars and science communicators decided to open a new foundation, which was called Evolution. Currently, it is one of the principal institutions
working on science popularization. The members translate popular science books and videos, organize lectures and conferences. All of this has been possible due to crowd funding campaigns promoted in social media channels, including *Facebook*.

Although popular among scholars, *Facebook* is, however, not the chief social media channel in Russia. *VK* takes the leading place. Founded in 2007, it is used by more than 97,000,000 users every day (*VK* 2018). *VK* is known as the most efficient platform for promotion and communication with the wide audience.

However, what unites both *VK* and *Facebook* is a lack of investigation of their scientific niches. In this thesis, the author contends that the popular science niche of these social media channels deserves deeper examination because it provides efficient tools for promotion of science, popular science projects and institutes.

### 6.1. Pilot study

Prior to starting the thesis, the author did a pilot study during her Method Project course. It allowed her to receive the views of teachers and fellow students. Subsequently, content analysis variables were tested, and a discourse analysis was conducted on a small sample of posts. The feedback helped to clarify several variables confusing for both teachers and students. One of the advisors also noticed that it was necessary to conduct interviews with science communicators about social media usage because content and discourse analysis could not actually answer the question – what Russian science popularizers themselves think of public communication of science in social media? Thus, in the thesis, the author decided to utilize 3 methods – content analysis, discourse analysis, and interviews in order to provide a full picture.

During the pilot study, there was also an idea of examining more posts on fewer pages, but it would not allow reaching the goal of this paper – to make an in-depth analysis of a relevant representative sample, to provide deeper insights into the Russian social media market, and to compare communication strategies of different science popularizers.

### 6.2. Content analysis

For RQ 1 the author used content analysis which is "particularly well suited for revealing trends and patterns" (Hansen & Machin 2013: 85).

The purpose of the content analysis is to examine science communicators' pages in order to see what they write about and what their subscribers like, share, and comment on most often.
Within this part of the analysis, VK and Facebook profiles of 5 science communicators from the Evolution foundation were analyzed. Among analyzed science communicators are:

- Alexander Panchin – a science journalist, biologists. Hold a PhD in Biology (Moscow State University), senior research fellow at the Institute for Information Transmission Problems of the Russian Academy of Sciences. Member of the Commission on Pseudoscience and Research Fraud in the Russian Academy of Sciences. Author of three popular science books. Lecturer, science journalists, blogger.

- Alexander Sokolov – a science journalist, creator of educational online project antropogenez.ru. Holds a degree in Mathematics (Saint Petersburg State University). Science. Author of two popular science books, organizer of popular science forum "Scientists Against Myths". Finalist of Enlightener Prize (2015), a laureate of Belyaev Literature Award.

- Asya Kazantseva – a science journalists, biologist. Holds a degree in Biology (Saint Petersburg State University) but for the past 10 years has worked as a science journalist. Author of two popular science books, one of them (Who Would Have Thought?) received a 2014 Enlightener Prize for educational non-fiction literature. Travels around Russia and abroad as a lecturer. Currently one of the most read and popular science journalists.

- Evgenya Timonova – a naturalist, science journalist, author and host of YouTube show Like the animals do. In 2015, she was nominated for the Russian Federation National Award for science and technology.

- Irina Yakutenko – a science journalist, molecular biologist. Since 2007 works in the science popularization domains. Head of the science department of Around the World magazine. Lecturer and host of popular science events.

These science communicators are chosen for the analysis because they are known as the key players in science popularization domain: they are the authors of the most popular and published popular science books; they are the leading experts and lecturers of Evolution Foundation. As these people work in science popularization, they will be also addressed as "science popularizers".

Posts published on their pages during the period of 2 months will be used (November-December 2017). The combination of both social media networks provided an understanding of how science communicators manage their profiles and what are the differences in VK and Facebook's usage. Interviews with these science communicators provided a possibility to hypothesize that ways of
managing VK and Facebook may be different. Content analysis will assist in verifying this supposition.

The codebook for this part of the analysis is presented in Appendix A. The following variables were coded: topics of posts (based on a close reading of the corpus, the author selected such topics as Personal life; Domain of science popularization; Science; Announcements of public lectures/events; Other), type of content, day of posting, time of posting, amount of likes, comments, and shares. Topics of science and science popularization are deliberately separated into different categories in order to examine how science communicators talk about their work as a lecturer/writer/professional science popularizer and how they write posts with a clear scientific agenda (news or other materials connected to fields of physics, biology, chemistry etc.).

As a guide for performing the content analysis, the author used the 8 consecutive steps identified in Anders Hansen's and David Machin's book "Media & Communication Research Methods" (2013). The research question was formulated as what are the main topics of posts published on science communicators' Facebook/VK pages and what topics are the most popular (liked, shared and commented) among subscribers.

The content analysis was performed for each individual page separately in order to compare science communicators' usage of social media and their audiences. Chosen science communicators are the key players of Russian science popularization market, however, they have different backgrounds, formats of communication with their followers, and topics they cover. The goal of the content analysis was to determine these differences but also, if possible, to find similarities. Such a comparative approach allowed finding patterns with acknowledgement of specifics of each page.

As a unit of analysis, the author used a single post written on a selected science communicator's pages during the period November-December 2017. Analysis of a 2-month period allowed her to find trends in how science communicators manage their pages and what their subscribers like, share, and comment on the most. The pilot study demonstrated that patterns become already visible even during the analysis of a 1-month period. However, the author chose to take a longer period in order to receive a clearer picture.

It is also necessary to pay attention to validity, which is "the extent to which a measuring procedure represents the intended [...] concept" (Neuendorf 2002: 112). In this study, research validity is judgment-based: variables were defined by the researcher, who was trying "to take a
step back, so to speak, and examine the measures freshly and as objectively as possible" (Neuendorf 2002: 115). To test the variables, a pilot study was performed. As for reliability, which is paramount for content analysis due to its "goal [...] to identify and record relatively objective [...] characteristics of messages" (Neuendorf 2002: 141), the author followed the intra-coder agreement and coded subsamples of units at two different times, in February and April.

Sampling for the research was a non-random one. In order to examine the way Russian science communicators manage their profiles, it was important that posts made during the chosen 2-month period be in chronological order. This is due to the reason that social media profiles are constructed in a way that people see content in chronological order. Therefore, a non-random approach helped to ensure a full picture of what pages consist of.

6.3. Discourse analysis

For RQ 2, the author will apply discourse analysis and look at recontextualizing strategies used by science communicators to find how they tailor information and engage the audience. Popularization of science is usually seen as a process of "translation" from scientific language to everyday language. However, science communication scholars argued that popularization is actually a matter of recontextualization of scientific discourse into another domain (Calsamiglia & Van Dijk 2004 in Luzón 2013: 429). Hence, in this research, it is suggested using discourse analysis with the focus on recontextualisation in order to trace how science communicators operate scientific concepts and ideas when communicating with a non specialist audience – their readers. The author particularly relies on María José Luzón's (2013) work, where she created a coding scheme based on the discursive strategies "used in different types of science discourse (in both specialist and nonspecialist settings) to respond to the context of the text" (Luzón 2013: 436). The discursive strategies are presented in Table 2 on the next page.

For the discourse analysis, the author was choosing 5 the most liked during November-December 2017 posts dedicated to science or science communication from each of the 5 examined profiles of science communicators, who were mentioned in section 6.2. The current analysis differs from Luzón's work because it also takes into account texts about both – science and the domain of science communication. The purpose of this was to examine how science communicators also attempt to involve their readers into the field and talk about their work. Overall number of posts was 23 due to the fact that on one of the pages there were just 3 posts connected to science or science communication.
Strategies to tailor information

1. Explanation of terms and concept (definitions, elaboration of terms)
2. Paraphrases/reformulations
3. Comparisons/metaphors
4. Examples from daily life
5. Links
6. Visuals conveying information

Strategies to engage the reader

1. Titles
2. References to popular lore, beliefs
3. Self-disclosure (reference to the blogger’s public or personal life)
4. Features of conversational discourse
5. Inclusive pronouns
6. References to reader
7. Questions
8. Humor
9. Positive evaluation of research or findings
10. Negative evaluation of research or findings
11. Personal expression of opinion
12. Expressions of feelings or emotional reactions

Table 2. Discursive strategies to tailor information and to engage readers (Luzón 2013: 437)

6.4. Interviews

When examining social media channels, one needs to ask scientists themselves how and with what purpose they use social media. To answer RQ 3, the author of this paper conducted semi-structural interviews with Russian science communicators. Svend Brinkmann (2013) argued that "compared to structured interviews, semi-structured interviews can make better use of the knowledge-producing potentials of dialogues by allowing much more leeway for following up on whatever angles are deemed important by the interviewee" (p. 21). That is why semi-structured interviews are more productive in terms of providing valuable information, which can appear when distracting from the prepared script. In this research, the author made an information-oriented selection of interviewees in order to "maximize the utility of information from small samples and single cases. Cases are selected on the basis of expectations about their information content" (Flyvbjerg 2006 in Brinkmann 2013: 57).

As was mentioned above, the domain of science communication in Russia has experienced dramatic changes, rises and falls. Currently "Russia is an ongoing science communication experiment" (Borissova & Malkov 2018). In modern Russia, the terms in science communication
are still not settled: for instance, when talking about science communication, many people still mean science popularization, which, as it was mentioned in section 3.1, is science communication on the public level. Being the most discussed, but still not properly examined, this level deserves special attention. The author particularly suggests analyzing the online activity of science communicators, who are recognized public experts with great experience in popular science events, book publishing, science journalism, and blogging. They are also experts and co-founders of the foundation *Evolution*, which is one of the leading institutions in Russia working in science communication.

The goal of the interviews was to receive insights into how science communicators understand the role of social media in their work. The intention was also to compare the results of the content and discourse analysis with interviewees' answers. As most of the participants live in Moscow or travel on a regular basis, the author did not have a chance to meet with them in person. All the interviews were conducted via Voice-over-IP (*Skype*). The interview guide is presented in Appendix B.

### 6.5. Ethics in online research

Ethics is a must for any research involving people and their private information. Both *Facebook* and *VK* are social media platforms, which are often used for public sharing content and communicating. However, still privacy is an important issue here. It is worth noticing that 3 out of 5 interviewed science communicators knew about the current research. 2 other people did not reply to the interview invitation. That is why, to respect privacy of all researched science popularizers, the results are given without direct mentioning the names: there is no specific indicator of to whom the mentioned pages or interview statements belong. For convenience of the reader, abbreviations SC1 (Science Communicator 1) or SC2 (Science Communicator 2) are used. Additionally, a singular gender-neutral pronoun "they" is used when referring to each of the science communicators.

### 7. Results

#### 7.1. Content analysis

In this section, the author will present the results of the content analysis. During the content analysis, 435 posts published the period from 1 November to 31 December on *VK* and *Facebook* pages of 5 Russian science communicators. Each page was examined individually in order to
compare results, to find both differences and similarities in audiences and science communicators’ strategies to manage their social media profiles.

First, it is necessary to provide a short analytical background of the analyzed pages. The number of subscribers of each page is presented in Figure 3. It demonstrates that 3 out of 5 of the communicators have more followers on *Facebook*. Despite being the leading social media platform in Russia, *VK* does not have all the advantages *Facebook* confers. One of these advantages is the opportunity to communicate with people all over the world. *Facebook* is known as an international social media channel where one can find, talk to and video chat with people from other countries.

![Figure 3. Number of subscribers on pages of Russian science communicators in VK and on Facebook](image)

For scientists, it is advantageous be "in the flow": to be aware of what foreign colleagues write about, what they are working on, and if they search for collaboration with other scholars. *Facebook* provides all the necessary features for developing an international scientific community. From this perspective, Russian researchers have to be on *Facebook* in order to be a part of this community. In comparison with *Facebook*, *VK* is still a local platform for Russian-speaking audience.

There is another distinction between *VK* and *Facebook*. The latter is known as a platform for "advanced" audience: people from Moscow and Saint Petersburg who speak English, travel often and work in business, cultural or education domains.
Therefore, it may also be a reason why science communicators have more readers on *Facebook*: people interested in science, education and science communication are more active on *Facebook*. However, this hypothesis demands a separate study with focus on who the audience of science popularizers is.

- **Number and frequency of posts**

The investigation demonstrated a great difference in the number of texts published by Russian science communicators. While some of them write 40-50 posts per month, others publish moderately – 5-7 posts per month (Figure 4). There is also a clear distinction in usage of platforms: while 2 communicators seem to prefer *VK* more, others write more or even only on *Facebook*. For instance, during November-December 2017 SC3 published 15 posts on *Facebook*, while in *VK* there were only 10. SC4 also prefers *Facebook* more: 33 posts on *Facebook* versus just 6 in *VK*. It raises the question of how Russian science communicators choose a platform for everyday communication with their followers, colleagues and friends.

**Figure 4.** Number of posts published in November-December 2017 by Russian science communicators

As far as timing of posting is concerned, science communicators are most active in social media most during the working week (Figure 5). For instance, SC3 posts something during the weekend only if it is an urgent issue connected to her upcoming event. Thus, we may suppose
that managing social media pages is still more connected to work because weekends are more associated with private time spent in "real" offline life.

**Figure 5.** When Russian science communicators use social media: working week VS weekends

- **Topics of posts**

All the posts published during November-December 2017 were also coded by their topics in order to find what science communicators write about in their social media channels. The purpose of this part of content analysis was to indicate whether or not science communicators use the potential of social media to educate users, "vet content for scientific accuracy" (McClain, 2017: 6), or talk about science and science communication.

The analysis provided a comprehension that science communicators do not fully exploit this opportunity: they pay rather little attention to educational content. Only 2 science popularizers devote more that 50% of their content to science, critics of pseudoscientific ideas, and educational materials (videos, books recommendations, articles). It is worth noticing that SC2 takes here the leading place because he/she shares their own education articles written for the media they work in. As for SC1, they take a great effort to explain people why pseudoscientific ideas are wrong and what we should know about homoeopathy, GMO etc. They also write why people believe in things that do not exist and why individuals become more superstitious in the environment full of uncertainty. Thus, they seem to pursue a mission of encouraging readers to develop critical thinking and to fight with pseudoscience. However, as Borrisova and Malkov
(2018) noticed, such an approach also seems to be "promoting radical scientism and atheism and expressing intolerance to views different than theirs".

Hence, there is a question how education content should be delivered in order to promote critical thinking, fact checking, and tolerance to the ideas of others.

<table>
<thead>
<tr>
<th>Who</th>
<th>% of educational content on VK</th>
<th>% of educational content on Facebook</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>58,3%</td>
<td>56 %</td>
</tr>
<tr>
<td>SC2</td>
<td>57,9%</td>
<td>58,1%</td>
</tr>
<tr>
<td>SC3</td>
<td>11,1%</td>
<td>21,4%</td>
</tr>
<tr>
<td>SC4</td>
<td>50%</td>
<td>18,1%</td>
</tr>
<tr>
<td>SC5</td>
<td>0%</td>
<td>16,3%</td>
</tr>
</tbody>
</table>

Table 3. How much educational content science communicators publish in their social media

One of the leading topics is also the announcement of events where communicators participate: give a lecture or perform as the organizer.

<table>
<thead>
<tr>
<th>Who</th>
<th>% of posts in VK dedicated to events where science communicator participates</th>
<th>% of posts on Facebook dedicated to events where science communicator participates</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>14,5%</td>
<td>6,4 %</td>
</tr>
<tr>
<td>SC2</td>
<td>11,5%</td>
<td>7,1 %</td>
</tr>
<tr>
<td>SC3</td>
<td>77,7%</td>
<td>40 %</td>
</tr>
<tr>
<td>SC4</td>
<td>16,6%</td>
<td>15,1 %</td>
</tr>
<tr>
<td>SC5</td>
<td>0%</td>
<td>6,5 %</td>
</tr>
</tbody>
</table>

Table 4. Amount of content dedicated to announcements of events where science communicators participate
We can see that, in comparison with other communicators, SC3 uses their VK and Facebook pages to advertise events where they participate: 40% of all Facebook and 77.7% of all VK posts are devoted to his/her lectures.

As social media is a platform for sharing personal photos, news etc., science communicators also publish content devoted to their private lives.

<table>
<thead>
<tr>
<th></th>
<th>% of posts in VK dedicated to personal life</th>
<th>% of posts on Facebook dedicated to personal life</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>2.08%</td>
<td>1.3%</td>
</tr>
<tr>
<td>SC2</td>
<td>17.6%</td>
<td>18.6%</td>
</tr>
<tr>
<td>SC3</td>
<td>0%</td>
<td>14.2%</td>
</tr>
<tr>
<td>SC4</td>
<td>16.6%</td>
<td>15.1%</td>
</tr>
<tr>
<td>SC5</td>
<td>0%</td>
<td>36.9%</td>
</tr>
</tbody>
</table>

**Table 5.** Amount of content on personal topic

The table yet again demonstrates that science communicators are different in their choice of platform for everyday communication. While some of them make posts only in VK (SC6), others do not publish anything there at all (SC4). For SC1 and SC2 the number of posts on personal topic differs from one platform to another just by 1%, which denotes that their communication strategies for both platforms are the same.

- **The audience**

Another goal of performing content analysis was to investigate what topics and content science popularizers' followers prefer the most: like, share, and comment on. There was also the purpose of analyze differences in preferences of readers in VK and on Facebook.

First, it is necessary to notice a common feature of audiences: people both in VK and on Facebook give more likes to content directly connected to the person they follow: posts on personal topic or the material (interview or article) created by this person. For instance, the post about the outcomes of 2017 year generated the maximum number of likes on SC3's Facebook page: what SC3 had done, where they traveled with lectures, what books they were reading etc. While the average number of likes for their Facebook page is 363.9, this post garnered 777. The same tendency continues on other pages. The author will consider the platforms where science
communicators are more active: as it was noticed above, for some communicators it is Facebook, for others – VK.

<table>
<thead>
<tr>
<th></th>
<th>Average number of likes on Facebook</th>
<th>Average number of likes in VK</th>
<th>Maximum number of likes on Facebook</th>
<th>Maximum number of likes in VK</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>207.6</td>
<td>318.9</td>
<td>734</td>
<td>1753</td>
</tr>
<tr>
<td>SC2</td>
<td>89</td>
<td>112.4</td>
<td>317</td>
<td>684</td>
</tr>
<tr>
<td>SC3</td>
<td>363.9</td>
<td>118.3</td>
<td>777</td>
<td>276</td>
</tr>
<tr>
<td>SC4</td>
<td>260</td>
<td>42</td>
<td>1002</td>
<td>57</td>
</tr>
<tr>
<td>SC5</td>
<td>44</td>
<td>0</td>
<td>357</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6. Analysis of likes on science communicators' pages during the period of November-December 2017

SC2's wedding photo in VK received 686 likes, while the average number of likes is 112.4. SC4's thoughts on Facebook about November depression gathered 1,002 likes: the average number of likes being 260. SC5's post about the release of their first popular science book generated 357 likes, while the average number of likes is 44. Thus, we can suppose that the audience is interested in coming closer to private lives of science communicators: readers feel affection for their personal reflections, photos, and news about professional success.

However, SC1's pages also demonstrated how posts with popular science topics can be the most liked materials. In her/his VK, SC1 wrote a text with hashtag #fairytales_of_popularizers, where he shared his thoughts about how science popularizers work in a humorous way. This post gathered 1,753 likes. On Facebook, SC1 also got the record number of likes for the text connected to science communication: he shared quotations of Andrey Zalyznyak, one of the most recognized linguists and science popularizers in Russia. The second and third most liked posts are also those dedicated to fighting with myths and pseudoscience.

On SC1's page, these posts, carrying a "fight pseudoscience" agenda, are also the most commented on: their interview on Russian Orthodox TV channel The Saviour (in Russian –
Spas) gathered more than 250 comments on Facebook and more than 1000 comments in VK. Such a difference in the number of comments can also be observed on other pages. For instance, on SC3’s Facebook the maximum number of comments during November-December 2017 was 17, but for VK it stood at 131. However, this most commented VK post was not published on Facebook so we cannot directly compare reactions of VK and Facebook readers to this text. However, still, comparing the pages of those who publish both on Facebook and VK, we can see a tendency that VK users are more active in terms of commenting on science communicators’ posts:

<table>
<thead>
<tr>
<th></th>
<th>Average number of comments on Facebook</th>
<th>Average number of comments in VK</th>
<th>Maximum number of comments on Facebook</th>
<th>Maximum number of comments in VK</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>31,4</td>
<td>87</td>
<td>&gt;270</td>
<td>1047</td>
</tr>
<tr>
<td>SC2</td>
<td>12</td>
<td>14</td>
<td>69</td>
<td>109</td>
</tr>
<tr>
<td>SC3</td>
<td>7</td>
<td>32,1</td>
<td>17</td>
<td>131</td>
</tr>
<tr>
<td>SC4</td>
<td>15</td>
<td>1,5</td>
<td>&gt;100</td>
<td>5</td>
</tr>
<tr>
<td>SC5</td>
<td>12</td>
<td>0</td>
<td>61</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 7.** Analysis of comments on science communicators’ pages during the period of November-December 2017

As for the most shared materials, detailed results are presented in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Number of shares on Facebook</th>
<th>Topic of the most shared posts on Facebook</th>
<th>Number of shares in VK</th>
<th>Topic of the most shared posts in VK</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>157</td>
<td>Andrey Zalyznyak and his quotations</td>
<td>380</td>
<td>Pseudoscience in Russia in 2017</td>
</tr>
<tr>
<td></td>
<td>151</td>
<td>Critics of new education course in Russian schools &quot;Moral Basics of Family Life&quot;</td>
<td>320</td>
<td>Andrey Zalyznyak and his quotations</td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>Meme about homoeopathy</td>
<td>212</td>
<td>Bioengineering and medical treatment of skin diseases</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>Danger of</td>
<td>57</td>
<td>Announcement of</td>
</tr>
</tbody>
</table>

39
<table>
<thead>
<tr>
<th>SC2</th>
<th>pseudoscientific TV programmes</th>
<th>popular science forum &quot;Scientists VS myths&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Anthropological news</td>
<td>26 Quotations of famous soviet pseudoscientist Trofim Lysenko</td>
</tr>
<tr>
<td>16</td>
<td>Opinion on Russian movie &quot;Matilda&quot;</td>
<td>16 Poster of popular science forum &quot;Scientists VS myths&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SC3</th>
<th>Books recommendations</th>
<th>SC3's video interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Announcement of lectures</td>
<td>26 Attracting the audience through managing advertising texts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SC4</th>
<th>Announcing the opportunity to travel with SC4 and famous Russian zoologist Nikolay Drozdov to Australia</th>
<th>Repost from the official page of SC4's YouTube channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>November depression</td>
<td>6 Repost from the official page of SC4's YouTube channel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SC5</th>
<th>Treatment of cold</th>
<th>Photo from the bookstore where SC6's book is presented</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

**Table 8.** The most shared posts on science communicators' pages during the period of November-December 2017

To conclude, the content analysis was applied in order to have a comprehension of how Russian science communicators manage their personal pages in social media. McClain argued that "scientists are missing a rich opportunity to discuss science with the nonscientists in their networks by actually posting and engaging with their networks" (McClain 2017: 4). In this thesis, the author suggests opening a discussion if Russian science communicators miss the same opportunity: being recognized popular science writers and lecturers, they can be those people...
vetting online space for scientific accuracy (McClain 2017: 6). McClain brought the discussion of scientists communicating in social media. However, Russian academics are still skeptical about the necessity to talk to the public, and scientific community is still closed for the wide audience. As it was noticed in paragraph 2, science communication domain is growing and developing in modern Russia.

However, it will take time before a new generation of researchers understands and values communication with people outside the academic world. Therefore, in my opinion, currently science communicators are the only ones who make use of all the opportunities to popularize science and talk about the necessity of scientific knowledge through social media, a common environment for most people now. If turning to intercultural communication theory, science communicators also the ones able to bring discursive resources to the public and scholars so they would be able to develop efficient communication.

Content analysis demonstrated that only 2 out of 5 science communicators devote at least 50% of all the content of their pages to science or the field of science popularization. Others usually write about personal life or announcements of events they participate in. The examination of subscribers' reactions (likes, comments and shared) to posts, provided a comprehension that people are ready to read and share scientific content or other materials dedicated to important issues like fighting with pseudoscience. SC1, for instance, seems to be the only science communicator who actively promotes articles, interviews, and books on the topic "science VS pseudoscience and myths". As it was confirmed during the interview with him, SC1 consciously does not publish any personal materials because "it is not that interesting in comparison with science". Thus, his page looks like a popular science blog. Analysis of his page demonstrated that readers are eager to consume and to like popular science content: TOP-3 the most liked and shared posts are somehow connected to science popularization.

7.2. Discourse analysis

Within the frames the discourse analysis, the author closely examined 23 posts with scientific agenda published on pages of 5 Russian science communicators. As the content analysis showed, only 2 out of 5 persons analyzed write about science or any other topic related to science community. Others usually publish posts about life as science popularizers, events or personal news, photos etc. Thus, the initial idea of analyzing only scientific texts could not be applicable to all science communicators. Following, in most cases for discourse analysis, the author had to pick texts about science popularization. This strategy was also valuable because it provided a
comprehension of how science popularizers tailor information about their work and try to engage their readers in the domain of science popularization.

The author used Luzón's (2013) and relied on intercultural communication. Luzón distinguished strategies for delivering science related content to the non-special audience. For the discourse analysis, five posts from each science communicator's VK and Facebook pages were chosen.

For SC3’, the author used only three posts for analysis due to a limited number of scientific content on their pages. The detailed overview of the results of the discourse analysis is presented in tables below:

<table>
<thead>
<tr>
<th>Strategy to tailor information</th>
<th>Number of posts overall</th>
<th>Number of posts where they occur</th>
<th>% of the posts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanation of terms and concept (definitions, elaboration of terms)</td>
<td>23</td>
<td>5</td>
<td>21.7</td>
</tr>
<tr>
<td>Paraphrases/reformulations</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Comparisons/metaphors</td>
<td>3</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Examples from daily life</td>
<td>1</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Links</td>
<td>7</td>
<td>30.4</td>
<td></td>
</tr>
<tr>
<td>Visuals conveying information</td>
<td>1</td>
<td>4.3</td>
<td></td>
</tr>
</tbody>
</table>

**Table 9.** Analysis of strategies to tailor information applied in posts published during November-December 2017

<table>
<thead>
<tr>
<th>Strategy to engage the reader</th>
<th>Number of posts overall</th>
<th>Number of posts where they occur</th>
<th>% of the posts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titles</td>
<td>6</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>References to popular lore, beliefs</td>
<td>2</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>Self-disclosure (reference to the communicator’s public or personal life)</td>
<td>23</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>Features of conversational discourse</td>
<td>7</td>
<td>30.4</td>
<td></td>
</tr>
</tbody>
</table>
Table 10. Analysis of strategies to engage readers applied in posts published during November-December 2017

Below, there are examples of how the aforementioned strategies were applied by Russian science communicators. It is necessary to mention that usually, if using terms, science communicators were trying to give an explanation. For instance, SC1 explained in his post:

"Bullous epidermolysis is a genetic disease during which blisters and erosions form on the skin and mucous membranes, the skin becomes vulnerable and sensitive even to minor mechanical trauma" (SC1, published on Facebook and VK).

However, sometimes the terms are just omitted without any clarification. For example, SC4 decided not to explain the term used in the post:

"It's not that I was going to tell the refined Petersburg public about the symbiotic aspects of digestion and correction of biota with the help of fecal transplantations at dinner" (SC4, published on Facebook).

Undeniably, a part of the posts were written with humor but still it brings the question of whether or not science communicators should give their subscribers and listeners details about concepts and terms they refer to each time, even in a humorous way.

If talking about metaphors and comparisons, science communicators were using them somewhat moderately. Only 13% of posts contained them:

"Darwin gave the Victorian society three slaps in the face" (SC4, published on Facebook).
It seems a loss because "analogies and metaphors help to reconceptualize an area of knowledge unknown to the reader in terms of a more familiar area" (Calsamiglia & Van Dijk, 2004 in Luzón 2013: 443). Hence, we may conclude that the analyzed texts lack this strategy, which is valuable for making materials more available for readers, who, if speaking from intercultural communication theory perspective, may not be participants of the same discourse system.

However, Russian science communicators try to bring links to their texts: 30.4% contained links to scientific works, books or useful materials. Even though these links have different purposes, they still "offer a great deal of extra information for the interested public and for peers" (Luzón 2013: 445). We may suppose that the number of links would be higher if analyzed posts were only scientific. However, there are also texts dedicated to science popularization so it influences the results.

Several strategies appear not to have been utilized at all. For example, there were not any posts with reformulations. Moreover, examples from daily life and visuals conveying information are presented extremely poorly: they were used only in 4.3% of the posts. A rather moderate number of applied strategies to tailor information signals that science communicators may not be conscious about how to "adapt information to the knowledge and interests of potential readers" (Luzón 2013: 442). Nevertheless, it is necessary to point out that writers still attempt to couple their texts with links in order to give readers an opportunity to check the original source or go to a source with more information about a mentioned topic. Additionally, posts with a scientific agenda were written with the purpose to promote new books of science popularizers so the link was served as a promotion tool:

"About this and other examples of gene therapy, I wrote in details in the [book] "Sum of Biotechnology." (SC1, published on Facebook and VK).

As far as engaging strategies are concerned, here more options were applied. For instance, titles were often (26%) used as a tool of increasing attention. As Luzón noticed, titles can assist in making text "more attractive, more relevant, and easier to understand by nonspecialist readers" (Luzón's 2013: 447). So Russian science communicators used this journalistic tool in their texts. Among the titles of analyzed posts there were:

"The Terrible Genetic Weapon from DARPA!" (SC1, published in VK);
"GM Skin, Bananas and Liver: Biotechnology News" (SC1, published both on Facebook and in VK).

Another popular strategy was conversational elements like slang or informal expressions of oral discourse:
"Here, for a change, some good news" (SC1, published both on Facebook and in VK). "It turns out that the concept of coastal migration is no longer mainstream" (SC2, published both on Facebook and in VK).

However, there were not any signs of such features as parenthetical metalinguistic cues (e.g., "Hmm", "Hmr", "Wow"), oral discourse markers ("Anyway", "Sorry", "trust me", "Well", "I mean", "Now wait", "You see") and response forms ("Ok", "Yep") expletives (Luzón 2013: 448-449). Thus, it seems that despite the informal nature of social media, science communicators still attempt to carefully write their texts without turning to conversational style. We may suppose that it is also connected to the fact that being somehow linked to the scientific community, they try to balance between different audiences and write in a neutral language.

Standing between various audiences, science communicators still try to apply strategies which facilitate the construction of a shared floor with their audience (Luzón 2013: 448). For instance, strategies like usage of inclusive pronouns and references to readers helped them in that:

"We live in a world of rapid progress, but the most surprising is that we will begin to change soon. It’s time to get ready!" (SC1, published in VK).

"And here's for you a rather unusual interview format - and immediately with a review from a grateful viewer!" (S3, published in VK).

References to popular beliefs were also identified during the analysis: but only 2 posts were written with application of this strategy. However, the references were not brought as an opportunity to clarify the picture for the audience but more as a way to underline common myths, which demonstrates a low level of scientific accuracy:

"...people refuse to vaccinate, consecrate rockets, launch eternal engines on satellites and are treated with fuflomycins, explaining all this by saying that "the world is unknowable." (SC5, published on Facebook).

As for personal opinions and evaluations, there were several cases of using these strategies. SC3 described their opinion about a famous Russian award for authors of popular science books:

"I am very pleased with the results of the Illuminator. Like everyone else, I was sure that Drobyshevsky would win by a combination of merit, but from the point of view of the direct benefit for society, the book of Daria Varlamova and Anton Zainiev, what's more important there" (SC3, published on Facebook).

SC1 also gave his estimation of the research which he was writing about:

"To edit DNA, an elegant technology was used, for which the Nobel Prize will inevitably be given, - CRISPR / Cas9" (SC1, published in VK).

However, evaluations connected to scientific topics appeared somewhat rarely: SC1 was the only one openly commenting on the research. Yet, again, it may be connected to the fact that in the corpus there was a combination of both texts connected to science and science popularization.
Thus, the number of scientific materials was limited. However, it seems necessary to mention that "writers of popular texts do make a high use of attitude markers to evaluate aspects of the content...[but] they do not use evaluation to position themselves or express their commitment to claims: They just report others’ (the experts’) opinions without evaluating research, results, or claims" (Luzón 2013: 450). Hence, the lack of any evaluations may also be connected to the fact that science popularizers usually balance between various audiences: colleagues, scientists, popular science fans etc. Thus, they cannot give their evaluations in an open manner or that often. However, science communicators sometimes express, in a very strict way, their negativity about people having religious ideas or those fighting with GMO. Borrisova and Malkov (2018) noticed that such an approach may be "promoting radical scientism and atheism and expressing intolerance to views different than theirs" (Borrisova & Malkov 2018). In this regard, it seems that usage of evaluations can be a tricky strategy, which, undoubtedly, may assist in reaching the "goal of encouraging readers to engage with the topic" (Luzón 2013: 450). However, at the same time, it seems necessary to point out that science communicators are people working with the public, promoting scientific knowledge and attitude, which is "impartiality, open-mindedness and critical distance to the opinions of oneself as well as of others" (Carlshamre 2015: 12). Therefore, their criticism should be constructive and accompanied with arguments and supportive materials. Analysis of the corpus gave an understanding that Russian science communicators attempt to explain their position and give their readers scientific explanation. However, whether or not they "promote radical scientism, atheism and […] intolerance" is still a question, which demands a separate study with more data and methods.

To sum up, the discourse analysis, performed while looking through the lens of intercultural communication theory, was conducive to the examination of strategies of how Russian science communicators write their texts in social media on their personal pages. The results demonstrated that a moderate number of strategies of tailoring the information and engaging the audience were applied during the period November-December 2017. As it was later confirmed during interviews, writers usually use catchy titles, references to personal/public life and links, as tools to attract attention to the posts, promote their books, and encourage the audience to participate in the discussion.

7.3. Interviews: view of science communicators

As the current research is aimed at constructing an understanding of science popularization in Russia and its development, the author also decided to talk to science communicators in order to collect information on specifics of science communication in modern Russia. The author
particularly conducted semi-structural interviews with science communicators whose pages were analyzed during content and discourse analysis. Their detailed profiles are presented in section 6.2. The interviews pursued 2 purposes: to receive insights in the field of science popularization in Russia from those working there, and to receive science communicators' interpretation of their usage of social media in order to compare this information with the results of the given content and discourse analysis.

- Goals of science popularization in Russia

During the first part of interviews SC1, SC2, and SC3 shared their own views on how science communication has been developing in modern Russia. As all of them have been working in this domain for 5-10 years, they have valuable information pertaining to this study. Interviews demonstrated that each communicator has their own comprehension of what science popularization (SciPop) is, but they do not formulate a direct definition. Usually, they were explaining what it was through the goals of SciPop:

SC3: "Most of the scientific materials pass us [science journalists]. Other people miss out even more information. So, schools and universities broadcast world view, which 5-20 years out of date. Thus, there is a demand of society for "translators" – those who read different materials and pick cherries from top of the cake [...] in order to provide people with a feeling of opportunity to track the key things happening in medicine, biotechnology, physics etc".

SC2: "Science popularization is one of the most important functions of scientists in relation to society. The society should know about the results that scientists receive [...] popularization is satisfaction of people's curiosity. Maybe, this is generally one of the functions for which scientists receive money. There is a statement by a Soviet physicist: "Science is a satisfaction of curiosity at the expense of the state." Whoever said that meant the curiosity of the scientists, but I mean the curiosity of mankind".

It was obvious that as all of them are colleagues: they shared a somewhat common vision on the goals of science popularization and even quoted each other. For instance:

SC1: "One of the points of view [on what is science popularization] was perfectly formulated by SC3: that this is an increase in the communicative value of the audience. Some popularizers believe that they are setting an opportunity for people who are interested in science to learn something new. Then they can discuss these topics, and this increases their social comfort".
Interviewees also mentioned such goals as improving image of science, attracting students to natural-science departments, fighting with common myths and pseudoscience, assisting in developing critical thinking. The last 2 interviewees were interestingly combined into a separate category by SC3, who called it "increasing personal security":

\textit{SC3:} "It is the ability to make more informed decisions, for example, related to some kind of domestic behavior".

Thus, science communicators attempt to tell the public how facts about the worlds appear, how science works and how to prevent logical mistakes in order to be more critical and thoughtful when taking decisions in everyday life. SC1 particularly noticed that scientific literacy plays an extremely important role when we talk about health and medicine:

\textit{SC1:} "[... ] there are socially significant phenomena associated with pseudoscientific activities, such as denial that HIV causes AIDS, a variety of forms of medicine, the effectiveness of which has not been proven, but which people are prescribed. Because of this, the moment is missed when it was possible to have an adequate treatment. Or even when pseudoscientific ideas go to school and universities (theology, homeopathy)".

In comparison with foreign academics, who often notice the importance of science communication in increasing citizens’ opportunities to become more conscious citizens aiming at developing democracy, Russian science popularizers somewhat rarely mention political goals of their work. SC1 was the only one who touched upon this issue when discussing aspirations of science communicators:

\textit{SC1:} "We see how many things are falling apart. We see problems in modern society: some charlatans occupy high-ranking positions and influence the laws adopted in the country, affect the health care system, education. And being silent is just hard. I think this is one of the important motivations for people [science popularizers]".

- Science popularization development in Russia

The interviews also provided an opportunity to distinguish several key features of how science communication has been developing in Russia. The first one concerns the spread of popular science activities in the country:

\textit{SC3:} "Geography in Russia reminds me a time machine: in 2004, popular science lectures became a usual activity in Moscow, then in 2008-2012 they developed in cities with population over 1 million citizens, now they are developing in cities with 300 000-500 000 people".
The second feature is difficulties with monetization. Interviewees explained that there are people who already know how to earn money in science popularization domain. SC3 stated that "it's like with any other show business: "if you just go into the profession, then [...] you will need to work very hard for free. And if you worked there for a long time and persistently and made it to the first 20 in the country, then you earn quite well".

Hence, still most of the communicators read lectures, write articles and books during their time after the "official" work:

**SC1:**"It is not that easy to earn money in popular science. There are people who found out how to do that [...] but still most of the science communicators combine their work with it. They don't have any financial purposes: it is like a form of socialization and contribution to the development of society".

**SC2:**"In Russia, a scientist does it [science popularization] in his spare time, basically by virtue of his or her enthusiasm. Of course, now there are performances and lectures that are paid for. However, it only works for those who are already popular among the audience. Moreover, to write a popular science book, you have to work a lot. So this work is [...] ungrateful".

Hence, there is a controversial situation: scholars interested in communicating with the public, have to find additional time to prepare lectures, articles, books, while there is not any guarantee that this work will be paid for. In this situation, there is a demand for professionals to obtain PR skills and know how to monetize intellectual products. Additionally, SC3 noticed that for scientists it is just impossible to devote enough time to science popularization: "If a person works in science and if he is seriously engaged in science, then he works 24/7. Those who seriously decide to stay in science, they depart from the popularization. At best, they can read a course of lectures in Moscow, where they live and work". SC1 had a similar point: "It is not a fact that it will be good if all scientists abandon science and go into popular science [...]"

The third trend in Russian science communication is science journalism development. In comparison with Europe and the USA, where scientists have a tradition of communicating with journalists and the public, Russian universities and researchers are still building this form of communication:

**SC3:**"[...] when science journalism was being born in 2008, [Russian] scientists hated us. Now, they already more or less understand that there are simply journalists and science journalists. In
2008, they immediately hung up on you when they heard that you are a science journalist or that you are a journalist from a TV station”.

The fourth feature, which was also underlined in section 2, is the growth of the science popularization field in Russia. SC3 brought forward 2 facts serving as evidence of that: the increasing number of popular science books and the appearance of new generations of science communicators.

SC3: “[…] absolutely the audience is expanding. It definitely grows every year: it can be seen simply on the basis of formal indicators. Because 10 years ago a good record for a book was 5 thousand copies, now a good circulation is 20 thousand copies or 40. Somehow, new people appear, but not so many”.

Considering "generations" of Russian science communicators, SC3 singled out 3 groups:

1) Scientists who "also made a name and money for themselves as popularizers": Alexander Markov, Tatyana Chernigovskaya, Vyacheslav Dubynin, etc.

2) "Strong professionals" – those who are professionally engaged in scientific journalism: Asya Kazantzeva, Alexander Panchin, Irina Yakutenko, Alexander Sokolov etc.

3) The new generation which enters the already shaped market.

To sum up, the interviews provided an opportunity to get insights of key Russian science communicators in science popularization in Russia. It became possible to formulate the definition and goals of popular science projects in Russia, trends and challenges of the market and its players. In the next section, the author will present the results of the interviews connected to science communicators' usage of social media.

- Russian science communicators in social media

The second goal of the interviews was to investigate how science communicators see the purpose of using social media and explain their own strategies in managing their profiles in VK and Facebook.

First, content analysis demonstrated that there is a great difference in what topics are the most popular on each page. For instance, SC1 dedicates a great number of texts to pseudoscience and educational materials. SC3 almost never writes scientific posts but shares personal news, opinion, and thoughts. The question for this study was whether or not science communicators have strategies for managing their pages.
During the interviews, it became obvious that they do not have actual strategies but they are conscious about the choice of the content they post. For example, SC3 explained why he/she does not share scientific texts with subscribers, preferring more personal posts:

SC3: “On Facebook, I write different simple things about life. And people like such kind of simple things. That is how people with some kind of popularity demonstrate their humaneness. [...] But I don't write anything about science in social media because I have been doing that for money for a long time. It would be nice to do but I don't have enough resources”.

Considering the attitude to sharing moments from their private life, SC1 also had a clear explanation of why they do not have such content:

SC1: "I know that examples from personal life are a useful tool for attracting attention. Maybe that is why SC3 is more popular in social media than me. [...] But I think stories from my life are more boring than science facts which I talk about. So it is just not interesting for me”.

Additionally, SC1 underlined an important moment they always have in mind when managing their profile – they never moderate comments:

SC1: "I almost never ban anybody and do not moderate comments. It really distinguishes me from many communities, from many people who are completely unprepared to participate in discussions of other people’s points of view. I have 2 reasons why I do it. The main thing is that no matter what feedback is, it is still feedback. If I'm wrong, then I would like to know about it”.

However, SC1 noticed that they do not have proper time to answer all the questions and critique. That is where they understood that they have somewhat a community of people sharing their views:

SC1: "[...] I had such an educated and well prepared audience. Often it turns out that I do not even need to do anything, other people come and explain everything perfectly to these strange commenters: why they are wrong, why their approach is not constructive”.

During the discourse analysis, it also became possible to analyze what communication strategies science communicators use when writing texts in social media. During the interviews science communicators noticed that they are also aware of writing strategies which may assist in attracting audience attention: titles, visual materials etc. However, it is not a priority for them:
SC1: “When I prepare materials, for me, the most important thing is that I like it. If within the framework of what I like, it is permissible to post some beautiful picture (which is, apparently, a factor that increases posts' coverage) or make it pleasing to me, but at the same time a more provocative title, then, of course, I use it. Everyone knows that such things increase coverage. It's just that I'm not ready to take care of it or change something”.

SC2: “As for communication strategies, then there are journalistic classics. We need a headline, in which there must be an intrigue, maybe a provocation. But this should not be a lie. The picture must be at least understandable too”.

Besides that, science communicators do not distinguish between other concrete features of their social media behavior. However, within this study, it seems necessary to point out that science communicators understand the important role of social media channels which help them to construct communication with both colleagues and the public.

SC1 also underlined that social media, especially Facebook, are important for him/her because they allow him/her to discover new articles and materials of his colleagues. He/she can widen horizons. Another important role of social media is an opportunity to receive feedback from readers and colleagues. They also acknowledge the fact that Facebook in Russian reality does seem more popular among scientists:

SC1: “For me, Facebook delivers interesting articles that my colleagues read. It widens my horizons [...] Scientists are more likely to register with Facebook, because it allows you to keep in touch with your Western colleagues. Science by definition, this phenomenon is international, so any scientist who travels to a conference, he has a lot of familiar foreign. [...] However, if we talk about broadcasting scientific facts to a wide audience, then VK solves the problem much better. There is much easier for some material, which will lay out popular bands that have hundreds of thousands of subscribers”.

SC2: “VK, for example, is the place for audience studies. [...] This is a natural place for recruiting people for events. This is a place for communication, to find like-minded people. [...] Facebook has less Russian-speaking audience. We are not talking about scientists, researchers and intellectuals, but about a broad audience”.

To sum up, the interviews have served as an efficient method helping to gain insights into science communication development and social media usage of popularizers in Russia. Several key trends can be distinguished based on the results of the interview:
• Science popularization field has been growing. As SC3 noticed, the number of popular science books has witnessed a 2 twofold increase in recent years;

• Currently, there are 3 generations of science popularizers in Russia: scientists who "also made a name and money for themselves as popularizers" (Alexander Markov, Tatyana Chernigovskaya, Vyacheslav Dubynin, etc.); "strong professionals" – those who are professionally engaged in scientific journalism (Asya Kazantzeva, Alexander Panchin, Irina Yakutenko, Alexander Sokolov etc.); new generation which enters the already shaped market.

• Russian science communicators do have strategies for communication with their subscribers in social media, but their number is quite moderate;

• They comprehend the difference of such platform as VK (more suitable for communication with the wide audience) and Facebook (space for communication with other scientists and foreign colleagues).

7.4. Intercultural science communication and results of the study

Intercultural theory was presented in section 3.2 of this study in order to present the hypothesis that science communication can be seen as an interdiscourse system of communication. The analysis performed within this research demonstrated that this supposition was true. As it was confirmed during the interviews, science communicators use social media channels for various purposes, including communication with different audiences: from scholars to the amateurs interested in science. Therefore, their vocabulary and delivery of the content depend on the situation. However, being the key science popularizers in Russia, they pay great attention to managing their profiles to appear attractive to the public.

Content analysis provided a comprehension that they share a great deal of personal content (photos, opinions etc.), which is most liked in social media world. Such type of posts seems like "a hook" for attracting the readers. At the same time, science communicators write posts with a scientific agenda and explain, if necessary, scientific concepts and terms. The discourse analysis demonstrated that this content is produced, even though not that often, with intriguing titles, metaphors, and references to popular beliefs. Such discursive strategies assist in making science world less esoteric and more accessible to everyday reasoning (Peters in Bucchi & Trench 2008: 139).
At the same time, as was noticed by one of the interviewees, social media platforms like Facebook serve as a space for communication with colleagues, exchanging materials and opinions with them. Thus, posts constructed for other scholars as the target audience, also have to be specific in its preparation: language and the way of delivering information are different in comparison with those used for posts for the public.

To conclude, social media platforms themselves may be seen as an interdiscourse system of communication, where different audiences, including scholars, journalists, amateurs, and other meet. Science communicators are the key players in making this meeting softer and more friendly. Through popular social media formats (personal photos, stories from private life etc.) they attract the public and then try to improve their scientific literacy and critical thinking skills so that in the future they will be prepared to communicate with scientists and other members of the scientific community. Thus, science communicators' pages in social media are truly an interdiscourse system of communication, where various discursive resources are realized to develop science communication on different levels.

8. Conclusion

In this chapter, the author will provide a quick overview of the current study and will present its results.

The purpose of the study was to analyze Russian science communicators, their Facebook and VK profiles and communication strategies. 3 research questions were identified. In order to find what science communicators write on their Facebook and VK pages and to analyze what topics are most popular (liked, shared and commented) among subscribers, a content analysis was performed. It gave an understanding that 2 out of 5 science communicators devote about 50% of all the content on their pages to science or science popularization domain. Others usually share personal photos, thoughts, or announcements of their lectures. Such results indicate that science communicators are "missing a rich opportunity to discuss science with the nonscientists in their networks by actually posting [scientific materials]" (McClain 2017: 4).

Analysis of subscribers' likes, comments, and shares demonstrated that people are actually ready to consume scientific content and materials connected to critiquing pseudoscience, fighting with myths etc. For instance, TOP-3 most liked and shared posts on SC'1 pages are connected to these topics. At the same time, Facebook and VK users willingly like and comment on posts about science communicators' personal life. Therefore, this balance between science and personal
content is thought through by each science communicator in dependence on their preferences and views of how theirs image in social media should be constructed.

Three science communicators confirmed that their communication strategies depend on their personal view of how their profiles should be managed during the interviews which were conducted in order to find answers to the 3rd research question – how Russian science communicators see science communication development in Russia and how they define the purpose of social media in their work. Interviews allowed the author to get insights into science communication development and social media usage of popularizers in Russia from those people who work in this field. During interviews, it became obvious that science communicators comprehend the difference of VK (more suitable for communication with the wide audience) and Facebook (space for communication with other scientists and foreign colleagues). They also do have strategies for communication with their subscribers in social media, but their number is quite moderate. They know that they do not fully exploit the potential of social media to promote science because they are used to writing scientific texts for money. They both lack strong motivation and enough amount of time to write texts for free. That is why usually they just share materials they create for media or their YouTube/text blogs. Whether or not it is enough to move science popularization forward is still a question open for discussion. Based on my investigation, it is enough for these science popularizers, but then there is a great need for new science communication specialists.

During the interviews there was also a point that science popularization domain has been growing and attracting both new audience and professionals. SC3 noticed that currently in Russia there are 3 generations of science popularizers. So new lecturers, writers, and bloggers enter the world of Russian science communication. Their work in social media demands another investigation.

In order to examine the 2nd research question, which was what discursive strategies science communicators use when constructing science posts to engage their readers and to tailor information, discourse analysis was applied. Public communication of science is usually seen as a process of "translation" from scientific language to everyday language. However, translation means that participants share common background, which would help to make sense of information (Peters in Bucchi & Trench, 2008: 139). This is not the case with science communication, where scholars and the audience (the public, colleagues from other domains, businessmen etc.) are from different discourse systems. So science communication should be seen as recontextualization of scientific discourse into another domain (Calsamiglia & Van Dijk
Discursive strategies can thus be used to make science discourse respond to the context of the text (Luzón 2013: 436). Within this study I found that Russian science communicators use such strategies moderately: usually writers appeal to catchy titles, references to personal/public life, and links to sources with additional or specifying information.

For the limitations of this study, it seems necessary to point that the current research is devoted to 5 key experts in the public communication of science in Russia. The applied methods provided an opportunity to look at their social media pages from different angles and to conduct interviews with them, which allowed mapping several trends in science communication development in Russia. However, there is a great need to broaden the horizons and to make bigger scaled research, which could examine more pages and more content. There is also a limitation of the content analysis, which is the intra-coder agreement: the content was coded only by 1 researcher. To make the next study more reliable and valid, it is important to work with other 1-2 coders.

Considering the next studies, it would be fruitful to conduct a research aiming to examine and to compare views of all above mentioned (section 7.3) generations of science popularizers on public communication of science. Moreover, there is a great need for audience studies due to the lack of understanding who the audience of popular science projects is: what motivates them to read popular science book, what formats of communication they are interested in, and if there is a potential for launching citizen science projects.

Finally, in a world with an agenda for global community creation, a number of countries are still missing from the map of science communication development. In order to create more research collaborations, a more advanced and scientific literate community, we need more studies about science communication, which would include different countries from different parts of the world so that we would be able to create a platform aimed at improving scientific literacy, critical thinking skills, and scholars’ work conditions.
References


10. Broks, P. (2018) "What is this thing called science communication?". Available online: [https://literacyofthepresent.wordpress.com/2018/02/03/what-is-this-thing-called-science-communication/](https://literacyofthepresent.wordpress.com/2018/02/03/what-is-this-thing-called-science-communication/) [05 Feb 2018]


## Appendix A

### Codebook

**Unit of Data Collection:** A post on a page

<table>
<thead>
<tr>
<th>Topics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Personal life: stories about person's life, photos, personal opinion on various issues and activities (education, music, culture etc.)</td>
</tr>
<tr>
<td>2.</td>
<td>Domain of science popularization: content devoted to how the field of science communication develops, including professional discussions, myths about public communication of science, professional events for science communicators, news of the field; science VS pseudoscience; useful videos/books/articles on scientific topics</td>
</tr>
<tr>
<td>3.</td>
<td>Science: content with clear scientific agenda, including science news, new researches</td>
</tr>
<tr>
<td>4.</td>
<td>Announcements of public lectures/events</td>
</tr>
<tr>
<td>5.</td>
<td>Politics</td>
</tr>
<tr>
<td>6.</td>
<td>Mixed (personal/professional, personal/science etc.)</td>
</tr>
<tr>
<td>7.</td>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of content</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Text</td>
</tr>
<tr>
<td>2.</td>
<td>Text + picture/photo</td>
</tr>
<tr>
<td>3.</td>
<td>Text + link</td>
</tr>
<tr>
<td>4.</td>
<td>Picture/photo</td>
</tr>
<tr>
<td>5.</td>
<td>Text + video</td>
</tr>
<tr>
<td>6.</td>
<td>Video</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day of posting</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Workday</td>
</tr>
<tr>
<td>2.</td>
<td>Weekend</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time of posting</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Morning (7am-11am)</td>
</tr>
<tr>
<td>2.</td>
<td>Middle of the day (12pm-5pm)</td>
</tr>
<tr>
<td>3.</td>
<td>Evening (6pm-10pm)</td>
</tr>
<tr>
<td>4.</td>
<td>Night (11pm-6am)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount of likes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>&lt;10</td>
</tr>
<tr>
<td>2.</td>
<td>11-50</td>
</tr>
<tr>
<td>3.</td>
<td>51-200</td>
</tr>
<tr>
<td>4.</td>
<td>201-500</td>
</tr>
<tr>
<td>5.</td>
<td>501-1000</td>
</tr>
<tr>
<td>6.</td>
<td>&gt;1000</td>
</tr>
<tr>
<td>Amount of comments</td>
<td>1.</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td>4.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount of shares</th>
<th>1.</th>
<th>&lt;10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.</td>
<td>11-50</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>51-100</td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td>101-200</td>
</tr>
<tr>
<td></td>
<td>5.</td>
<td>201-500</td>
</tr>
</tbody>
</table>
Appendix B

Interview Guide

Research question – How Russian scientists themselves define the purpose of using VK and Facebook?

1. How would you define what is science popularization? What is the goal of science popularize?
   → On what stage is science popularization in Russia today?
   → What are the main difficulties science communicators have?

2. When we talk about the necessity of creating a bridge between science and the public, we often mention science journalists. Do you think that social media can become this bridge now and soon we will not science journalists?

3. What role social media channels like VK and Facebook play in science communication in modern Russia? How would you define the purpose of using these channels when working in science popularization domain?
   → Which channel is more priority for you and your work?
   → Do you see any difference in the audience of VK and Facebook?
   → In 2015 Facebook was the platform where members of Russian scientific community were discussing how to save Foundation "Dynasty". Why do you think Facebook was the main place for discussion?
   → Can you say that more people are leaving VK and going to Facebook?
   → How can you define the purpose of VK and Facebook in your work?

4. What strategies do you use when communicating with your subscribers? Do you have any special approach to writing a text or a post in social media?

5. When discussing science communication, researchers often mention scientists and the public. However, there is not a clear idea of how are "the public". Do you know who is your audience?
   → Do you know what content your subscribers prefer the most?
Appendix C

Example of the coding sheet

<table>
<thead>
<tr>
<th>Post</th>
<th>Date</th>
<th>Topic</th>
<th>Type of content</th>
<th>Day of posting</th>
<th>Time of posting</th>
<th>Amount of likes</th>
<th>Amount of comments</th>
<th>Amount of shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>The year 2017 once again confirmed that Apophenia is a prophetic dystopia.</td>
<td>31 Dec</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1. We are already seriously compelled to discuss a flat Earth. Let me remind you that Igor Prokopenko, who made a significant contribution to this direction, received TEFI in the &quot;Enlightenment Program&quot; nomination.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. A conference was held at the Department of Medical Sciences of the Russian Academy of Sciences, where the &quot;release-active&quot; preparations of Oleg Epstein were praised. Let me remind you that this is just a rebranding of homeopathy. We are very close to the fact that innovative homeopathy will be &quot;treated&quot; by diabetes, encephalitis, HIV and cancer. Epstein has already been supported by the chief gastroenterologist of the Ministry of Health, the chief urologist of the Ministry of Health and several academicians. Meanwhile, the Ministry of Health did not collect the promised commission, which was supposed to consider criticism of homeopathy, set out in the Memorandum of the Commission on Combating Pseudoscience.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The Minister of Education and Science (or already the Minister of Magic?) Olga Vasilieva does not hide her positive attitude towards theology and supported the award of the degree of the candidate of theology for the thesis, where the &quot;personal experience of faith&quot; is mentioned among other methods. At the same time, negative reviews (which were more than positive ones) were ignored, as was the appeal, which indicated numerous violations on the defense itself. For example, &quot;The claimed scientific degree does not correspond to the scientific degree specified in the documents created after the defense (the list of the members of the dissertational council who attended the meeting for the defense of the thesis and the conclusion of the dissertation council) ». And also the lack of publicity: journalists were not allowed to defend.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The case of Medinsky showed that it is possible to keep a doctorate in historical sciences even after the profile Expert Council of the Higher Attestation Commission (VAK) recommended deprivation of the degree. After the expert council, the decision was to be approved by the Presidium of the Higher Attestation Commission and the Ministry of Education and Science. Not approved.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| If the theologians had a personal experience of faith, then Medinsky had something similar. Here is an excerpt from the dissertation: "The criterion of a positive or negative assessment," according to our contemporary, the famous Russian scientist and thinker OA Platonov, "can only be the national interests of Russia." The first question, to which historical science should honestly answer, is how much this or that event or private act is in the interests of the country and the people. Weighing on
the scales of Russia's national interests creates an absolute standard of the truth and reliability of historical work."

5. And on a trifle. On TV, they turn adverts of "magnetotherapy devices" with impunity. The price of these useless devices is about ten thousand rubles, but people are being kept. Advertising Epstein's homeopathy even penetrated into "Popular Mechanics." The first channel posted an announcement about the search for a physicist who will tell about the magical properties of the Epiphany water. The possibility of introducing the course "Moral Foundations of Family Life", in which they refer to telegony, is considered in schools. Metropolitan Hilarion (Alfeev), the main ideologist of the introduction of theology in Russian universities, proposes to introduce compulsory teaching of religion in schools from the 1st to the 11th.

Can this be stopped? I do not know.

At one time, the Commission for Combating Pseudoscience coped with Viktor Petrik, despite his enormous influence and financial capabilities. She covered the project that Petrik did with the former chairman of the State Duma, Boris Gryzlov. Perhaps something can be done with Epstein. Alas, I can not yet open all plans.

To stop the clericalization of science and education and the homeopathy of healthcare - the tasks are much more complicated. Not to mention the return of an adequate system of scientific reputations, in which one can not simply become a candidate or a doctor of sciences by writing of a thesis. This will require total effort and hard work.

I want to thank everyone who is not indifferent. I hope that in the New Year we will be able to win back positions that have lost in this. In the meantime, we will be content with the fact that obscurantism has not won completely. Resistance is still alive. The war is just beginning. Let the power of science be with you. Happy holiday.

Version with references:
https://scinquisitor.livejournal.com/127667.html

From the scientific point of view, the first series of the new season of the Black Mirror is, of course, a complete trash. Our memories and life experience are not stored in DNA. From it can be extracted unless the information on the appearance, but for this it is easier to use a person's photo.

But what a steep drama! What a suspense! Plot! All urgently to look!

"I would like to speak out in defense of two simple ideas that were formerly considered obvious and even simply banal, but now sound very unfashionable:

1) Truth exists, and the goal of science is its search.

2) In any question under discussion, a professional (if he is really a professional, and not just a bearer of state titles) in the normal case is more right than an amateur.

They are opposed by the provisions, now much more fashionable:

1) Truth does not exist, there are only many opinions (or, in the language of postmodernism, many texts).

2) On any issue no one's opinion weighs more than the opinion of someone else. A fifth-graded girl has the opinion that Darwin is wrong, and a good tone is to serve this fact as a serious challenge to biological science.

This poverty is no longer purely Russian, it is felt throughout the Western world. But in Russia it is markedly strengthened by the situation of the post-Soviet ideological vacuum.

Version with references:
https://scinquisitor.livejournal.com/127667.html

<table>
<thead>
<tr>
<th>Date</th>
<th>6</th>
<th>2</th>
<th>2</th>
<th>1</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Dec</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>29 Dec</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

65
The sources of these now fashionable provisions are clear: indeed, there are aspects of the world order, where the truth is hidden and, perhaps, unattainable; indeed, there are times when a layman is right, and all professionals are mistaken.

And the enormous strength of the stimulus for their acceptance and belief in them is their psychological advantage. If all opinions are equal, then I can sit down and immediately send and my opinion on the Internet, without hampering myself with a long-term teaching and laborious acquaintance with what is already known in this regard by those who have devoted this to years of research.

Psychological advantage is here not only for the writer, but equally for a significant part of readers: the sensational refutation of what was yesterday considered to be the generally accepted truth, relieves them from the feeling of their own insufficient education, puts them one step higher than those who pored over the study of the corresponding traditional wisdom, which, as they now know, is worthless.

From the recognition that there is no truth in some deep philosophical question, a transition is made to the fact that there is no truth in anything, say, that in 1914 the First World War began. And we already read, for example, that there was never Ivan the Terrible or that Baty is Ivan Kalita. And what is much more terrible, regrettably a large number of people accept such news willingly.

And the current media, alas, turn out to be the first allies in spreading such amateurish nonsense, because they say and write first of all what should impress the mass audience and listener and impress him, therefore, the most catchy and sensational, and is by no means the most serious and reliable.

I do not feel particularly optimistic that the vector of this movement will somehow change and the situation will change by itself. Apparently, those who realize the value of truth and the corrupting force of amateurism and charlatanry and try to resist this force will continue to find themselves in a difficult situation floating against the current. But the hope is that there will always be those who will still do it."

A.A. Zaliznyak

Always with pleasure watched how he thundered obscurantists and popularly talked about science.

Yesterday I was at the awarding of the participants of the contest of scientific and popular science articles on biology of the Biomolecule.

I read a lot of good articles as a member of the jury. Now I will spread some of the most liked. I'll start with this one. Author Anton Mindubaev.

And the winners in different nominations can be found here: https://biomolecula.ru/biomolt-/biomol-tekt-2017/articles...

Today, an awarding ceremony of the "Enlightenment" prize was held.

In the nomination "People's Enlightener" (popular vote), the winners were the books "The Constructing of Languages" by Alexander Piperski and Stanislav Drobyshevsky's "Getting the Link". The jury voted a little differently. The Humanitarian Prize was divided into "The Design of Languages" and "The Sign does not erase". This happens for the first time.

In natural sciences, the award was awarded to the book "From the Mind" by Daria Varlamova and Anton Zaimiev. In addition, all the books of the short list will be sent to libraries across different cities of Russia. You can see the list here: http://premiaprovvetitel.ru
Appendix D

Examples of the discourse analysis

Strategies how to engage readers:

- self-disclosure
- references to popular lore, beliefs
- title
- questions
- negative evaluation of research or findings
- positive evaluation of research or findings
- expression of feelings or emotional reactions
- references to reader
- features of conversational discourse
- inclusive pronouns
- humor
- personal expression of opinion

Strategies how to tailor information:

- explanation of terms/concepts/ideas
- links
- examples from daily life
- comparisons/metathors

Examples of the analyzed texts:

1. It's not the first time I've come across the amazing principles of working with sources used in the MGPPU.

Last time I tried to find the Russian adaptation of the alarm scale of Beck (still relevant), and I looked through a lot of articles from the staff of the Moscow State Pedagogical University, in which they all unanimously refer to Tarabrina's book in this context. All would be well, but there is one problem – in the book of Tarabrina there is not a word about the alarm scale Beka.Seychas (looking at including Russian sources for the post for Evolution about teenage suicides) stumbled upon an article of the MGPPU staff, seemingly even useful. But there is strangeness. They write: According to international data on the study of macrosocial risk factors for suicidal behavior (Fortune, Hawton, 2005), the most important of them are: 1) the availability of means to reduce bills with life (guns, poisonous substances, etc.); 2) a broad discussion in the media of
cases of suicide, which may lead to a "normalization" of this method of solving problems; 3) the availability of information on methods of suicide, which in the modern world becomes a particularly big problem in connection with the advent of the Internet (about ten special Russian-language sites are devoted to suicides with detailed descriptions of various methods and the possibility to find a partner); 4) socio-economic crises and other social stresses, increasing the number of families with difficult financial situation and unemployment; 5) the level of consumption of alcohol and drugs in society and their accessibility; 6) the system of values that dominate the society, for example, the cult of success and the propagation of unrealistic standards of happiness and success; 7) for such a large country as Russia, it is necessary to emphasize the high variability of suicide rates depending on the region, which also requires special studies. Referred herewith, respectively, to the article Fortune S. A., Hawton K. Suicide and deliberate self-harm in children and adolescents // Current Paediatrics. - 2005. - V.15. - p. 575-580.

Post of Asya Kazanzeva

2. GMOs: FOR AND AGAINST

The project "In short, Wikipedia" gives such an ingenious definition to genetically modified organisms (GMOs): "Gene weapons, successfully used to reduce the population of the Earth from four to seven billion people." How do scientists manage to implement such a "treacherous" plan? And what problems can genetic engineering solve?

It is very likely that among your acquaintances there are those who suffer from diabetes. So: almost all of the insulin, which is used by diabetics, is produced today with the help of genetically modified microorganisms carrying some human genes. Previously, doctors had to use insulin of animal origin. But it differs from the human and it is expensive to produce. Now these problems are solved. There are other drugs that produce genetically modified organisms: hormones, vaccines, enzymes, antibodies, blood coagulation factors, an internal factor that helps to convert the inactive form of vitamin B12, which comes from food, into an active, easy to assimilate, and much more.

In addition, genetic engineering opens up new possibilities for the treatment of certain hereditary diseases that were previously considered incurable. Unfortunately, Down’s syndrome is not up to the scientist yet, but, for example, hemophilia is another case. The disease occurs due to a lack of blood clotting factor, which is normally produced in the liver. Because of the genetic breakdown, the synthesis of the factor is disturbed. Fortunately, in order to help the patient, we do not need to
change the DNA in each of the trillions of its cells. It is enough to fix the liver cells - hepatocytes. But how to deliver the missing gene in them? To do this, we use already "invented" by nature viruses that purposely penetrate into hepatocytes. From viruses leave their shell - it is responsible for selectively getting into the right cells. The genes of viruses, which are the cause of their pathogenicity, scientists replace with DNA sequences responsible for the synthesis of the clotting factor. To many patients, such gene therapy has already helped. This is not a complete cure, but the symptoms of the disease are diminishing. The coagulation factor appears in the blood.

Another example is the treatment of blood cancer. Recently, the Food and Drug Administration in the United States has authorized gene therapy for leukemia. Cancer cells are mutants that, due to breakdowns of DNA, divide too actively and therefore threaten a person's health. Because these cells are different from the usual ones, the immune system often recognizes them as alien objects and destroys them. But sometimes the cells of the immune system do not have suitable receptors. Mutant cells continue to live, reproduce, evolve - this leads to the development of severe oncological diseases. Now the patient takes the cells of the immune system, puts it in a test tube, supplies them (with the help of viruses) with genes that encode missing receptors, and returns them back to the blood of the patient. Such a genetically modified cell of the immune system can recognize a cancer cell, begin to share and fight the disease. In the US, the first clinics are opened, where this approach will be applied.

And one more story from the field of medicine. This year, American scientists have shown how it is possible to rid human embryos from a mutation leading to congenital heart disease. For this, DNA editing technology is used, which was borrowed from bacteria. The fact is that bacteria are skilled genetic engineers. They are able to build into their ring chromosome small pieces of viral DNA, to then recognize the full-length viral genes and cut them with a special protein. It was this protein that scientists borrowed. They learned how to "target" it to virtually any DNA sequence that needs to be cut or modified. As a result, it was possible to fix non-working copies of genes in cells, replacing them with working ones. For the present nobody creates genetically modified people (technology needs to be tested), but it is already clear that this is only a matter of time. And in the future it will be possible not only to overcome any known hereditary diseases, but also to make people resistant from birth to many viruses, giving them the mentioned bacterial antiviral immunity.

Post of Alexander Panchin

3. **Commentary on the speech of V.V. Putin about genetic engineering.**
Still, genetic engineering does not yet provide an opportunity to create people with "given characteristics". And the abilities of people depend not only on genes, but also on the environment.

"Fearless" people exist. For example, with Urbach's disease - Vita. This is a hereditary disease leading to the destruction of the amygdala. Needless to say, such people have a lot of health problems and are unlikely to become good soldiers. But what is really being developed:

1. Editing genomes of embryos to eliminate genetic diseases. While only embryos were obtained, no adults of GM were received. But it's a matter of time.
2. Gene therapy of hereditary diseases in adults. There are already examples of successful clinical trials.
3. Gene therapy of oncological diseases. There are successful examples of treatment. The FDA approved some approaches.
4. The creation of organisms resistant to certain viruses. Made on plants, on human cells in vitro, in the future it is possible on embryos.
5. Gene therapy of aging. There is a positive experience in mice. There are no normal experiments on people.

We do not know which genes must be changed to make a person a "mathematician" or a "soldier". Even just smarter to make problematic, although some success has been achieved on GM mice.

You can increase muscle mass. There are such mice received in the laboratory. And mutant bulls, bred by breeders. But it is unlikely to be used in public in the near future, because the benefits are doubtful, and the problems are obvious. As you can see, nothing terrible and comparable to a nuclear bomb. On the contrary, a lot of useful and interesting. More about this I tell in the lecture "Playing in God: the science has passed the border." [https://youtu.be/pRjGw1LrxqA](https://youtu.be/pRjGw1LrxqA) And also in the book "The Sum of Biotechnology: A Guide to Combating Myths on Genetic Modification of Plants, Animals and People." Putin's speech: [https://ria.ru/video/20171022/1507331249.htm](https://ria.ru/video/20171022/1507331249.htm)

Post of Alexander Panchin