FOR THE POPULARISATION OF SCIENCE: A CRITIQUE OF THE PRESENT MAINSTREAM ANTI-SCIENTISM

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ABSTRACT:
This is a critical review of a conservative and scratchy article about popularisation of science understood only as vulgarisation. The equivalence of popularisation and vulgarisation is questioned and, because the text is a *lamento* against the mass education and culture, a deconstruction of the suppositions of the malignity of mass culture and popularisation of science is sketched.

KEYWORDS: popularisation of science, vulgarisation of science, mass culture.

The present review was occasioned – not by a book, as it is usual, but – by an article in *Revista de Filosofie* entitled, promisingly, "Ethical and epistemological difficulties related to the vulgarisation of science"[2]. A very interesting topic: towards which I had the normal expectations of knowing something new/valuable about this delicate aspect lesser studied by the epistemology of science.

Popularisation=vulgarisation?

But the text has disappointed me, starting from the translation into English of the Romanian title by he author (the paper is written in Romanian) and the ideological *parti-pris* already expressed in the abstract. Indeed, the equivalence made by the article between popularisation and

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[2] Ion Vezeanu, „Dificultăţi etice şi epistemologice în vulgarizarea ştiinţei", *Revista de filosofie*, LXII, 6, 2015, pp. 775-779 (http://www.institutuldefilosofie.ro/e107_files/downloads/Revista%20de%20filosofie/2015/Rev.%20filos.,%20LXII,%206,%202015/Ion%20Vezeanu,%20Dificultati%20etice%20si%20epistemologice%20%C3%AEn%20vulgarizarea%20stiintei.pdf)

Introducing his abstract, the author has translated the title as „Ethical and epistemological difficulties in the popularization of science". Every one sufficiently familiar with the problem knows that *nowadays* vulgarisation (*vulgarizare*) is not tantamount to popularisation (*popularizare*): at least, from a rigorous scientific standpoint, as the author assumes to profess and support.

vulgarisation is not at all correct. Yes, in Latin *vulgo, -āre* is to spread, to disseminate (but also to prostitute), since *vulgus, -i* is mob, populace, crowd, and the adverb *vulgo* means publicly, usually, generally, everywhere (but also illegitimate), while the adjective *vulgāris,-e* is common, usual (but also vulgar, degrading/humiliating, as in *vulgarae artes*, degrading crafts), the adjective *vulgātus, -a, -um* being usual, normal (but also known, disclosed). And since *pŏpŭlus, -i* is folk, nation, the totality of citizens (but also common people, the lower orders, the *pleb, -ēbis*) and the adverb *pŏpŭlāriter* means like the people, like the ordinary, in the everyday/common language – and the noun having in its family the interesting words *pŏpŭlātĭo, -ōnis*, pillage, rapine, robbing troop, spoils of robbery (but also corruption and decay of morals, *populatio morum*) and three other nouns (*pŏpŭlātŏr, -ōris*, *pŏpŭlātrix, -īcis*, *pŏpŭlātŭs, -ūm*) designating the same aspects of robbery –, it is obvious that the two families of words reflect the same thing. The overlapping of *vulgus* and *pŏpŭlus* has corresponded to the ancient elitist ideology where the historically inherent social hierarchy was marked with the disdain towards the common people.

But in the modern era, the meanings of *vulgar* and *popular* have diverged. Not because – the real social relationships determining the language – the social hierarchy has disappeared, but because in modernity the popular strata have become a political actor and thus the leadership of society was legitimated through the people (and no longer legitimated through God). No one thought in the 1800s, for example, that the common people, the lower strata would not have had vulgar manners and language, since they had, but the Enlightenment ideology has differentiated between the behaviours resulted from the conditions and education people have enjoyed and, on the other hand, the universal characteristics of the human beings, able to betterment since "the good sense is, of all things in the world (among men), the most equitably (equally) distributed"[3]. This is the reason that the family of *popular* has enriched – in France in the 19th century, but inherited from the tradition of rationalism[4] – with two words reflecting just the spirit of Enlightenment: *popularisation* ("popularisation; the act of

[3] René Descartes, "Discourse on Method or Rightly Conducting the Reason and of Seeking for Truth in the Sciences" (1637), in *Descartes Philosophical Writings*, Selected and translated by Norman Kemp Smith, New York, The Modern Library, 1958, part I, p. 93.

[4] Bernadette Bensaude-Vincent, Liz Libbrecht, "A public for science. The rapid growth of popularization in nineteenth century France", *Réseaux. The French journal of communication*, volume 3, n°1, 1995. pp. 75-92, doi: 10.3406/reso.1995.3290.

popularizing") and *populariser* ("to popularise: a) to spread among the people, to make popular, to make suitable to the common mind; b) to render popular, to win over the favour of the people"). While, since the adjective *vulgaire* meant "vulgar: a) common; b) vernacular, national; c) used or practiced by common people; d) consisting of common persons; e) low, trivial, unrefined"[5], the last meaning has developed (the *Dictionary* gave examples only for e)) just in order to precise the difference between the appurtenance to the common people and the specific quality of being trivial. And even though the French has maintained *vulgarisation* ("vulgarising") and *vulgariser* ("to vulgarise; to make vulgar; to popularise"), the English has given to it as synonym "to popularise" only in the last instance/in order to specify even this meaning.

I quoted the French words – and their English translation[6] – because it seemed that in French, Italian (*divulgazione*), Spanish (*divulgación científica*) and Portuguese (*divulgação científica*) there still would be equivalence between *popularisation* and *vulgarisation*; but the ambiguity and polysemy of the last one once more requires a *historical* approach; which the author seems to not grasp enough, though he devotes most pages to the history of *vulgarisation*.

But just because of the modern non-overlapping of the two words[7]: 1) has the English assumed *popularisation* for the spreading of science in the entire population[8], and better and rather in the last decades, the English scientific world is using the formula *science communication*: in order to precise that there are not two sciences – one the genuine, and the other

[5] E.-C. Cliffton, Adrian Grimaux, *A New Dictionary of the French and English Languages*, New edition revised and corrected, Paris, Garnier, London, Hachette, 1880, p. 1076.
[6] *Ibidem*, p. 818.
[7] *Routledge Handbook of Public Communication of Science and Technology*, Edited by Massimiano Bucchi, Brian Trench, Second Edition, Abingdon, New York, Routledge, 2014 (vulgarisation is less neutral, "already incorporating a certain value judgement of its modest relevance in comparizon with more elevated scientific communication and practice").
[8] Teodolinda Barolini, H. Wayne Storey (Eds.), *Dante for the New Millennium*, New York, Fordham Universiy Press, 2003, p. 169 (though the French does not distinguish the meanings of the two words, *vulgarisation* being just the spreading of science, the English does).
But see also Brigitte Nerlich, *Science communication and 'vulgarisation scientifique': Do words matter?*, February 1, 2015, http://blogs.nottingham.ac.uk/makingsciencepublic/2015/02/01/science-communication-and-vulgarisation-scientifique-do-words-matter/: "One can argue that French *vulgarisation* and English *vulgarisation* are partial false friends. The English word mainly means 'the act of rendering something coarse and unrefined' while the French word means 'the act of making something attractive to the general public or to popularise something'".

"public", the result of the popularisation – but only one that is approached nearer to society by the instrumentality of mass media, and that there are many problems[9] in the process of communicating science, but this process is inevitable and necessary; and 2) has the French made the difference in the 19th century between "popular science" – the result of the qualitative popularisation of science – and vulgarisation, the process of informing the general public about the scientific achievements but, because of the gap between the increasing specialisation of scientists and the mass cultural level, this process would lowering science[10].

In fact, it is not so much about a geographic and linguistic difference – English versus the above Romance languages – than about a historical one where, inherently, there are *different ideological presuppositions*. Indeed, even in the 19th century France, have coexisted two different *paradigms* related to two different ideologies.

As a result of the utopian liberalism that still lasted in the trace of Enlightenment and supported the ideology of progress (fuelled by the soaring of sciences and sung by positivism), one paradigm assumed that there was a difference between *science populaire* and *vulgarisation*, the former being the result of popularisation – transmission toward the general public of the *scientific outlook of sciences* only without their formulas but thus preserving the high quality of the scientific logic – while the latter being a needless simplification giving to a superficial and passive public only low cognisance about rather a spectacular science[11].

[9] For example, Peter Weingart, "Science and the media", *Research Policy*, Vol. 27, Issue 8, 1998, pp. 869-879; Brigitte Nerlich, and C. Halliday, "Avian flu: The creation of expectations in the interplay between science and the media", *Sociology of Health and Illness*, 29(1), 2007, pp. 46-65; David Dickson, *The case for a 'deficit model' of science communication*, 2012, http://www.scidev.net/global/communication/editorials/the-case-for-a-deficit-model-of-science-communic.html;
Brigitte Nerlich, *Science communication: From filling deficits to appreciating assets*, 2013, https://blogs.nottingham.ac.uk/makingsciencepublic/2013/08/04/science-communication-from-filling-deficits-to-appreciating-assets/.

[10] Bernadette Bensaude-Vincent, **«** Splendeur et décadence de la vulgarisation scientifique », in *Les cultures des sciences en Europe*, Edited by Philippe Chavot and Anne Masseran, 2010, pp. 19-32, http://questionsdecommunication.revues.org/210.

[11] Camille Flammarion, *L'astronomie*, 1e année, Paris, Flammarion, 1882, p. 3, quoted by Bernadette Bensaude-Vincent, **«** Splendeur et décadence de la vulgarisation scientifique », *ibidem*: "We want to popularize science, to make it accessible without reducing or altering it to all the human minds which understand its value and will to take the trouble to bring some attention to serious study; but we want not to vulgarize it, to get it off to the level of indifferent, slight and mocking vulgar. There is here a distinction one does not make enough".

The other paradigm has continued the elitist ideology, being a conservative standpoint exalting the distance between the specialised culture of science and the low culture of those executing the physical work of the first industrial revolution, and picturing an extremist position: either the science will keep its specific language – only in this way developing its ability to grasp the laws of existence –, or it is perverted through the lowering into a common lay language, but without any gain, on the contrary falling into decay (and showing once more that science as such being even more vulnerable than religion concerning the capacity to diving in the deep mysterious world). The conservatism of this paradigm consisted not only of the above suggestion of equality between science and religion as vectors of knowledge (if not just inferiority of science), but also the principles of un-translatability of science – and more, of different social cultures – and the caste type closing of the social cultures related to different social classes: these cultures would be impermeable to each other. This is the reason this paradigm has avoided the complex social aspects of the transmission/communication of science and was reduced to/ expressed through only the problem of language.

The two modes of thinking[12] clashed within the entire 19th century, the 20th and clashes in present, and certainly either the one or the other has a stronger voice in different moments, reflecting the general relations of forces and the concrete historical conditions favouring one or another[13]. And since nowadays neo-conservatism is the mainstream, it's no wonder that the out-of-date contempt towards popularisation understood as vulgarisation of science can be heard: and not in the centre type country the author lives in, but in a peripheral one[14].

[12] One could speculate about the relationships between these two paradigms and, on the other hand, the two "models of science", one critical and explicitly distancing from the former assumptions and theories, and the other being rather dogmatic and aiming to preserve the older acquisitions (these two models of science, Bernadette Bensaude-Vincent, *L'opinion publique et la science. À chacun son ignorance* (1999), 3e éd., Paris, Éditions La Découverte, coll. Poche/Sciences humaines, 2013).

[13] The post-war years were those of optimism and at the same time those of radically questioning the role of science and scientists in society. See Bernard Schiele, "Publicizing Science! To What Purpose? (Revisiting the notion of public communication of science and technology)", *Popularization*, 8, 2007, pp. 65-75.

[14] Though the popularisation of science in the peripheral countries was an important vector of modernisation. See Faidra Papanelopoulou, Agustí Nieto-Galan, and Enrique Perdiguero (Eds.), *Popularizing Science and Technology in the European Periphery, 1800–2000*, Farnham, Ashgate, 2009.

Because, once more: in the centre type countries where the *science studies* are the more developed, no one confounds popularisation and vulgarisation, or the usual viewpoint of the scientific communities is that popularisation and vulgarisation *are not the same*. And even though, in France for example, there are researchers who use *vulgarisation* for *popularisation*[15], they discuss both meanings of the former: as popularisation made by researchers of their own domains and researches, not only for notoriety but also for the construction of science as such, popularisation being "a component of the scientific field" and contributing to the "socio-diffusion of concepts"[16], and as vulgarisation as such being today rather an accusation made by those who speak from the standpoint of the "dogmatised science" of "specialists opposing to the 'incompetence' of the vulgarisers"[17].

Therefore, it is important to note that the *present meanings of the two words do not superpose, only their historical meanings may lead to confusion*: which a philosopher of science does not assume. And since the researchers, the more so today, interpret according to the newest theories and paradigms, it would have been normal the author to not neglect these newest standpoints and to not assume some absolutely obsolete ones.

In Romanian, the language of the paper, *vulgarisation* means to diffuse *in a simplified form*, to interpret *in a simplistic, banal, trivial way* – namely not simply to diffuse/spread/interpret, but to do this in a simplistic manner –; while popularisation is to spread/diffuse science, ideas etc. in an *accessible* form: but the accessible is not tantamount to the simplistic and trivial. We can make science be known by a large number of people without trivialising it: thus it depends on the communicator if it chooses to popularise or to vulgarise.

[15] The French use of *vulgarisation* arises from the 19th century tradition of the impossibility to transmit a more and more sophisticated science (Bernadette Bensaude-Vincent, **«** Splendeur et décadence de la vulgarisation scientifique », *ibidem*) but the *present dominant meaning is just that it is possible to transmit science to lay persons without lower it*. See the UNESCO Kalinga Prize (https://en.wikipedia.org/wiki/Kalinga_Prize; http://www.unesco.org/new/fr/natural-sciences/science-technology/sti-policy/global-focus/science-popularization/prizes/kalinga-prize/).

[16] Daniel Jacobi, Jean Marie Albertini, Bernard Schiele (Sous la dir.), *Vulgariser la science: le procès de l'ignorance*, Collection Millieux, Champ Vallon, 1988, p. 114.

[17] *Ibidem*, p. 280.

However, the author does not preoccupy with this subtle "questions de finesse"[18]: for him, popularisation would be a simplistic, banal interpretation: quite vulgarisation. So since vulgarisation is bad, popularisation is also bad: *this is the thesis of the article*. But this standpoint is absolutely exterior both to science and to the most authorised voices of the scientific community of science studies: it is ideological in the bad sense of this word (as false conscience – the first Marx), because it contradicts both the suppositions of science and the science studies. According to them, since the reason of science is to know, to gain knowledge, the realisation of science is not fulfilled only remaining in its esoteric realm: science itself cannot be made if it is not socially accepted. And in order to be such, it must be communicated.

The logic of scientific communication

These arguments related to the mechanism of science as such are the most powerful. But there are also the arguments linked to the social architecture. The reason of science is to be communicated: and not only to the colleagues from the scientific community, but also to an increasing number of lay persons. If science would not be communicated, people would not know anything about its discoveries, and there would not be breakthrough points which might be integrated within the life of people. There would be absolutely ignorance of the new medical technologies and perspectives, the cutting-edge theories about society, the state-of-the-art physics, biology, ecology, IT and AI. People would know only to use the scientific events as spectacles and the technical gadgets, and eventually to assume them uncritically as well as the theories in fashion: without relating each other, without understanding their reasons, *raisons d'être* and consequences, as passive consumers incapable to choose and only receiving advices from the rulers and their omnipresent advertising. But is this standpoint not the one of the conservative forces and ideology?

The author gives the authoritative Leibniz's theory of language as support of this conservatism. But Leibniz was a (realist) democrat of his time, *inter alia* insisting on communication and popularisation through libraries – because he was confident that a (European) community of minds is quite possible –. And the reduction of (science) communication to language is no longer enough nowadays.

[18] By the way, the antonym of *finesse* is vulgarity.

The fact that the communication of science takes part from the general communication of information within society and thus, on the one hand, reflects all the problems *society* and the general communication have and, on the other hand, that it has specific features means that we have to consider both its structural and temporal *continuity* and *discontinuity*: and by not neglecting one or another of these aspects, we must not refuse the communication of science on the basis of some negative elements occurred on its common or specific sides.

Science has a special language – and many languages specific to its multiplying disciplines – i.e. concepts, strictness, logical demonstration "all the way", and criticism of every step, instrument, presupposition, proof, example, experiment, measurement and theory –. But this language is not untranslatable: because it uses not only formalism but also – and in a decisive way – the natural language. And if the scientific language is clear-cut – this meaning that the scientists understand in a clear manner what they profess – it can be transmitted to lay persons in a clear manner: without the formalism and the technicalities involved in research, but keeping the attention just on *the logic of the phenomena*, on the *dialectic of novelty and accredited cognisance*, on the *manifold consequences* and the *responsibility* of the human beings in front of this unitary and complex world. These high stakes of the communication of science make it attractive and absolutely *sine qua non*. At the same time, this high quality of the communication of science allows the common people to participate to the scientific dialogue[19] and to situate in front of science in an *active* way.

But the scientific communication is beneficial not only to the general public, but also to the scientists. Communicating science, they aid themselves to better understand their researches – at least their social impact – and even to see new aspects. The translation of science into "lay language" does not decrease its quality – i.e. neither the quality of the genuine science and nor of the popularised one –: there is any "epistemological incommensurability" (as the author considers) between the two discourses, if the communicators want to fulfil the above criteria, and if they treat the general public with respect, not considering it a crowd of uneducated and subjected passive consumers. The great science communicators from more than one century onwards have proved that only

[19] Isabelle Peschard, "Participation of the Public in Science: Towards a New Kind of Scientific Practice", *Human Affairs, Special Issue 'Action and Practice Theory'*, edited by Theodore R. Schatzski, 17 (2. Dec.), 2007, pp. 138-153.

vulgarisation means the reduction of science to isolated spectacular events non-related to each other and thus not serving the need of a *coherent and unitary image of the world through science/knowledge*. The vulgarised science, and not the popularised one, is which is part of what Hermann Hesse called The Feuilletonistic Age (*The Glass Bead Game*, 1943).

(But the caricature of the science communicators the author makes is a disservice not only to them, but to the whole democratic ideology of the Enlightenment: he transmitted the idea that the intellectual endeavouring to popularise science would have assumed that popularisation is vulgarisation and that his mediation between the erudite elites and the ignorant masses is moral: "would be also a moralist. Through the popularisation=vulgarisation of science, he would be able to disseminate the happiness too. There would be no need to take a fight with us for the fulfilment of the duty towards the moral law"[20]. In fact, any positivist philosopher did not reduce happiness and morality to the access of scientific education, the Enlightenment and the positivists only have underlined that education (and a high quality one, including through the popularisation of science) is a condition of human development and thus, of happiness; but happiness is a subjective state and the above philosophers were focused on the *objective* conditions of human fulfilment; and to discuss the big problem of popularisation – versus vulgarisation, if it's allowed to say – on the basis of a caricaturised presupposition of the 19th century enthusiasts of science is disqualifying. To know something about the world – including through the instrumentality of popularisation of science – does not mean to do away with the striving to understand, to experience the effort of systematic education, and certainly does not substitute the moral deliberation between the good and the evil. And is the whole systematic education not a process of popularisation of knowledge?).

The elitist refusal of every mass culture, and not only of the present consumerist culture

It is important to show the framework of the argumentation of the article. Popularisation understood only as vulgarisation is part, the sign and a main cause of the present mass culture: so the *mass culture* as the result of popularisation=vulgarisation is the main background argument. The mass culture is only hurry-scurry characterised as "populism, dadaism, pop-rock,

[20] Vezeanu, p. 787.

New Age, rap, jeans, hamburger, coca-cola, *art-poubelle*, Anglicism, *horror*, *gore*, violence, *Kitsch*, pornography, *culture-pub*, feminism, *graffiti*, *fast-food*, *mass-media*, drugs, Superman, postmodernism, nomadism, egalitarianism, *Facebook*, alter-globalisation, monitoring, *people-magazine*,social networks, *politically-correct*, terrorism, tattoo, *pizza*, *paparazzi*, anarchism, alienation, *star*, transhumanism, *Gay Pried*, *show-biz* etc."[21]. The joining of so different types features – from which only ones are ontological (as alienation), others are ideologies, and others cultural objects, all being historically constructed in/by capitalism, but one does not say a word about this, nor does one determine the historicity of the mass culture as such, appeared in modernity as a result of the industrial revolutions and their need of adequate workforce and consumers, and limited and controlled just from the standpoint of the ruling strata – already prove a style strange to a scientific article.

But although the mass culture has some negative and harmful aspects – but would egalitarianism be harmful for the masses, and does egalitarianism belong only to our days? – and though the difference between mass culture and (a supposed high quality) elite culture is a historical *capitalist* answer to the development of *objective* processes of mass literacy, spreading of cognisance through mass media, the increase of the general cultural level and thus the acquisition by large layers of the population of the intellectual instruments able to support a reasonable critical manner to look at society as a whole, the more so we must not reduce the mass culture only to negative aspects. Mass culture means also museums, public libraries, affordable high level information and education. The mass culture is contradictory, and depends on those who treat it: lowering it or elevating it. The *mainstream* attitude towards the mass culture consists in giving to it a superficial view about things, isolating them each other and avoiding a unitary perspective on structures and the causality of structures. However, the logic of culture, and of the mass culture, is just the access of all to culture/to a high quality culture, and the increase of general competency to express the points of view of every one.

The article throws anathema on the mass education (the big number of universities, indeed not all providing high quality education, but this – I emphasise – just because of the assumed neo-liberal principles), suggesting that the masses as such and the mass education would be guilty

[21] *Ibidem*, p. 776.

– towards a quality education and the elite, the only ones promoting excellence and expertise – and dodging any historical and social production of the modern elite and its institutions such as the mass university, as if this one would be a neutral natural creation. However, the fact that the mass university is the result of the modern labour and economic and industrial processes framed in capitalism does not annul the necessity of a high level mass education. The mass education may well transform into a quality mass education, it is not necessarily "an anarchical state of knowledge, disorder and irresponsibility"[22]. But the author does not bother with this challenging historical task required by the objective facts of the intellectual *differentia specifica* of all humans (*differentia* that allows the increase in geometrical proportion of the intellectual capabilities just from the moment people acquire intellectual instruments – concepts, worldviews etc. –) and the modern economic and cultural development of society. In fact, for the author this task does not exist, he even hate it, he only suggesting that the task would be the cancellation of just every mass education beyond the primary abilities to consume and obey, the cancellation of just every aspiration to high quality mass education and culture.

Concretely, the article considers as the basis of the present odious mass culture, understood as a consume culture desired by the masses, and mass education – modernisation and "the crisis of the Western culture"[23], and as the basis of the present popularisation=vulgarisation of science "the inflation of the values of knowledge"[24] leading to a disorder in knowledge and to the "utopia of knowledge". The article avoids any social reference and suggests that the crisis of the Western culture would consist just in the development of mass culture and of a bankrupt popularisation of science: on the basis of the ideology of "pseudo-cultural and globalising equality". The picture constructed by the author is absolutely unilateral and even apocalyptic: since there are no counter-tendencies either to a low level popularisation (an ordinary vulgarisation) or to a crisis of knowledge (an inflated knowledge), since the mass culture seems to spring without stopping, the valuable culture and science would no longer have the force to impose the real road to society. Or they would have it, through the force of those who control it?

[22] *Ibidem*, p. 785.
[23] *Ibidem*, p. 777.
[24] *Ibidem*, p. 778.

A strange assumption too is that which considers the diffusion of knowledge as "sharing[25] (initiation, education, communion, sacralisation)" and not "transmission (secularised communication, secular information, mass instruction, desecration)"[26].

The article reduces the relations between production of science – with its technical language and instruments – and the spreading of scientific information and cognisance to the question of language. And since the two processes use two types of language – one, technical and the other, accessible – there would not be any possibility to translate the first into the other: the real science and the "popular" one being untranslatable and incompatible.

But the author reduces the scientific language to a hermetic one – which, I add, in the case of bad philosophy, is hermetic even for philosophers – as if: science could not be transmitted in a clear natural language and the real science would not be expressible in a logical way, though without formulas but unfolding just the logic of things[27]. Deploring the lack of scientific accuracy within the popularisation of science, the author does not reflect to the *impossibility of the demographic increase of scientists without the increase of scientific education of the masses*, neither to the *impossibility of the development of society without scientifically educated people*, nor to the implicit solution he gives when he despises the popularisation of science: it is only credulity and religion, is it?

This reduction of the critique of popularisation of science to the problem of language is based on an anti-empiric stance: that, again, reduces the perception of real life, the understanding through experience to the formal discursive understanding of things.

The commitment of science towards society

It is important to understand that the theory of the gap between science and the lay public is an *ideological* – thus historical – position. The gap as such exists, of course, as a result of the historical division between

[25] In Romanian, this verb has also a religious meaning: to give the Eucharist. This is the reason the author uses it together with the other senses he insists on.
[26] Ion Vezeanu, p. 780.
[27] Einstein's standpoint fits to both the scientific explanation and the transmission of science: "If you can't explain it simply, you don't understand it well enough". Certainly, the accessible language does not mean reductionism – "Everything must be made as simple as possible. But not simpler" –, on the contrary it means the transmission of the problems treated by science in their *relationships and significances*.

the physical and intellectual work, and as a capitalist means to control the ruled. But in the article the gap as such is discussed in order to argument that it cannot be surpassed, and more, the guilt for it belonging just to the uneducated lay strata. Or the gap can be tackled in order to construct the manners to decrease it, the responsibility pertaining to the *scientists* themselves, to the *public* and to the *power* with its *media*. And though this last viewpoint that I assume is not dominant[28], it presses with the force of both the new IT means which are used by the common people[29], and the evidence of the consequences of the neo-liberal mass education – including through the mainstream mass media – which widen the gap and accentuate the general gullibility and obscurantism (and the mainstream media do no longer consider science and knowledge as sacred).

The last viewpoint can be expressed as democratic – opposing to the first, elitist – and it insists not on the deficit of knowledge and culture of the lay lower strata (that is real but the result of a political programme), but on the *co-participation* of both science/scientists and the public within the process of understanding and applying science *in society*. It's sure that this co-participation implies the education of scientists to be committed towards the *consequences* of science in society – they must no longer be neutral and closed within their discipline or domain – and thus to make also a "popular science", science interpreted for the general public according to high standards[30]. There are official[31] and citizen initiative[32] institutions concerned just with the *responsibility of scientists* and the *public awareness of science*[33]. The science-society relationship can no longer be treated only as communication of science, but more and more – since the global problems are so grave – as *citizen commitment*[34].

[28] Bernadette Bensaude-Vincent, **«** Splendeur et décadence de la vulgarisation scientifique », *ibidem.*

[29] We may understand the already old observation – the means of communication as means of production, Raymond Williams, *Culture and Materialism: Sellected essays* (1980), London, Verso Radical Thinkers Series, 2005, p. 170 – as pertaining to both the owners and controllers of these means and to the ruled, the large layers of society which are the force of development.

[30] https://en.wikipedia.org/wiki/Popular_science; and http://www.popsci.com/.

[31] See the *Committee on the Public Understanding of Science* founded in 1985 by the British Association for the Advancement of Science, the Royal Institution and the Royal Society.

[32] See Scientists for Global Responsibility, http://www.sgr.org.uk/.

[33] https://en.wikipedia.org/wiki/Public_awareness_of_science.

[34] Philippe Chavot et Anne Masseran, « Engagement et citoyenneté scientifique : quels enjeux avec quels dispositifs ? », *Questions de communication*, 17, 2010, pp. 81-106.

Actually, even the communication of science is an *objective* process – not an "ideology", not a belief or a salvation – and, letting aside its objective generation by the development of means of communication and the need of scientists to be socially recognised and to arrive to the accepting of their theories by different publics – a question of *commitment*, and of commitment of both the scientists as citizens and the lay persons[35]. Since ordinary people have "a higher level of doubt and a lower level of acceptance of science", as well as limited science literacy[36], a new type of communication of science is necessary: not only from the communicators to passive receptors, but also from the citizens' discussion about science towards the decision-makers and scientists[37].

And thus, the *present* mass culture and popular science do no longer appear as low quality simplification just existing and showing the guilt of the masses as such, but the result of the generalisation of *business model* in culture and popularisation of science. This generalisation – that means *hyperbolisation* and *sensationalism* subordinated to a more and more lucrative privatised science and academia[38], and leading to catastrophes as the global warning[39], the destruction of biodiversity[40] and the enrolling of science as a tool of wars[41] – can be countered only by a *public activism*

[35] Cheng Donghong, Jenni Metcalfe, Bernard Schiele In collaboration with Michel Claessens, Toss Gascoigne, Shi Shunke (Eds.), *At the Human Scale: International practices in Science Communication*, Beijing, Science Press, 2008.

[36] Bernard Schiele, "Communicating science in the real context of society" pp. 3-24 in *ibidem*, p. 21.

[37] Martin W. Bauer, « Changement de paradigme de la communication scientifique. Un public critique pour la science commercialisée ? », *Questions de communication*, 21, 2012, pp. 123-144.

[38] Henry Etzkowitz, Andrew Webster and Peter Healey (Eds.), *Capitalizing Knowledge: New Intersections of Industry and Academia* (S U N Y Series, Frontiers in Education), Albany, New York, State University of New York Press, 1998.

[39] See Naomi Klein, *This Changes Everything: Capitalism vs. the Climate*, New York, Simon & Schuster, 2014.

[40] Douglas J. McCauley, Malin L. Pinsky, Stephen R. Palumbi, James A. Estes, Francis H. Joyce, Robert R. Warner, "Marine defaunation: Animal loss in the global ocean", *Science*, 16, Vol. 347, Issue 6219, Jan. 2015, DOI: 10.1126/science.1255641;
http://www.livingplanetindex.org/home/index.

[41] Science itself was transformed into an instrument of war: see Nigel Calder (Ed.), *Unless Peace Comes: a Scientific Forecast of New Weapons*, New York, Viking Adult, 1968; even on the expense of destruction of environment (Gordon J. F. MacDonald, "How To Wreck The Environment", in *ibidem*,
https://coto2.files.wordpress.com/2013/11/1968-macdonald-how-to-wreck-the-planet.pdf).

based on the knowledge of the consequences of this type of science. Indeed, the *public critique* against the *business model* in culture and science seems to be the only counter-power.

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And the present disastrous consequences of wars, experiments of weapons and military manoeuvres and exercises worldwide are "countered" by a science subordinated to the military-industrial complex with a geo-engineering whose long-term effects are not yet studied and taken into account. See Eli Kintisch, *Hack the Planet: Science's Best Hope or Worst Nightmare for Averting Climate Catastrophe*, Hoboken, N J, John Wiley & Sons, 2010; http://www.geoengineeringwatch.org/; also *Geo-engineering: Climate fixes 'could harm billions'*, 26 November 2014, http://www.bbc.com/news/science-environment-30197085; Christina Sarich, *Geo-Engineering Scientist 'Terrified' of Projects He Helped Create An excuse for weather modification programs?*, January 2, 2015, http://naturalsociety.com/geo-engineering-scientist-terrified-projects-helped-create/; Rady Ananda, *Planetary Weapons and Military Weather Modification: Chemtrails, Atmospheric Geoengineering and Environmental Warfare*, December 01, 2015,
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