Knowledge Communication Theory Revisited

– from 'communicatio' to 'communis esse'

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MULTI TRUST

1.Introduction

This paper reflects directly on the 2nd challenge, as described in the workshop programme, i.e. "how to communicate complex overall assessments in such a way they can be used in practice by different actors and stakeholders with different perspectives and values."

Going somewhat back to basics, as it were, philosopher Bertrand Russell stated that there are two kinds of people: those who produce scientific knowledge and those who consume it. Even if such a dichotomization is by no means unproblematic, it is – nevertheless – not altogether untrue. The very fact that this workshop is concerned with how complex assessments may be communicated in such a way that actors and stakeholders, other than the producers of said complex assessments, may be able to utilize it, substantiates that. From the point of view of sociology of knowledge this dichotomy may, in many ways, be seen as a byproduct of an ever increasing specialization of scientific disciplines, and – consequently – of the knowledge(s) they produce.

The research field which has this dichotomy, gap or asymmetry as its object of study is known under such names as Public Understanding of Science, Science Communication, Science and Technology Studies and the like. Different though they may be, the common denominator of these disciplines is an appreciation that the relationship between science and public[1], prototypically personified as the relationship between the expert and the lay person, is in many ways a conflictuous one. Even if what is deemed problematic may be seen from a myriad of perspectives (e.g. gender, culture, power, status, 'capital' etc. etc.) the ur-point of departure, so to speak, is the idea that between the expert and lay person – or in the sense of Russell: between the producer and the consumer of scientific knowledge – there a) exists a knowledge imbalance and that b) this state of social affairs in not advantageous to the lay person. In my presentation, I will address and discuss this problem as a knowledge *communication* problem.

In order to situate my discussions, I will apply a catalogue of three distinct approaches to communication to examples from the MULTI TRUST deliverables. This, in turn, entails that the aim of my presentation is to add to the ongoing process of negotiating what questions we may ask – and what answers we may hope for – in order to be able to design an approach to communication which would allow the MULTI TRUST project to communicate "in such a way [*that the findings and insights*] can be used in practice by different actors and stakeholders with different perspectives and values." My paper ends with a section in which I point to some of the central theoretical strengths and weaknesses of the different appreciations of communication in relation to MULTI TRUST

1. Public Understanding of Science Research : Three Generations in a History of Ideas

Within the research field of Public Understanding of Science (henceforth PUS) it seems quite well-established that three generations (or generations) have dominated its history of ideas (Bauer et al., 2007). As can be seen in the below table, each generation is typically subsumed under a heading pertaining to the prevalent ideology of the particular generation.

[1] I explicitly refrain from entering into the discussion as to what constitutes a public neither how a public may be appreciated at this point.

In what has been labeled 1st generation PUS research, the point of departure was that a) the public was in a knowledge deficit when it came to basic knowledge of science, and that b) this state of affairs needed rectifying. Consequently, emphasis was on instilling in the public a “scientific literacy” (e.g. Miller, 1987). Even if, in 2nd generation PUS research, the public was still seen as being in a scientific deficit, the underlying communication idea was not one of “promoting science *to* the public” but one of “science education *for* the public” (Kurath and Gisler, 2009). Along with this change in perspective, came a change of focus; PUS research would now also encompass studies of publics’ attitudes towards science; and not merely what a public would retain in terms of scientific knowledge. The “deficit model” (e.g. as presented by Miller, 2001), however, still lingered on (Irwin, 2001:15) alongside the notion that the degree to which a public was scientifically literate would correspond proportionally with said public’s favorable attitude towards science. Later research showed that while there was certainly a correlation between knowledge of and trust in science it was not necessarily a causal one (along the lines of: knowledge breeds understanding, e.g. Bauer et al., 2007:84). Epitomized by the European Commission’s slogan-like credo of “Science <u>and</u> Society”, 3rd generation PUS research has sought to leave behind the idea of the “deficit model” and has turned to an ideology of convergence. Summing up the core elements of this brief history of ideas of PUS, we may depict the main movement of the trajectory as a movement away from an ideology of opposition inherent in the “deficit model” towards one of convergence (Kastberg, 2010). With this radical shift in focus the key issues in 3rd generation PUS research becomes the mediation of understanding across knowledge asymmetries (Kastberg, 2011).

Where traditional, 1st generation PUS research would dichotomize expert and layman, knowledge deficit vs. knowledge surplus, and in the process canonizing the “deficit model”, recent, or 3rd generation, PUS research focuses on integration and convergence. Examples would be democratizing science movements (McCormick, 2007) and participatory science governance (Bora and Hausendorf, 2006) etc. Even if the generations in this history of ideas seem to constitute an unbroken timeline, a caveat should be issued here, for in what we may call real-life practical PUS activities these generations do in fact co-exist. That is: theoretically accepting that such a trajectory can be constructed does not imply that real-life practical PUS activities necessarily follow suit – neither that it is necessarily a bad thing if they do not. The relatively speaking younger generation need not eo ipso surpass the relative older one in all respects; it is therefore imperative that we not perceive of these generations as mutually exclusive or incommensurable in the Kuhnian sense (1995[1962])[2] but rather as incremental expansions (Lakatos, 1978 et passim). In this sense, each newer generation is able to both encompass the empirical and the theoretical landscape of its predecessor but also to qualify and to add to it. This implies that with the onset of each new generation the scope of what PUS research is and can do is critically evaluated and subsequently widened without discarding of the valuable insights gained in previous generations. This evolutionary, rather than revolutionary, reading of the trajectory allows us to acknowledge that each generation has its mediational merits, its science communicative pros and cons. With this caveat in mind I will now go on to elaborate somewhat on the communicative ideologies of the different generations.

2. Communicating Sci-Tech Knowledge : A Typology Based on Mediational Merits

The focal shifts of the above generations quite tellingly – if not surprisingly – mirror a similar trajectory in science communication ideologies: *From* communication seen as <u>transmission</u> *via* communication seen as <u>interaction</u> *to* communication seen as <u>co-action</u>. That is: *From* communication as a matter of a sender sending *via* communication being a matter of a sender sending as well as adjusting to feedback from a receiver and / or the environment *to* the idea that communication is basically a cooperative enterprise (Tomasello, 2008). This last shift is in many ways emancipatory in as much as it stipulates the equal

[2] Or, as it were, in the sense of the younger Kuhn.

involvement of both sender and receiver – now explicitly perceived of as communication partners (Kincaid, 1973) – in a co-actional meaning making process (see also Kastberg, 2007). PUS activities as transmission could for instance be monologues (e.g. a formal lecture held by a scientist to a lay audience), PUS activities as interaction would entail some kind of feedback loops (e.g. question-answer sequences), whereas PUS activities as co-action would be cooperative endeavors (e.g. upstream engagement when it comes to science policies).

Qualitatively, each instantiation leads to a different outcome, a different knowledge deposit, as it were, in the minds of an audience (or communication partners) and, as Dewey pragmatically put it, "[t]he deposit is what counts" (1933:153). Due to the fact that the PUS activity that is an instantiation of transmission ends with (actually: *is*) the act of transmitting, we, strictly speaking, have no way of gauging the knowledge deposit of a transmission. In the case of the lecture, for instance, everything said may have been heard, understood and accepted – then again it may not. However, when it comes to interactive PUS activities the knowledge deposit can (at least) be interpreted on the basis of the interaction itself, e.g. on the number and relevance of questions, of critical remarks put forward by an audience etc. The deposit emerging from a co-actional PUS activity on the other hand is gaugeable on the basis of the cooperative activity itself, i.e. the deposit is what the participants in the PUS activity can agree on, what they are able to co-construct.

In the following paragraphs I will illustrate the different modes of communication by means of examples and I will raise questions as to how this understanding of communication modes may inform the MULTI TRUST project when it comes to communicating "complex overall assessments in such a way they can be used in practice by different actors and stakeholders with different perspectives and values."

As may be inferred from the presentations above, Sci-Tech communication activities feature many and – at times – overlapping expressions. But this does not mean that we are dealing with an amorphous matter where we cannot distinguish one form from the other. Adhering to the notion that conscious "perspective taking" is a prerequisite for systematic analysis (Perner et al., 2003:358), I look at Sci-Tech communication activities from the perspective of the above three communicative ideologies. The examples presented below are prototypical expressions (Kleiber, 1993) of the different kinds of Sci-Tech communication activities. At the core of each type's prototypicality stands its mediational potential, i.e. a potential presented and discussed as a function with reference to each type's position in the PUS trajectory, the science communicative ideology employed, and the degree to which the each type may be said to afford (science) learning.

2.1 Sci-Tech Communication as Transmission

Sci-Tech communication as <u>transmission</u> typically takes the form of activities which we may call traditional science communication endeavors aiming at informing the public. As transmission, science communication – whatever the modality – is a linear process *from* a sender *to* a receiver (e.g. Theodorson and Theodorson, 1969); in our case from the scientists to a lay audience. Communication-wise the ideology is oriented towards the sender, i.e. communication is primarily a matter of sending out messages while trying to avoid "noise" (Shanon and Weaver, 1949). Strictly speaking, it is not of primary interest what the receiver may retain from the communication, since, again strictly speaking, it goes without saying that (ideally) the receivers retain what is transmitted. The primary interest, consequently, is that the sender delivers, as it were. In a learning perspective this idea corresponds with the idea of the student as "the empty vessel" (e.g. Feiman-Nemser and Remillard, 1995:9) or the "recitation model" (e.g. Eisner, 1991: 135-149). Formal monologous lectures or sermons would be examples of this kind of communication and teaching. Here everybody is offered the same kind of scientific information, and in the same way; and even if this is done by means of, say, new media it is still mass communication (e.g. Windahl et al., 2009), mass transmission. In terms of retention or "deposit" (Dewey 1933) we have no way of knowing *in situ* what an audience may have learned from such an experience. As transmission this kind Sci-Tech communication does not elicit interaction (see section 2.2) or coaction (see section 2.3), it can, albeit ritualistically, elicit reaction. Applauding (or booing for that matter) is an audience's ritualistic reaction to any monologue; however, applauding per se does not mean "understood", "accepted" and "hereafter my actions will correspond accordingly". The applause (or the lack of it) merely gives an indication as to the satisfaction of the audience. Satisfaction with regards to how the content was delivered – alas – is no guaranty for having understood or retained. In order to gauge a deposit, follow-up activities of an interactive nature, e.g. control questions, assignments or the like, are required on behalf of, say, a teacher. As a concluding remark it is noteworthy, even if it is mundane, that such Sci-Tech communication activities may very well be elaborate events in their own right and consequently very costly to develop and execute.

2.2 Sci-Tech Communication as Interaction

Sci-Tech communication as interaction typically takes on the form of science demonstrations or science shows[3]. Such demonstrations or shows are typically centered on the reenactment of a a particular scientific experiment in front of a lay public. Sci-Tech communication of this type is typically performed by natural science students demonstrating physical or chemical experiments in front of high school or grade school children. More often than not such shows take place in a school gym or in a school assembly hall, where the natural science students have arranged different set ups in order to show a selection of physical experiments (e.g. magnetism or vacuum) or chemical experiments (e.g. the mixing of liquids with spectacular effects).

In stark contrast to the first type of Sci-Tech communication, it is a prerequisite for this type of Sci-Tech communication to thrive that there is interaction between the actors involved (in casu: students and children). Being interactive, this type of science communications does not, in fact cannot, take place once a sender has sent, so to speak, but first once an audience has – in one way or the other – interacted with a sender (e.g. Katz and Kahn, 1978); a trait, which, in turn, allows us to perceive of this type as an instantiation of a 2nd generation PUS activity. The interaction in this kind of Sci-Tech communication takes place on two levels: between actor and audience and between audience, actor and the props used. Although this type is closely related to *dialoguous* learning formats, which we know from exercise classes (e.g. Perkins, 2009), it is qualified significantly by the fact that verbal communication is integrated into the practice of conducting experiments. As can be inferred, this type of Sci-Tech communication makes use of select dramatic and / or aesthetic elements without necessarily uniting them in a coherent, incrementally progressing, scripted plot. In further contrast Sci-Tech communication as transmission, the deposit in the audience resulting from this type of Sci-Tech communication can be – if not directly measured then at least – appreciated. Due to the proximity (or even intimacy) of standing around the table where the demonstration takes place, the audience has the possibility to give instantaneous feedback in the form of questions, comments, and of handling the props – and they are in fact encouraged to do so. Apart from the verbal interaction between actors and audience there is the practice of interacting with the props in order to conduct the experiment in question. This interactive type, which is a mixture of play and performance in a wider sense of the word (Schechner, 2002), is closely related to learning how to play a game while a) playing the game and b) while being mentored by a more knowledgeable comrade. As an additional note, it is a strong testimony to the educational merits of this type of Sci-Tech communication that one of its more ritualized expressions, i.e. the anatomical theater, is today seamlessly integrated in and forms an indispensable part of medical and surgical programs at universities all over the world.

[3] To some extent the Internet (and the new media in general) has also provided a platform for Sci-Tech communication as interaction; concretely in the shape of, e.g., quizzes, multiple choice exercises and learning software in more general terms in which interaction is achieved via some kind of interface connecting the user with a database. Whereas we may hold that interaction takes place, it is interaction in which one of the interactants is, for all intent and purposes, a piece of software. Even if this software was written by a human being, it is interaction by proxy. I am not saying that that this kind of by proxy interaction is without merits – for it most definitely is –, however, for the sake of this illustration, I refrain from taking this added complexity into consideration.

2.3 Sci-Tech Communication as Co-action

The Sci-Tech communication activities, which I have labeled co-actional, are in two important respects quite different from the previous two types. First of all, being co-actional means that the traditional roles, no pun intended, of audience, actor and audience are no longer adequate. As a co-actional endeavor a Sci-Tech communication activity is co-constructed by its participants. Secondly, the scientific product, while it certainly is the pinnacle of the work carried out by the participants, is *not* the core activity. The core activity is the co-actional process leading up to the product. All in all, traits which merit that this type be perceived as an instantiation of a 3rd generation PUS activity.

A prototypical example of a co-actional Sci-Tech communication activity is the "MathTheater" ("MatematikTeater"). Spurred by the experience that many 5th graders would agree with Knight's laconic statement "[…] that much science is rather dull […]" (2006:2), a group of teachers paired up with a drama and a math consultant in order to see if the theater format might change that perception – at least for one group of 5th graders. Under the guidance of experts (in casu: teachers and consultants) the children would design, develop, and produce their own MathTheater play, and in the process transform a standard 5th grade math syllabus into a performance; a performance that the children eventually performed before an audience of other children, teachers, and parents. In terms of scenography and plot, the play featured, among other things, a cardboard castle lived in by medieval knights wearing geometrically shaped shields and armor. The greedy knights would hoard gold, meticulously weigh the heavy metal and argue amongst themselves over who would be allotted what percentage of the gold. In another act pirates would roam the Caribbean, measure the nautical miles travelled and on their journey discover an uninhabited, exotic island; here they would ponder the geometrical shape of the island's volcano (a truncated cone, as it turned out) – all the while drinking rum and fighting amongst themselves as true pirates do. In another act, on a perilous scientific expedition to Greenland, the weight of ice as well as the crystalline structure of snowflakes would be duly measured and documented.

When it comes to retention and learning, the play as well as the process were not add-ons to math class, they *were* in fact math class. The children were not (merely) the audience of transmitted scientific knowledge neither were they (merely) to interact with predefined demonstrations; the children were in fact co-acting with their teachers as well as each other and, thus, co-constructing both the process as well as the end result. Concretely, in the process of making the dialogue, which they were later to perform, comprehensible to themselves, they were in effect making math comprehensible to themselves. In terms of deposit, the play itself became a testimony to what the children had learned. Despite such qualities, this type of Sci-Tech communication is a relative seldom occurrence. Apart from the fact that it takes a certain willingness on behalf of all participants – in this case children and teachers –, as well as a certain training – in this case especially on behalf of the teachers –, co-actional activities are often also dependent on the possibility to alter the mindset of whoever is funding the activity – in this case the school's management.

3. Considering MULTI TRUST

In this last section of my paper I would like to present a condensed version of some of my thoughts on the different strengths and weaknesses of the different Sci-Tech commutative types that I have introduced above and relate these thoughts to MULTI TRUST. As stated in the opening section of this paper, the aim of this section is to problematize and to open up a discussion rather than to conclude.

In lieu of the above presentations and discussions the question of "how to communicate complex overall assessments in such a way they can be used in practice by different actors and stakeholders with different perspectives and values" has become even less straightforward than it was to begin with. For if we take seriously that the 'other' not only needs to be exposed to "complex overall assessments" but indeed is required to be able to operationalize these assessments as a consequence of our communication, then we also need to take seriously that gauging the deposit of whatever Sci-Tech communicative endeavor we may perform, is critical to our success. Consequently, if an ensuing operation performed by the 'other' is a criterion for our communicative success, then transmission cannot stand alone. For whereas all sorts of content may be relatively easily transmittable at the click of a mouse, understanding and an ensuing operationalizing based on this understanding is not. From the point of view of communication theory we need to turn to interaction and / or co-action. But interactional and co-actional communicative endeavors hold other problems.

For both of these appreciations of communication it is not enough to transmit, so to speak, a prerequisite for communication to take place is engaging an audience – albeit in different ways. Speaking of Sci-Tech communication as interaction we are also speaking of feedback loops. The prototypical feedback loop is the question-answer sequence of the dialogue. And while the face-to-face dialogue is a fine way of trying to ensure understanding and compliance (operation) it is also quite costly. Appreciating the fact that supervising or tutoring each MULTI TRUST stakeholder is, quite simply, not an option does not, however, imply that we must abandon interaction altogether. In an online environment interaction may be built into quizzes, games or FAQ-like sequences, implication-like structures of "if so – then so" kind. Being interactional (and not co-actional), however, implies that any interaction progresses along a pre-defined path, so to speak, leading to a set of pre-defined outcomes. This, naturally, makes the communication controllable but it also poses limitations to creativity – as well as to user-generated content.

While there is little doubt – at least not in my mind – that the Sci-Tech communication of the co-actional variety mirrors the Zeitgeist, as it were, of late or postmodern societies inclined to favor deliberative and participatory engagement (e.g. Putnam 2004), it is also quite demanding. Demanding both in terms of the ever-present troika time/money/manpower– that goes without saying – but also in terms of the intrinsic uniqueness of the co-actional process. Whereas we may quite effortlessly transmit the product of a co-actional activity, the co-actional process leading to the product is a local one, bound in time and place; and as such not easily communicable. If we take the above MathTheater performance as an example of this we may indeed film the play and distribute this film globally at the click of a mouse, we cannot, however, with the same ease distribute the co-actional process leading to the play. The very process, as it were, which made understanding and operation possible in the first place[4].

Embarking on a co-actional Sci-Tech communicative endeavor does not mean, however, that one needs to enter into the world of drama; co-action can also be found by, say, framing a Wiki-like environment, by initiating an open blog, by hosting a series of consensus conferences or the like. In order, however, to allow for others than those originally initiated into the co-actional endeavor – be it a play or a WIKI – to take part in the communication, in order for the communication to be meaningfully transferable across and beyond an original time and place, one needs to take into consideration that the history of the co-actional endeavor be made available and accessible to all. And, even if it is rather mundane, it is paramount to explicitly note that such co-actional communication is incredibly difficult to control and quite costly to maintain.

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[4] Even if the example dealt with 5th graders the underlying principle is by no means limited by age or institutional affiliation.

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