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*Letter from the Editorial Board*

# THE ART OF SCIENCE COMMUNICATION

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Two incidents in the last few months inspired me to write this letter. The two cases I report on are random choices. The first case might be of scientific interest for most of our readers, and the second likely had and has a large impact on science communication beyond our discipline. These cases are by far not the only ones in which scientific results were more or less lost in translation on their way from original scientific analysis to perception by mass media consumers. They merely happen to represent two major sources of misunderstandings, thus serving as illustrations for a common phenomenon.

### *Case One: Does birth order affect personality?*

Some of you might have come across the recent study on birth order effects and personality. Birth order is a high-impact topic, as we can deduce from the success of Frank Sulloway's "Born to rebel". Published in 1996, it ranked 35$^{th}$ among the best-selling books on Amazon, and continues to be a recommended read in many evolutionary psychology and developmental psychology courses.

The recent study I am referring to was carried out by a group of German researchers: Rohrer, Egloff and Schmukle (2015) revisited Sulloway's theory of family niches, i.e. the assumption that siblings occupy different niches in the family ecosystem, which translates into specific adaptations to these niches, that manifest in different personality characteristics. According to Sulloway, niches are not occupied randomly, but according to birth order. Rohrer and her colleagues aimed at re-evaluating the family niche concept by analysing data from three large databases, totalling in a sample size of over 20,000 subjects. Other than many previous studies, they took into account not only birth the order (i.e. first-borns vs. later-borns), but introduced family size as an additional factor. The large sample allowed for addressing more differentiated questions. As Rohrer and her colleagues clearly state, their findings consisted mostly of an absence of birth order differences in personality:

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"*The main message of this article, however, is crystal clear: On the basis of the high power and the consistent results found across samples and analyses, it can be concluded that birth order does not have a meaningful and lasting effect on broad Big Five personality traits outside of the intellectual domain."* Even for the intellectual domain, the effect size is very small: *"Both the already-documented effect on objectively measured intelligence and the previously unidentified effect on self-reported intellect found in the present study were statistically significant, but small (at ~10% of a SD), in terms of conventional effect sizes."*

Now here is what media made of this: The Independent titled: *"First-born children are more intelligent than their siblings, research reveals"* (Murphy, 2015). Graziadaily: *"First-born children more intelligent, study says"*. M2woman: *"Science says the first born child is the most intelligent"* (Smith, 2015). Social media was immediately hooked and even among my science friends quite a few shared postings stating that first-borns are more intelligent without further comment.

So much for the bad news, but there are also some positive cases of differentiated communication: The Standard uses careful language in its title *"First-born child tends to be smarter than younger siblings"* (Marshal, 2015). Medical express *"Birth order has small effects on personality"*, citing verbatim the press release of the University of Mainz and ABC *"Birth order personality theory debunked"* (Cooper, 2015) actually got the main message of the study right. Which should actually not have been too hard if you read the citation in the press release correctly: *"This effect on intelligence replicates very well in large samples, but it is barely meaningful on the individual level, because it is extremely small. And even though mean scores on intelligence decline, in four out of ten cases the later-born is still smarter than his or her older sibling," explained Schnukle. "The real news of our study is that we found no substantial effects of birth order on any of the personality dimensions we examined. This does not only contradict prominent psychological theories, but also goes against the intuition of many people."*

This case illustrates clearly what scientists are afraid of in media work. Despite your best efforts, your story might be twisted into something that only has a remote semblance with your original findings.

### *Case Two: The bacon story*

When the WHO announced that processed meat was likely to cause cancer and red meat probably causes cancer, the world went haywire. The publication of the report by the International Agency for Research on Cancer Monograph Working Group (Bouvard et al., 2015) captured the attention of media like few other science reports ever do.

There was no media outlet that did not report on this, and the early headlines made a point of comparing the threat associated with a diet including processed and red meat to smoking. *"Processed meat ranks alongside smoking as a major cause for cancer, World Health Organisation says"* is the telling headline of The Telegraph (Donnelly, 2015). The Guardian adds another item to the list: *"Processed meats pose same cancer risk as smoking and asbestos, reports say"* (Gayle 2015) and sings the same tune as the Scientific American. And the BBC went over the top with *"Processed meats do cause cancer – WHO"* (Gallagher, 2015).

After having caused substantial panic among people, some more cautious statements started to pop up. I am particularly fond of The Guardian, where on the day of the WHO announcement there was an article titled *"How bad is meat for me - frankly, the experts don't know"* (Boseley, 2015). In this article you find a paragraph putting the effect into proportion:

*"In fact, the numbers are fairly low. In the UK, about six in 100 people get bowel cancer, said David Spiegelhalter, Winton professor of the public understanding of risk at Cambridge University. In other words, if 100 people ate a sandwich containing three rashers of bacon (about 50g) every day of their lives, then 18% more of them would get bowel cancer, which equates to seven rather than six."*

The New York Times blamed the WHO for doing a bad job in its initial communication of the warning: *"The main problem with the public health messages put out by the W.H.O. is that the agency did a poor job of explaining what its risk-ranking system really means. By most accounts, it's arcane and even confuses some scientists. That's because it's based only on the strength of the overall research, not on the actual danger of a specific product."* (O'Connor, 2015). The WHO assigns products to the different classes (causes cancer; probably causes cancer; possibly causes cancer; not classifiable as a cause of cancer; and probably not a cause of cancer) based on consistency of findings and quality of scientific evidence, rather than on effect size. While, from a scientific point of view, such meta-analyses are highly important, their relevance for formulating recommendations lifestyle changes can be disputed: If the effect size is small, the impact a given factor has on an individual life can be close to negligible, as seems to be the case here. As O'Connor continues:

*"Even the most strident anti-meat crusader knows that eating bacon is not as risky as smoking or asbestos exposure. Smoking raises a person's lifetime risk of developing lung cancer by a staggering 2,500 percent. Meanwhile, two daily strips of bacon, based on the associations identified by the W.H.O., would translate to about a 6 percent lifetime risk for colon cancer, up from the 5 percent risk for people who don't enjoy bacon or other processed meats."*

Casey Dunlop (2015) of Cancer Research UK did a beautiful job in clarifying what the data on meat consumption habits and cancer risks actually means. Grant Schofield (2015) provided a number of helpful citations that put the warnings into proportion. He also highlights the major shortcoming of most studies in nutrition sciences: As the studies mostly rely on epidemiological evidence, a direct causal interpretation of the correlations is not justified. Whereas studies try to control for covariants, they cannot exclude the possibility of an independent factor being responsible for the correlation. The fallacies of epidemiology are well-known and teach us to read the findings of epidemiological studies carefully (Diez-Roux, 1998). In experimental animal studies the results are far less consistent: One study even found red meat to be associated with reduced colon cancer risk in rats.

As Ted Underwood tweeted, there might be an upside to this story nobody had expected: *"A stubborn love of bacon just taught more Americans the difference between p-values and effect size than 100 stats courses could."* We could actually make use of this, quoting the

bacon story when we talk about small effect sizes. Thus, we might be able to make sure that our findings are not exaggerated.
This case illustrates that media can sometimes do a much better job at communicating what the findings actually were than scientists themselves.

### *Successful communication needs good communicators and common ground*

The number of cases where reports on scientific findings completely miss the point of the actual research is large. The mismatch between scientifically valid findings and media coverage affects the relationship between science and media far beyond a single news-cycle.

I recently attended a think-tank on the future of science on television, where I learned a lot about the ambivalent relationship between scientists and the media. By and large, scientists are suspicious of the media and reporters because they fear that they will misreport their findings. Only a very small proportion of scientists do active outreach work.

Some journals offer a media liaison service, which consists of compilations of press releases and distribution thereof among science reporters. Some universities offer similar services. Publicising research is of importance for funding agencies, as they have to justify their spending activities. Daniel Kruger serves as the media liaison for HEB. So far, media services have been offered upon request from the authors.

The relationship between scientists and the media is still governed by a significant portion of distrust. Many scientists fear that the translation of their findings from high scientific English into everyday language might lead to a loss of necessary detail and thus transfigure the intended message. On the other hand, the desire to share scientific insights with a broader audience is widespread. The two cases mentioned earlier illustrate how hard it can be to communicate science appropriately and accurately.

We tend to blame journalists if the story of their research does not come across in the way they want it to be represented. Are we really entirely innocent if our findings are not reported correctly? The WHO communication on bacon and meat and cancer tells a different story. The initial communication in the press release of the WHO was misleading, and actually journalism in general should be lauded for looking closely at what lay behind the headlines. By and large, media coverage of the topic did a fine job of providing the necessary details, and translating the findings into numbers that were both accurate and easy-to-grasp. Cancer Research UK was instrumental in providing graphs and numbers that made the message accessible to the average reader. Tara Haelle of the Association of Health Care Journalists therefore has good reason to praise science journalists for their differentiated and mostly accurate accounts: “Despite bacon headlines, reporters got to the meat of the story.”

In the tenuous relationship between scientists and reporters we must acknowledge that there are two sides to every story. While we are quick to blame reporters when they misreport on our studies, we should not forget about our own role in science communication.

When communing with our peers and students, we often use a shorthand that is specific to our field of research. The shorthand typical for any group of people who build upon a shared manifold is not a bad thing entirely. As long as its use is limited to communication among people who have sufficient command of this shorthand language, it can ease communication and make information transfer more efficient. The danger lies in cross-cultural communication, in our case communication between members of a specific scientific community and outsiders. If we grow too comfortable in the use of our shorthand, we assume that others will understand it, irrespective of their background, which can then lead to grave misunderstandings. This is why we need to leave our communication in-group regularly, and ideally do so in a low-risk setting.

Talking to our non-science friends about our findings has proven most useful for me in identifying risk-factors in my communication of research findings. Their responses usually highlight the points where more or less detail is needed, and questions pinpoint potential sources of misunderstandings.

We also have to acknowledge that the increasing competitiveness in academia might be a source of miscommunications in science, too. Scientists more and more find themselves marketing their findings like fishmongers trying to get rid of yesterday's catch. In order to get published, scientists have to emphasise the innovativeness and the interestingness of their study. While the findings might be interesting, they do not provide definite answers most of the time – at least not in our field. Getting published in some high-impact journals seems to require such ultimate answers, or at least the pretence of providing them. So the scientists find themselves cornered: Do they opt for sensational wording in order to get their study published and push their own career or do they stick to careful wording, risking people asking them what whole the point of the exercise was, if a definite conclusion is not forthcoming. Careful and well-executed scientific studies merit acknowledgement irrespective of the novelty of the insights they generate. The non-negligible number of irreproducible findings in psychological sciences should have taught us to value each and every replication of prior findings.

We need to unambiguously communicate that science does not generate facts. What good science can do is provide a close approximation of reality as perceived through a human interface. We also need to use appropriate language to describe our findings to avoid underestimation and exaggeration of the impact they have. The intergovernmental panel on climate change (IPCC) published a report on how to deal with uncertainties in publications (Mastrandrea et al. 2010). While these guidelines are to some extent specific to the needs of environmental sciences, they actually are a good basis upon which to build guidelines for communication in psychological and behavioural sciences. If we agree on a certain set of words that unambiguously link to certain statistics, then communication might be a bit less likely to go awry. And who would be better suited than us to develop such communication tools that serve disambiguation in the communication between scientists on one side, and the general public on the other side, than people who deal with cross-cultural communication?

Generating common ground is the pretext for any kind of communicative interaction: By ensuring that the communicators speak the same language – not only using the same set of communicative tokens, but attributing the same meaning to them – we can take a large step towards successful communication.

Many of us probably have had both, good and bad experiences in our dealings with mass media. As in all communicative interactions, success cannot always be achieved, despite all efforts. We will have to continue to practice our communication skills outside our scientific in-group, and at the same time monitor the activities of journalists. If and when we succeed in establishing a working relationship with media producers, outreach work can be very gratifying and make the effort worthwhile. So let us try to make this work!

## REFERENCES

Boseley, S. (2015). How bad is meat for me? Frankly, the experts don't know. http://www.theguardian.com/lifeandstyle/2015/oct/26/how-bad-is-meat-for-me-frankly-the-experts-dont-know

Bouvard, V., Loomis, D., Guyton, K.Z., Grosse, Y., El Ghissassi, F., Benbrahim-Tallaa, L., Guha, N., Mattock, H., Straif, K. on behalf of the International Agency for Research on Cancer Monograph Working Group (2015). Carcinogenicity of consumption of red and processed meat. The Lancet Oncology. 16:16, 1599-1600. DOI

Chung, S. (2015). Science says the first born child is the most intelligent. http://www.m2woman.co.nz/science-says-the-first-born-child-is-the-most-intelligent/

Cooper, D. (2015). Birth order effect on personality theory debunked. http://www.abc.net.au/news/2015-10-20/birth-order-personality-theory-debunked/6866990

Diez-Roux, A. (1998). Bringing context back into epidemiology: variables and fallacies in multi-level analysis. Am J Public Health 88:216–22. DOI

Donnelly L. (2015)Processed meat ranks alongside smoking as major cause of cancer, World Health Organisation says. http://www.telegraph.co.uk/news/health/news/11954640/World-Health-Organisation-report-processed-meats.html

Dunlop, C. (2015) Processed meat and cancer – what you need to know. http://scienceblog.cancerresearchuk.org/2015/10/26/processed-meat-and-cancer-what-you-need-to-know/

Gallagher, J. (2015). Processed meats do cause cancer – WHO. http://www.bbc.com/news/health-34615621

Gayle, D. (2015) Processed meats pose same cancer risk as smoking and asbestos, reports say. http://www.theguardian.com/lifeandstyle/2015/oct/26/processed-meats-pose-same-cancer-risk-as-smoking-and-asbestos-reports-say

Haelle, T. (2015) Despite bacon headlines reporters got to the meat of the story. http://healthjournalism.org/blog/2015/10/despite-bacon-headlines-reporters-got-to-the-meat-of-the-story/

Marshall, T. (2015). First-born child 'tends to be smarter than younger siblings'. http://www.standard.co.uk/news/health/firstborn-child-tends-to-be-smarter-than-younger-siblings-a3094651.html

Mastrandrea, M.D., C.B. Field, T.F. Stocker, O. Edenhofer, K.L. Ebi, D.J. Frame, H. Held, E. Kriegler, K.J. Mach, P.R. Matschoss, G.-K. Plattner, G.W. Yohe, and F.W. Zwiers, 2010: Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. Intergovernmental Panel on Climate Change (IPCC). Available at <http://www.ipcc.ch>.

Murphy, P. (2015). First born children are more intelligent than their siblings research reveals. http://www.independent.ie/life/family/family-features/first-born-children-are-more-intelligent-than-their-siblings-research-reveals-34128852.html

O'Connor A. (2015) So will processed meat give you cancer? http://www.nytimes.com/2015/11/01/sunday-review/so-will-processed-meat-give-you-cancer.html?smid=fb-nytscience&smtyp=cur&_r=0

Parnaud, G., Peiffer, G., Taché, S., Corpet, D.E.(1998) Effect of meat (beef, chicken, and bacon) on rat colon carcinogenesis. Nutrition and Cancer. 32(3):165-73. DOI

Rohrer, J.M., Egloff, B., Schmukle, S.C. (2015) Examining the effects of birth order on personality. PNAS, 112 (46), 14224 – 14229. DOI

Schofield, G. (2015) Red meat, processed meat, and cancer – how strong is the evidence? http://profgrant.com/2015/10/28/red-meat-processed-meat-and-cancer-how-strong-is-the-evidence/

Smith, L. (2015). First Born Children Are 'More Intelligent', Study Says. http://www.graziadaily.co.uk/hot-topics/trending/first-born-children-more-intelligent-study-says-20151056095

Sulloway, F. (1997). Born to Rebel: Birth Order, Family Dynamics, and Revolutionary Genius (New York: Pantheon; New York: Vintage, 1997)

Tromp, G. (2015) Processed Meats Pose Same Cancer Risk as Smoking, Asbestos- http://www.scientificamerican.com/article/processed-meats-pose-same-cancer-risk-as-smoking-asbestos/

http://medicalxpress.com/news/2015-10-birth-small-effects-personality.html

All links were active as of December 8th 2015.