



Comments on

(1) M. A. Maier, A. Vogel, J. Storch, & M. C. Dechamps:
Non-Classical Correlation Between Subjective and Objective Color Observations: Change of Effect as a Function of its Empirical Documentation

(2) M. A. Maier, A. Vogel, & M. C. Dechamps:
Macroscopic Complementarity Between Subjective and Objective Food Image Assessments: A Conceptual Replication of the Color-Erasure Effect

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Chasing the Wind: Empirical Signatures of Generalized Entanglement

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I applaud Markus Maier, Moritz Dechamps and their collaborators to this fine piece of thinking, resulting in even more impressive pieces of experimental documentation. I do this humbly:

A Bit of History

We have, over nearly two decades, striven to come up with a direct test of our Generalized Entanglement Hypothesis without success. The idea first occurred to me, actually in a conversation with Walter

von Lucadou in the train between Karlsruhe and Freiburg, when I discussed the strange findings of my clinical trial of classical homeopathy in chronic headaches (Walach et al., 1997), around 1993 or so. I saw that the data signature of parapsychology and of research in homeopathy were rather similar: First experimental tests of whatever experimental paradigm was used found strong evidence for such anomalistic results. When following up on those, they tended to go away or switch channels, and the better controlled experiments were, the more likely such a decline was. My headache trial was in fact the third in a row of similar trials in homeopathy research. The first (Brigo & Serpelloni, 1987) was extremely badly published, but had, according to Prof. Diener, the then head of the German association of neurologists, the best result in the whole migraine literature (implying: it must be wrong). The second (Whitmarsh et al., 1993) had a smaller effect, missing conventional significance, and my own trial was, as my fiercest critics grudgingly acknowledge, one of the methodologically best ever done in homeopathy and had the worst clinical outcome. After my conversation with Walter von Lucadou, it suddenly dawned on me: There is very likely a category of effects that are systematic, yet not causal (since clinical trials are, in a way, cause detectors). They are real, but cannot be manipulated in the same way as causal, for instance pharmaceutical systems, can. After a few more years of reading around in the quantum physics literature, studying Jung's synchronicity concept, and discussing with physicists I generated the idea that what was known in quantum theory as entanglement or non-local correlations was likely only a special case of a much broader, a generalized version of non-local correlations. My long-standing interest and study of Leibniz under the guidance of my late philosophy teacher Friedrich A. Uehlein hat helped here: Leibniz was the first who actually introduced such a concept under the term "preestablished harmony" (Walach et al., 2009). I approached Hartmann Römer, who then was the chair of theoretical physics in Freiburg with the idea; I had met him at a philosophy seminar invited by the philosopher Prof. Klaus Jacobi. When I detailed the idea that perhaps non-local correlations might also be operative in the macro-world under certain circumstances, he thoughtfully replied that this might be the case and that this should be formally stated. I challenged him to do that, and out came the formalism of Generalized Quantum Theory (GQT) (Atmanspacher et al., 2002). After that we spent quite some time and effort to "prove" that such generalized entanglement correlations exist. My hunch, at the time, was that we would have to find complicated models with many degrees of freedom. We tried Grinberg-Zylberbaum's (Grinberg-Zylberbaum, 1982) model of EEG-correlations across subjects. After initial positive results (Wackermann et al., 2003), and some really strong effects, that were never published (Naranjo, personal communication), the effects waned (Wackermann et al., 2004). We tried Walter von Lucadou's matrix PK experiment. After some strong initial results (Walach et al., 2020), a replication failed (Walach et al., 2021). We had indeed documented the No-Information-Transfer Axiom (NT axiom) in

real experimental life that we had previously confined to paper (Lucadou et al., 2007). This series of experiences together with others, not detailed here, convinced me that a) macroscopic entanglement correlations are likely real – under certain circumstances, and that my original idea was viable and useful and b) that it would likely not be taken up widely, because a direct experimental proof was impossible. And since our current scientific paradigm operates under the assumption that only experimentally validated and replicated results have to be taken seriously, we must await the dawn of another paradigmatic day.

For specialists: I know that physical entanglement correlations can be endlessly proven true, if one can operate the experimental set-up. But there is a decisive difference: Physical entanglement experiments are not experiments in the sense used in psychology, medicine or biology. They are documentations of empirical deviations from a theoretically expected behavior that are predicted or confined by Bell's theorem, i.e. measurements against a theoretical distribution. Since GQT is a much weaker formalism and does not have such strong quantitative framework notions as proper physical quantum theory, we cannot derive a theoretical prediction. And direct causal tests are ruled out by the NT axiom.

The NT Axiom and Time-Reversal Problems

The authors of these studies have taken the NT axiom seriously, probably because they saw it in action themselves previously (Dechamps & Maier, 2020; Maier & Dechamps, 2018; Maier et al., 2018). The ingenuity of these studies is the indirect approach. They bank on the reality of both generalized entanglement correlations and the prohibition of using them causally. Hartmann Römer has provided, in the appendix to our publication of the NT axiom (Lucadou et al., 2007), a formal proof, why entanglement correlations must not be used for causal signal transfer. If so used, they must break down. Every physicist knows this and the formal proof states, in a sense, the obvious. But why does it have to break down in the generalized case as well? Entanglement correlations are non-local, i. e. they appear as if signals could be transmitted faster than light. According to Special Relativity, the speed of light also sets the time frame of future and past, because nothing can travel at a greater speed than that of light. If we were able to use entanglement correlations causally, i. e. in a replicable and reliable manner, then we could break the arrow of time and could signal into the past. This leads to time-reversal paradoxes that have long been discussed in the philosophy of science (Fitzgerald, 1971): We could signal into the past and buy someone to kill our grandmother in which case we would not be here to do the buying. Therefore, nature does not seem to like such arrangements. A classical experiment, in which the control group is randomly created constitutes such a causal signal coding, at least

potentially. For the results of the first experiment could be used to know the group assignment of the second experiment, constituting a code that potentially allows signaling faster than the speed of light. That seems to be not a viable concept of Nature, and hence generalized entanglement correlations appear to have an inbuilt mechanism of self-destruction: As soon as they are misrepresented and misused as causal signals, they must break down. How quickly and how definitive such a breakdown happens seems to be dependent on the framework. If the controls, the blinding, the methodological rigor of an experiment are strong, the breakdown happens earlier.

But why do such systems work in practice? many ask. Homeopathy still works in clinical practice despite the fact it is very likely not causal. Synchronistic events happen all the time, and synchronistic systems such as the I Ching can be used to give meaningful answers to important questions. Parapsychological events, especially spontaneous ones, seem to happen despite the fact that they defy the current paradigm, and spontaneous macrokinetic events like spook and poltergeist phenomena have not died out. Single instances of them do seem to go away, if they are systematically documented, but as a group they continue appearing. The difference is this: None of these systems, supposedly operating on the basis of a generalized entanglement correlation, extracts causal signals out of the system. Homeopaths simply use homeopathic medicines. As soon as they start asking the question where, in the system, the supposedly healing information is, they are getting into trouble. Such systems work best if undoubted and used naively. But a scientific experiment is the opposite. It tries to extract a causal signal.

The Ingenuity of the Studies

This is, where the studies' ingenuity comes into play: Without compromising scientific rigor the authors have worked along the theoretical ideas of Generalized Quantum Theory and the predicted correlations and shown both: that such correlations appear to be operative. This can be seen in their high accumulated Bayes Factor of nearly 40 in the first study of the first publication and even higher in the second publication, which constitutes quite strong evidence. And the second prediction, that by repeatedly probing the system this would go away – an operationalization of the NT axiom –, was also borne out. The fact that they submitted also this specific distribution – a strong peak, followed by a steady decline – to a statistical test by generating a distinct distribution of this pattern by permuting the data 1000-fold is another ingenious step in analysis.

The second study does not test this hypothesis formally, but it also documents a decline of the effect size across the four studies from a high $d = 0.6$ to a smaller $d = 0.25$ with linear decreases from study to study.

I am convinced anyway. I would have to be modeled by a strong positive Bayesian prior and need no convincing. But what about a sceptic? Would he be convinced? Probably not. He might demand a replication of this study, even by a sceptic, to exclude a non-classical experimenter effect, whereby the consciousness and the expectation of the experimenters affect the system non-classically. Such a replication, indirectly, is the second set of studies in the second paper. The trick, why this second series does not continue the decline of the first set of experiments, is the novelty effect: instead of colors, food items are chosen. This, conceptually, constitutes a new set of experiments, and hence, sets out with a strong effect, documenting the effect of generalized entanglement correlation due to the incompatibility of objective measurement (in the second set of experiments: the caloric value) and subjective evaluation of tastiness.

In the first set of studies, the correlation rests in the meaningful complementarity between objective properties of presented colors and the subjective ratings and in the contrast between real and unreal pairs, in the case of deleted or unsaved properties. Since they are accumulated, each participant's data series constitutes a signature of such entanglement correlations, minute as it is. Knowing this, in a replication experiment the signature could be used to code a signal – stronger liking ratings for entangled versus unentangled pairings. So, the expectation according to the NT axiom would be that in a direct replication experiment the peak would go away. The authors avoided this effect in the second set of studies by using a different stimulus. Thus, they could set out afresh. Had they chosen to do more replications, seven, say, I am quite sure that the effect would have converged against a null-result. In the present set of four studies, they see the effect in each single study, albeit with declining effect size, and can confirm it in an overall analysis.

This, in my mind, constitutes preliminary experimental proof that generalized entanglement correlations exist and that the theoretical structure holds. This disallows causal misuse of the correlations. In future studies, new experimental paradigms will likely show again a strong initial effect that will decline with direct replications. If they are not too numerous, it might be possible to accumulate the effect, like in these studies. And across similar, but conceptually independent series of experiments the effect might be even more easily accumulated. Perhaps the empirical signature of the decline described by such quite similar experiments might help a good theoretician like Hartmann Römer to model an important parameter for the generalized quantum formalism, which will move the whole enterprise an important step forward. In that sense, I am looking forward to more ingenious studies from this creative and energetic group.

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