Reply to Comment: "Bayesian Network Integrated Testing Strategy and beyond"

I read with satisfaction commentary by F. M. Stefanini where he presents supporting arguments for our work on using Bayesian Networks (BN) as an operational framework for Integrated Testing Strategies (ITS). Further, he comments that the ITS operational framework can be broadened to take advantage of Bayesian graphical models (BGMs) in general. I applaud and support this conclusion. One framework does not fit all needs and, depending on the context, different approaches can be more or less suitable, as we expressed it in the outlook of Jaworska et al. (2010). However, BNs, the most frequently used type of Bayesian graphical models, provide a very attractive framework for ITS. In BNs all edges in the graph are directed. A directed edge represents a causal impact that is of critical importance in ITS, which should allow for a mechanistic interpretation. Therefore, I expect that among BGMs, the ones using directed graphs will be more useful in applications to ITS. I look forward to development of new practically applicable approaches based on BGMs , especially when larger datasets than we have today become available for ITS analyses.

Next, F. M. Stefanini discusses the need for careful handling of uncertainty in 1) data via imputation, and 2) model structure. This discussion also provides a summary of how to maximize the potential of these powerful algorithms and to limit misuse, which is always a useful reminder. Specific criticisms of our proof of concept ITS (ITS-1; Jaworska et al., 2011) regarding single imputation and uncertainty of BN structure were already identified as weaknesses in the discussion of that paper. In addition, as proof that we took them seriously, they were addressed in our follow-up work (ITS-2; Jaworska et al., 2013) by 1) generating more data in the refined tests, and 2) taking advantage of the advances in the mechanistic understanding of skin sensitization. Our approach was, in both ITS-1 and ITS-2, to use mechanistic knowledge to construct a structural prior and learn parameters from data. Data availability as well as mechanistic understanding did not allow materializing it in the ITS-1 in a manner that became possible in the ITS-2. In general, refinements and extensions of ITS frameworks must draw in a balanced way on both machine learning and mechanistic insights to be well predictive.

References

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Joanna Jaworska, PhD
Procter & Gamble, Modelling & Simulation
Biological Systems, Brussels Innovation Center
Temselaan 100
1853 Strombeek-Bever, Belgium
e-mail: jaworska.j@pg.com