Reviewer’s report

Title: Bridging the Gap Between Complexity Science and Clinical Practice by Formalizing Idiographic Theories: A Computational Model of Functional Analysis

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Reviewer: Günter Schiepek

Reviewer's report:

The paper is of high importance and relevance to the field of practice and practice-based research. It tries to integrate approaches of case conceptualization and mathematical formalization.

It should be noted that there are at least two ways of creating personalized models for case conceptualization: Designing an idiographic model for or with each client, or specifying a general model (theory of change) according to the (control) parameters (which have to be operationalized and measured), the values of the variables, the shape of the relations between the variables (in some approaches this depends on the control parameters), and the initial conditions.

p. 7 (122-125) key advantages: integration of multiple problems: case conceptualizations should not only rely on problems or symptoms, but also on resources, competencies, and so on; finally, all psychological concepts or hypotheses should be able to be integrated. Prescription of interventions: This depends on the structure of the model (interventions on specific variables) and on the current dynamics which has to be simulated and measured by real-time monitoring. Heuristics have to be available for the decisions on appropriate interventions. Prediction of outcome: chaotic processes cannot be predicted on the long run. Support for the therapeutic relationship: This is true, but it depends on the concrete work of designing an idiographic model (case conceptualization) in an intensive cooperative work of client and therapist. The co-creative modelling process usually is an important intervention in the sense of a cognitive restructuring of understanding one's own problems and psychic functioning.

P 8: The selection of the variables and concepts is important and has crucial impact. Although the authors stress the importance of not only taking disorder-specific concepts into consideration, the panic model is quite restricted to disease-related concepts and terms. The SORC model is linear and is restricted to hypotheses of conditioning (S-R, R-R, and R-C relations). Methods of idiographic system modelling were developed in order to open the search horizon on basically all psychological hypotheses which can be related in a systemic way. By this, it is an important step from Figure 2 to Figure 3.

Equations: Except for one multiplicative term, the equations are linear. Coupled nonlinear modelling would be an important step. Current research shows that psychotherapeutic processes are nonlinear and chaotic.

P 12: Interventions should be tested in the model. Yes, but this only can be done if the model is right (see comment on p 14).

P 14 comparison of simulated data and observed patterns in clinical practice. The sources of discrepancies or not corresponding dynamics are manifold: wrong variables included in the model or
too much or too less, invalid parameters modulating the relations between the variables, wrong parametrization, invalid relations between the variables (mathematical functions define the interactions), small differences in the initial conditions of the real and the simulated dynamics, different kinds of dynamic noise, and others. In nonlinear systems small differences of the initial conditions and of the parameters values may create completely different patterns.

The frequently used term "idiographic theory" is a contradiction in terms (oxymoron). A theory should be applicable and explain a certain range of phenomena or cases (nomothetic claim), whereas idiographic procedures like case formulation should explain or describe a specific case.

There are former approaches to the formalization of idiographic system models, see Schaub, H. & Schiepek, G. (1992). Simulation of psychological processes: basic issues and an illustration within the etiology of a depressive disorder. In W. Tschacher, G. Schiepek & E.J. Brunner (Eds.), Self-Organization and Clinical Psychology (pp. 121-149). Berlin: Springer.


Are the conclusions drawn adequately supported by the data shown?

Generally, yes. In detail, there are some conclusion and expected benefits which are difficult to fulfil or are dependent on ambitious preconditions.

To formulate a testable theory (p. 17, line 365): This depends on many specific conditions, e.g., exact initial conditions, valid parameter values, input and boundary conditions, and so on, and on appropriate measurement procedures. The same holds true for any attempt to test interventions in computational models (p. 18, 396).

p. 18 (406-407): Simulated data can only be compared against reported behaviour if there is a measurement device which allows for a comparison at the same sampling rate and the same variables or measurement scales as the simulation. This is a topic which is not detailed in the paper. The variables of the model (may it be idiographic or nomothetic) should be represented in the measurement procedure (e.g., questionnaire) and vice versa. (see remark on p. 14)

P 20 (441ff) Mathematical competencies are not part of the education of clinical practitioners, but it should be part of it. The concept of "system competence" in psychotherapy includes a training in basic mathematics, analysis tools for nonlinear time series, and complexity science.

P 20 (455ff) The estimation of parameters from nonlinear time series data is very difficult and undergoes severe limitations.

P 21 (486) enhancing predictive precision: nonlinear models principally have limited prediction horizons.

I fully agree with the perspective of creating a simulation tool for clinical work, integrated with a measurement tool for a continuous assessment of the variables, continuous parameter estimation (big challenge) and model optimization.
Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

Yes

Does the work include the necessary controls?
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No

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