

Modeling the psychotherapy change process

From single-case reports with R, to aggregated cases with PLS-SEM

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● BACKGROUND

○ The core symptoms of autism (social deficits, language disorder, and stereotypic behavior) often respond well to intensive behavioral interventions, demonstrating that they are indeed malleable. However, this possibility is not related to an understanding of mechanisms of therapeutic action. Access to this knowledge is a challenge for research and practice (Kazdin 2008). But, by what method ?

○ Designs that seem to be most appropriate and necessary are small *N* or single-case studies focused on change process. With these designs it is possible to identify, describe, infer assumptions about how the therapist's interventions, patient's responses and their interactions (i.e., the therapeutic process) contribute to predict the therapeutic outcome. Single-case research can be of *experimental* type (with manipulation) or *observational* type. There is nothing inherent in single-case designs that requires either direct manipulation or passive observation.

○ Characteristic of all single-case research is a focus on variation within subjects over time and the attempt to understand this variation as a fonction of other variables that vary *within subject* over time or as a fonction of variables that vary *across subjects*. According Hilliard (1993), global aggregation across cases must be avoided and the generality of one's findings can be addressed through direct and systematic replication on a case-by-case basis. Actually, different methods, where conceptualisation, modeling and tests succeed, seem open the possibilities of generalisability (Carey & Stiles 2015).

● MODELING INVOLVES SEVERAL ISSUES

1. Epistemological: the transactional nature of the relationship between patient and therapist determines the therapeutic action's process (Jones *et al.* 1992). The term *process* implies the temporal unfolding of variables within therapeutic dyads. The term *case* or *subject* may refer either to a single individual (the patient or therapist) or to a therapeutic dyad, depending on whether the phenomenon of interest is analyzed at the individual or dyadic level.

2. Methodological: single-case measures, at a fine grain level, are collected; measures of the variable(s) are repeated over time; a consensual description of the internal process is obtained from a specific instrument; activity of the therapeutic process and the associated results are described; qualitatively and quantitatively; assumptions about active variables are inferred and tested (Kazdin & Kendall 1998); variations *intra* and *inter subjects* are distinguished. Quasi-experimental single-case studies, carried out in natural conditions as part of a clinical research network, may meet these criteria (Thurin *et al.* 2015); the Child psychotherapy Process Questionnaire (CPQ) (Schneider & Jones 2006) is a central tool of process investigation.

3. Analytical: based on data from individual cases, case-to-case comparisons, and secondarily aggregated cases after replication, descriptive and statistical methods can be applied without the direct manipulation of any of the variables studied (i.e., measures of external indicators of change, mediators, moderators, case profiles, sequential and growth curve analysis, causal chains). Each approach may contribute to modeling.

● SINGLE-CASE ANALYSIS

○ Intrasubject design refers to research that focuses on the temporal unfolding of variables within individual subjects. Five steps of data analysis are described:

1. Initial Case Formulation and functional analysis

A case formulation, as a summarization and integration of pre-treatment and first sessions clinical assesment, is realized. Case Formulation is complemented by a functional analysis that describes the relations between clinical features and variables associated outside and in therapy.

2. Longitudinal quantitative assessment of external indicators of change (behavior, development, functioning)

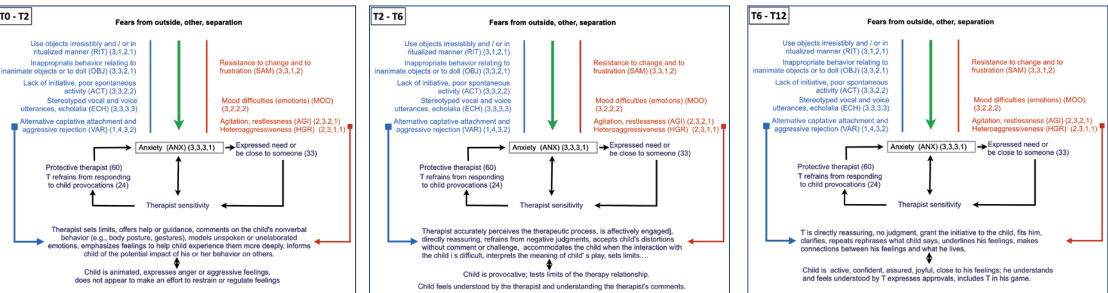
3. The ranking of the 100 variables of the CPQ characterizes the internal process of therapy. Measures follow a normal distribution.

Variables always very characteristic and 20 most characteristic variables at each phase of therapy (e.g. beginning, middle an end) are selected and grouped by theme. They represent the range of potential mediators from the therapeutic dyad. Mechanisms of their potential impact and expected outcomes are inferred.

4. Results. The relationship between 1) the external indicators; 2) the potential mediators; and 3) the moderators are examined and described in the 3 periods of the evaluation. Variation between initial and one year case formulation is assessed.

5. Discussion and conclusions. Threats to internal validity for this case are examined, strengths and limits are presented. Remaining questions are underlined.

Below, we present the simplified change process of a case in the 3 study periods: 0-2, 2-6, 6-12 months.



The three graphs above describe the main characteristics of the change process of Caesar, an autistic child who started psychotherapy at the age of 9 years and whose main problems were: high anxiety about the outside, intolerance to frustration and to separation from his mother. Various defense mechanisms are associated: ritualisation, aggressiveness ... Behaviors (upper graph part) are evaluated with the BSE-R. Items of permanent dyadic interaction during the year are presented in the center part and the specific interactions at 2, 6 and 12 months, in the graphs lower part.

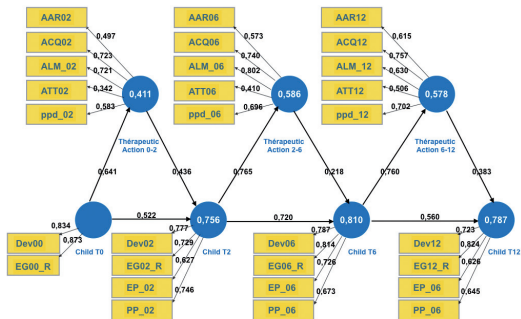
● AGGREGATION ACROSS CASES and ANALYSIS

○ Intersubject variation refers to differences between or across subjects. Cross-sectional perspective and direct aggregation across cases are avoided. Intersubject variability may be studied in patterns of intrasubject variability of change. The generality of findings is usually addressed through replication on a case-by-case basis.

○ Two types of *replication* across subjects are described (Kazdin, 1982). The first, designated *direct replication*, refers to the attempt to replicate the findings in subjects that are similar in terms of the individual-differences variables that are viewed as affecting the phenomenon of interest. The second type of replication, *systematic replication*, refers to the attempt to show that the findings differ in predictable ways when one selects subjects that differ along the critical individual-difference variables. The comparison of subjects highly similar in terms of certain individual-difference variables (sex, age, initial disorder severity), but whose outcome is different is a fruitful way of single-case research.

○ Once the phenomenon of interest is sufficiently well understood at the single-case level, intelligent aggregation over truly homogeneous groups may be possible. Three factors are to be considered when exploring the issue of true *homogeneity*: (a) the nature of the question being asked, (b) how the pattern of intrasubject variation differs across subjects, and (c) the particular aggregational statistic that can be used.

○ The aggregational statistics are multilevel statistics : growth curve, factor analysis, principal component regression, PLS-SEM (Falissard 2014, Hair *et al.* 2014). Below, we present the simplified figure of the main variables involved in the evolution of 60 cases, calculated with PLS-SEM method.



Structural Equation Modeling (SEM) allows the researcher to incorporate unobservable variables indirectly measured by indicators variables. PLS focuses on explaining the variance in the dependent variables when considering the model. This graph shows the relationship between latent variables describing evolution of the clinical status of the child and latent variables describing therapeutic action. The chain is initiated by the initial status of the child, from which therapeutic action is committed. Therapeutic action involves the therapist and the child (dyad).

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