

Generalised Quantum Theory – Theory and Applications

Harald Walach



Medical University, Poznan, Poland

University Witten-Herdecke, Department of Psychology,
Germany

Institute for Border Areas and Mental Health (IGPP), Freiburg
Change Health Science Institute, Berlin



BACKGROUND

World Models and Paradigms

- ▶ We always make presuppositions
- ▶ Robin G. Collingwood (1940, *An Essay on Metaphysics*)
 - ▶ „Absolute Presuppositions“
 - ▶ Are derived from the cultural background
 - ▶ Without formal discussions
 - ▶ Define what is taken for granted



World Models and Paradigms -

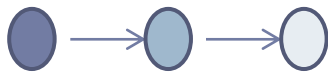
- ▶ Thomas S. Kuhn (1962: Structure of Scientific Revolutions): Paradigm
 - ▶ Standard assumption
 - ▶ Standard experiments
 - ▶ „Normal science“
 - ▶ Until too many anomalies accrue



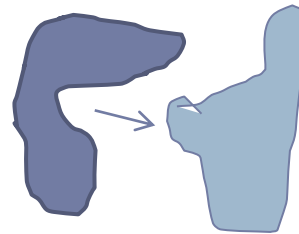
Our Current World View

- ▶ Paradigmatically determined („Absolute Presuppositions“ in the sense of Collingwood) by a commitment to
 - ▶ Local causes
 - ▶ Analysis before synthesis
 - ▶ „Individuals“/“Particulars“ before wholes
 - ▶ „External“ instead of „internal“ relations

Mechanical causes



Lock-key principle



Our current world-view...

- ▶ Also determines what we can see
 - ▶ Only local-causal phenomena
 - ▶ Mostly material outer relations
- ▶ Many phenomena do not fit
- ▶ Hence are not „seen“ or
- ▶ Not taken scientifically seriously
- ▶ Similar to the heartbeat at the time of William Harvey (1623)



Example from History: William Harvey Detects the Heartbeat (1623-9)

- ▶ When William Harvey postulated that the heart is a pump and therefore there is a heartbeat there was an outcry through Europe:
- ▶ Parisano: „There is no one in Venice who can hear a heart beat“



Parisano (1647) Disceptationes Recentiorum de Motu Cordis, Sanguinis et Chyli. Leyden, p 107

In aquæ ab equo deglutione, & motum percipi, & aquæ sonitum exaudiri, facile admittimus; at in sanguinis è venis in arterias traductione pulsus fieri in pectore, & exaudiri, nec nos quidem percipimus, nec imaginatione assequi possumus, nec etiam assequi nos unquam posse credimus, nisi ab Harveio suum aurium instrumentum acusticum mutuemur. Inprimis iam talem sanguinis traductionem non admittimus. Sed esto, in eius gratiam; Ex corde in arteriam magnam, seu in saccum, (ut existimat & tradit,) transmittatur; sic non est ex venis, sed ex corde in arterias traductio. Quod si in pulmonibus, ex eorumdem venis, seu ex venæ arterialis ramis & ramulis, in arteriæ venalis ramulos, peragitur; quomodo percipitur in pectore, pulsus? quomodo sonitus? Innocens ego sum ab huius speculationis subtilitate. Adde præterea, quod Harveio pulsus fit ex immisso à corde sanguine in aortam, seu in saccum & utrem; ut ita ex sanguine sequatur pulsus & (quod ulterius addit) sonitus; quem nos surdastri audire non possumus, nec Venetiis sunt qui audiant. si tantummodo Londini exauditur, faustum, felix, fortunatum esto, nos Venetiis scribimus.

If a horse swallows water, a sound can be heard; we admit that... but that the transport of the blood... should produce a sound that can be heard, this we do not perceive, nor do we think that it should ever be possible, except Harvey borrows us his hearing aid... how should a pulse be felt in the breast? How a sound?... Harvey says, a beat arises... from the motion of the blood, and (moreover!) a sound: we deaf people cannot hear that, neither can other people in Venice. If they can in London, they are utterly lucky. But we are writing in Venice.

Many Phenomena

- ▶ Implicitly often presuppose other paradigmatic foundations
 - ▶ Non-local/internal relationships, or formal „causality“
 - ▶ No signals, but correlations
 - For instance: all para-normal phenomena
 - ▶ Wholistic synthesis instead of analysis of individuals
 - ▶ For instance various types of complementary medicine
 - ▶ „Internal“ relations
 - ▶ For instance: intentional healing
 - ▶ Mind-body relationship that is not committed to an apriori materialist and reductionist stance

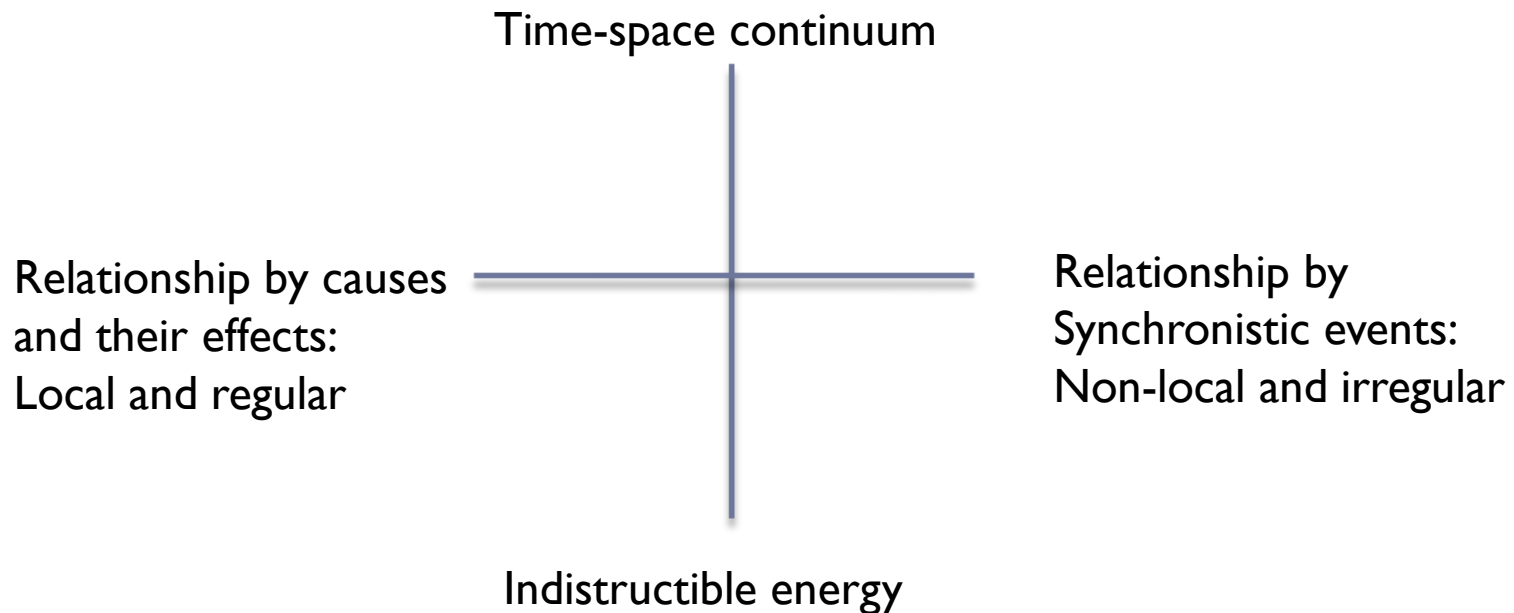


A General Intuition - 1

- ▶ There is a class of phenomena that are not causally mediated through stable signals
- ▶ Yet regular
 - ▶ PSI phenomena
 - ▶ Phenomena in complementary medicine (homeopathy, spiritual healing, „energy techniques“)
 - ▶ Synchronistic events
 - ▶ Coordination phenomena in large groups and across time




Predecessors: Jung and Pauli' Concept of „Synchronicity“



Meier, C. A. (Ed.) (1992). *Wolfgang Pauli und C.G. Jung. Ein Briefwechsel 1932-1958. Heidelberg: Springer.*

p. 60, Jung in a letter to Pauli, 30.11.1950



Local and Nonlocal

- ▶ Regular signals, limited by Special Relativity
 - ▶ i.e. 300.000 km/sec
 - ▶ Moon and earth are not locally connected at the same time instance
 - ▶ Exchange forces of our known 4 forces
 - ▶ e.g. photons, gravitons
 - ▶ Defines the arrow of time
 - ▶ Efficient causality (in Aristotelean terminology)
- ▶ Regular, but likely no signals
 - ▶ Correlations only
 - ▶ Hence no limitation in spatial or temporal outreach (non-local)
 - ▶ No known or needed „forces“ or „energies“
 - ▶ Atemporal and aspatial
 - ▶ Formal and final causality (in Aristotelean terminology)
-



A General Intuition - 2

- ▶ These phenomena resemble **phenomenologically** coordinated correlated events as in EPR- or non-local correlations in quantum physics



A General Intuition - 3

- ▶ The general *structure* of quantum theoretical insights might be applicable to systems beyond strict physical systems



therefore

A NEW MODEL TO COMPLEMENT THE MECHANISTIC MODEL

Quest for a New Paradigm

- ▶ **Generalised Quantum Theory (GQT)**

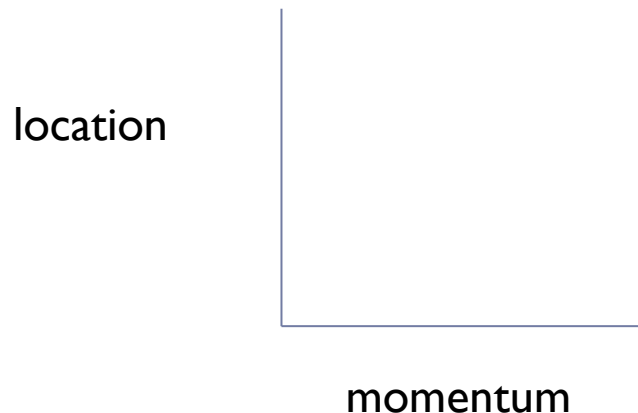
(Atmanspacher, Römer & Walach, Foundation of Physics 2002, 32:379)

- ▶ Formal theoretical framework derived from algebraic QT
- ▶ Designed to deal with incompatible operations/variables outside the physical quantum realm proper
- ▶ Compatible or commuting:
 - ▶ $a*b = b*a$ or $a*b - b*a = 0$
- ▶ Incompatible or non-commuting:
 - ▶ $a*b \neq b*a$ or $a*b - b*a > 0$ -> Heisenberg uncertainty



Incompatible / Complementary Variables

- ▶ are not simply contradictory opposites
 - ▶ Such as: hot ————— cold
 - ▶ Dry ————— wet
 - ▶ Light ————— dark
- ▶ But maximally incompatible descriptions of
 - ▶ One and the same object or situation



Complementarity/Incompatibility

- ▶ Two descriptions that are both incompatible but necessary to describe a situation



Compatible and Incompatible Observables

- ▶ Our macroscopic models are normally only dealing with compatible concepts
 - ▶ Contradictory or simple opposites
 - ▶ Can be dealt with binary logic
 - ▶ Either – or
 - ▶ True or false
 - ▶ There are many situations where we have situations that are analogous to the quantum formalism, constituted by incompatible observables or variables
 - ▶ That cannot have sharp or defined values at the same time



Examples of Incompatible Variables

▶ Quantum Mechanics

- ▶ Well known and well defined
 - ▶ Location and momentum
 - ▶ Time and energy

▶ Generalised Context

- ▶ Not well known and ill defined
 - ▶ Individuality and community
 - ▶ Mind and body
 - ▶ Process and substance
 - ▶ Function and structure
 - ▶ Novelty and confirmation
 - ▶ Love and hate
 - ▶ Structure and freedom
 - ▶ Internal and external validity
 - ▶ Chance and necessity
 - ▶ Insecurity and belonging
 - ▶



Another Way of Putting it

- ▶ Whenever we have situations where the measurement process changes the measured object or the measurement, we have incompatible observables
 - ▶ In quantum mechanics measuring location disturbs the measurement of momentum and vice versa
 - ▶ In our lived world
 - ▶ Describing or attending to an inner state changes it (psychology)
 - ▶ Making a situation public is the beginning of a change (sociology, politics, economy)
 - ▶ Making a diagnosis or prognosis is already a treatment (medicine, psychology)
 - ▶



therefore

**WE NEED A QUANTUM MODEL:
GENERALISED QUANTUM THEORY
BEYOND PHYSICS PROPER**

A Special Kind of Relationship in Quantum Physics

Entanglement:

Non-local correlation without signal or energy transfer

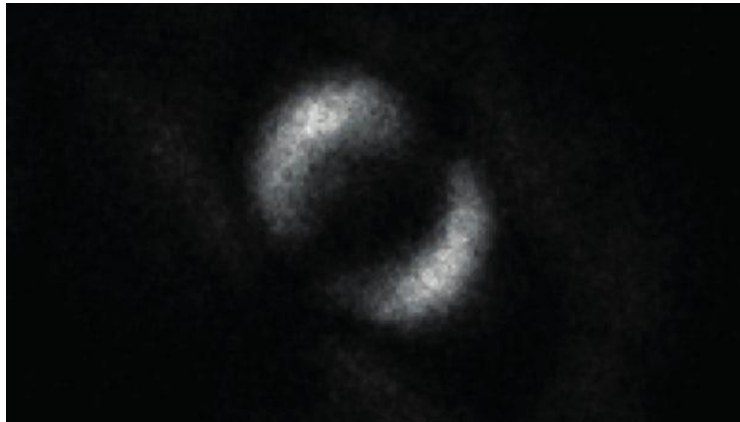


Quantum Entanglement

Well known in quantum mechanics

Experimentally solidly proven

Basis for applications like quantum computing



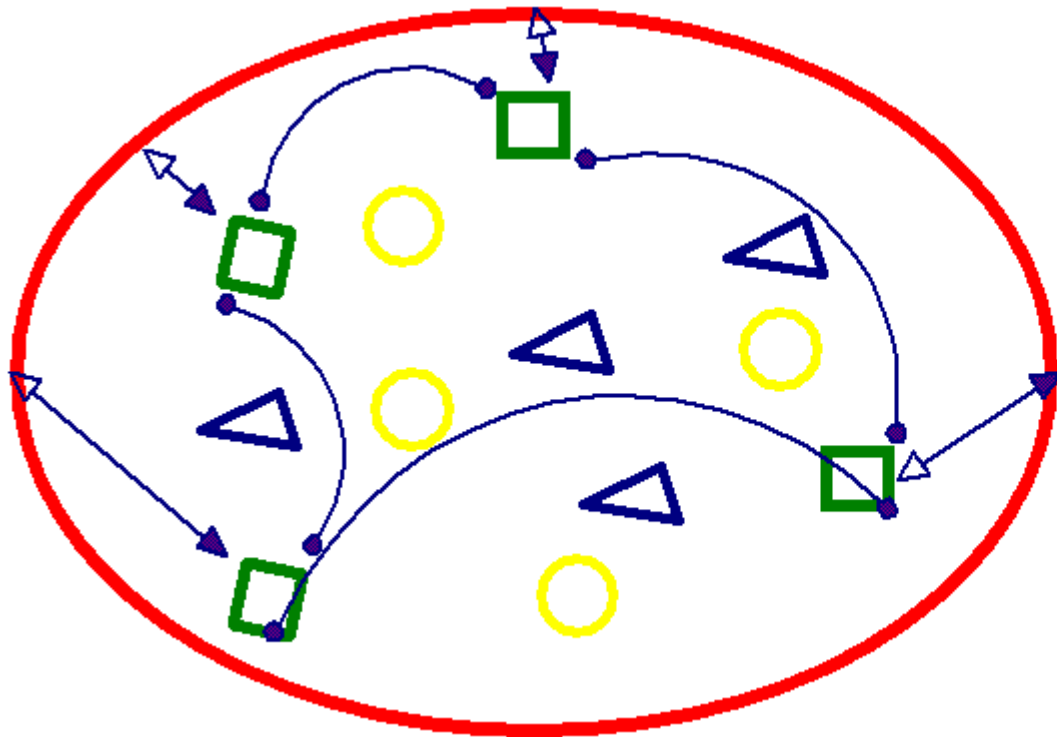
For instance: in a two-photon system polarisation angles are correlated, irrespective of the distance

If one photon is measured, the value of the other photon is known instantaneously

Generalised Quantum Theory

- Non-local correlations are also predicted by the generalised model
- In all types of systems, provided
 - There is a strong boundary of the system (for instance via a ritual or natural system boundary - organism)
 - The system contains subsystems
 - There is incompatibility between the global and the local description of sub-systems

Generalised Entanglement Correlations



Complementarity

between

global and

local

observables

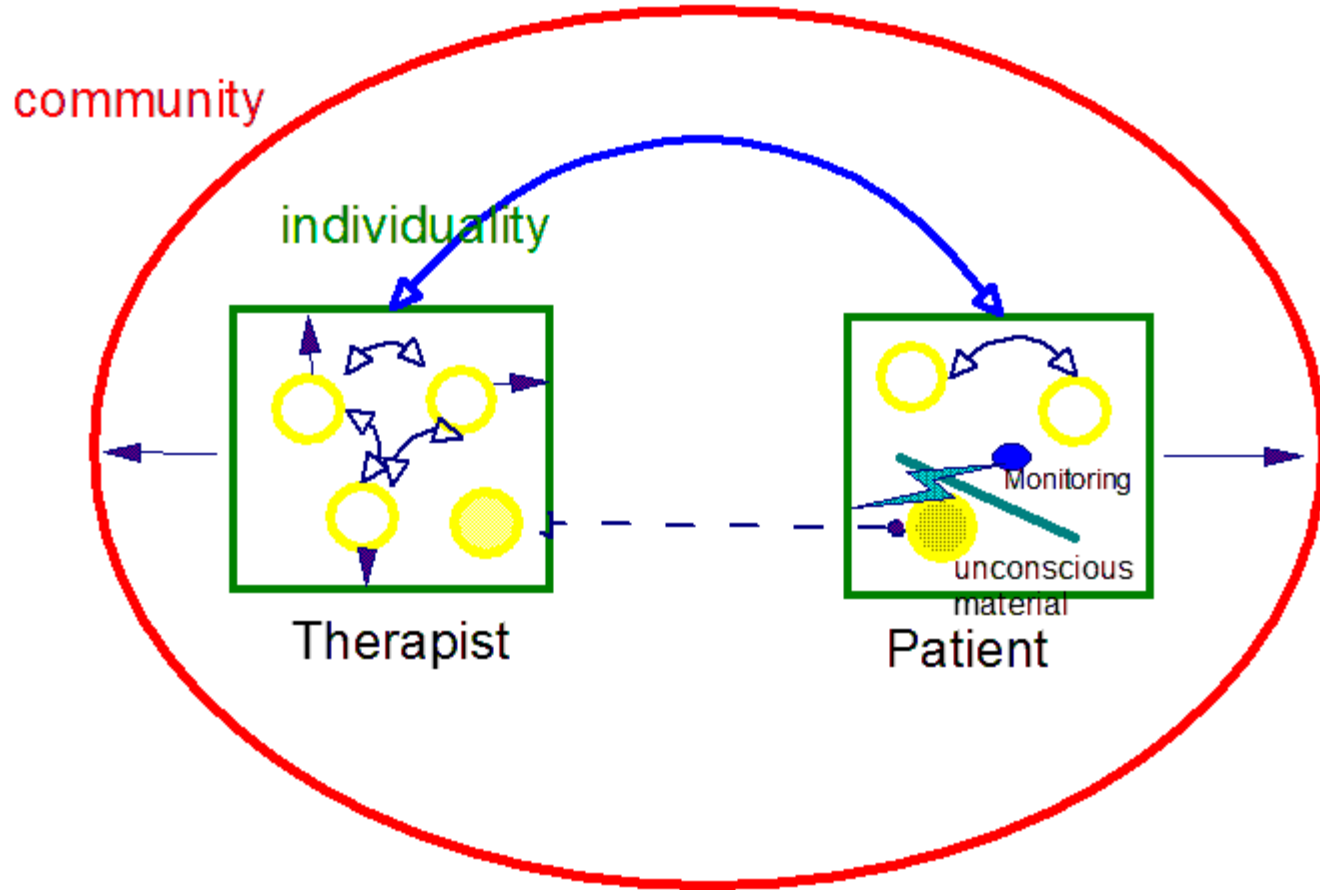


Applicable to Theretically Reconstruct...

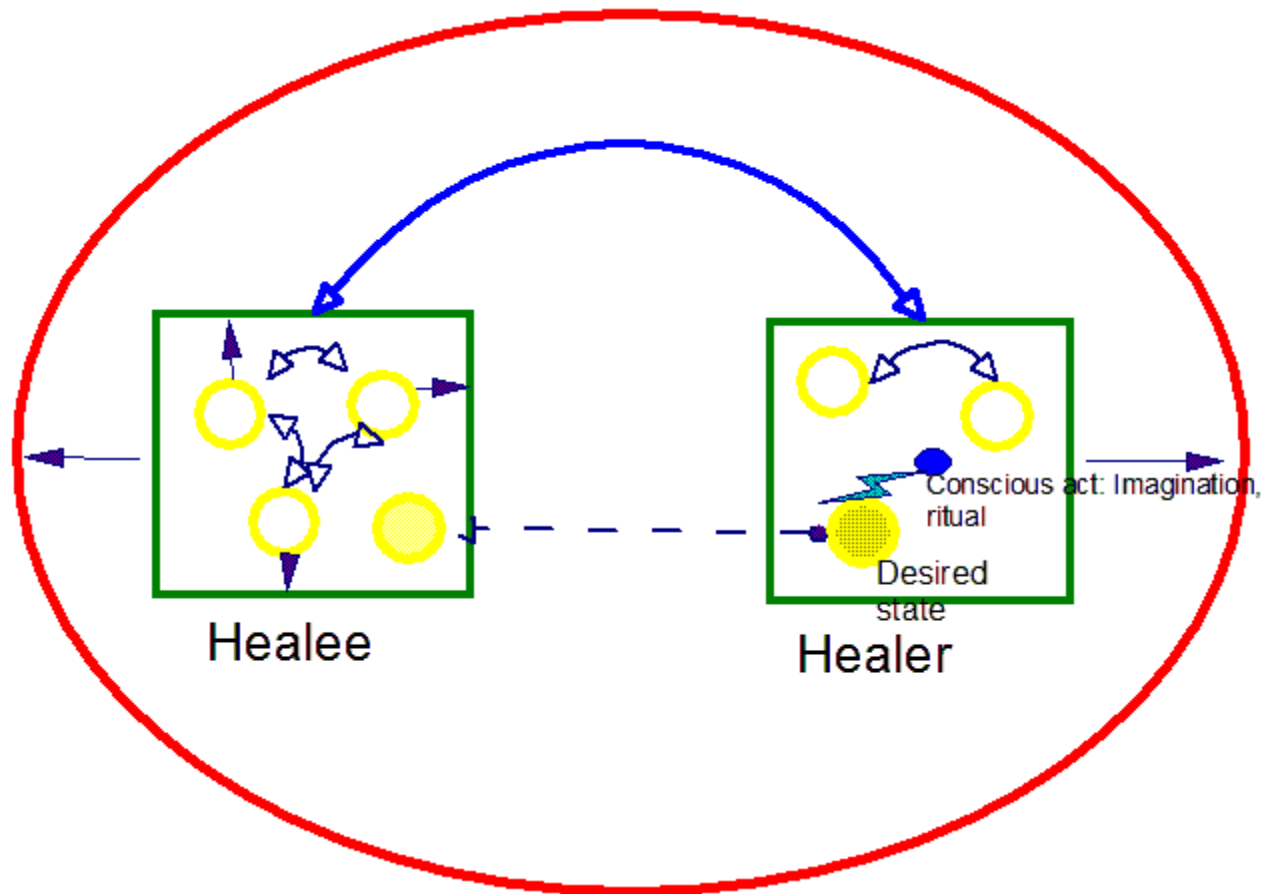
- ▶ Transference experiences in close therapeutic and other relationships
- ▶ Homeopathy, spiritual and intentional healing and other instances of ritual healing
- ▶ Religious or indigenous rituals
- ▶ Sequence effects in psychological measurements – position effects in questionnaires
- ▶ Time parameters in bistable images
- ▶ Synchronistic events and experiences, parapsychological phenomena
- ▶ Macro-coordination in organisms, groups, flocks, etc.
 - ▶ In addition to classical processes



Example: Transference



Example: Reverse Process in Intentional Healing



Example

- ▶ Blinded clinical placebo controlled trials
- ▶ Set up non-local correlations between groups through
 - ▶ Randomisation and blinding
 - ▶ Incompatibility between
 - ▶ Definitive allocation (local observable)
 - ▶ Blinding (global observable)
 - ▶ Hence: non-local correlations between groups
 - ▶ Correlation between improvements in treatment groups

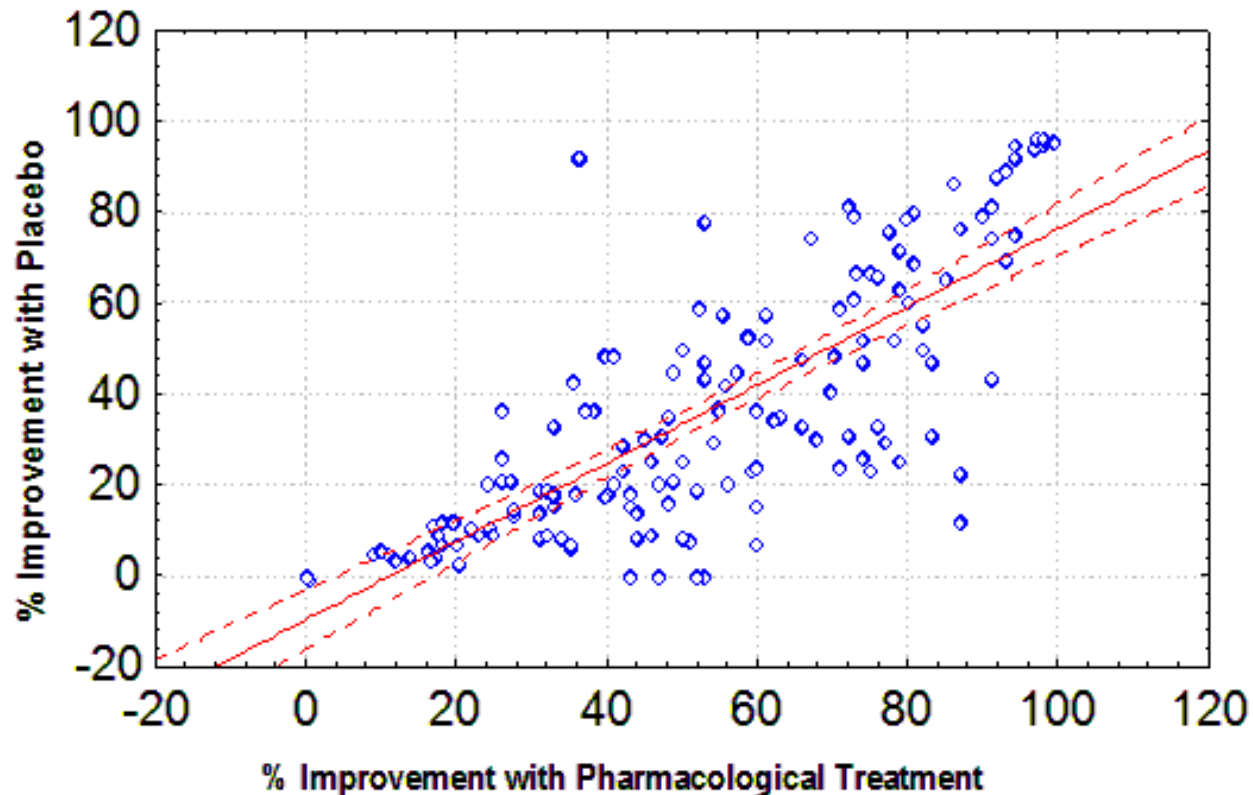


Correlation Between Treatment Groups and Placebo Groups in 144 Long Term Trials

Correlation between Improvement with Treatment and Placebo

n = 144 Placebo Controlled, Double-Blind Studies

Correlation: $r = .78$

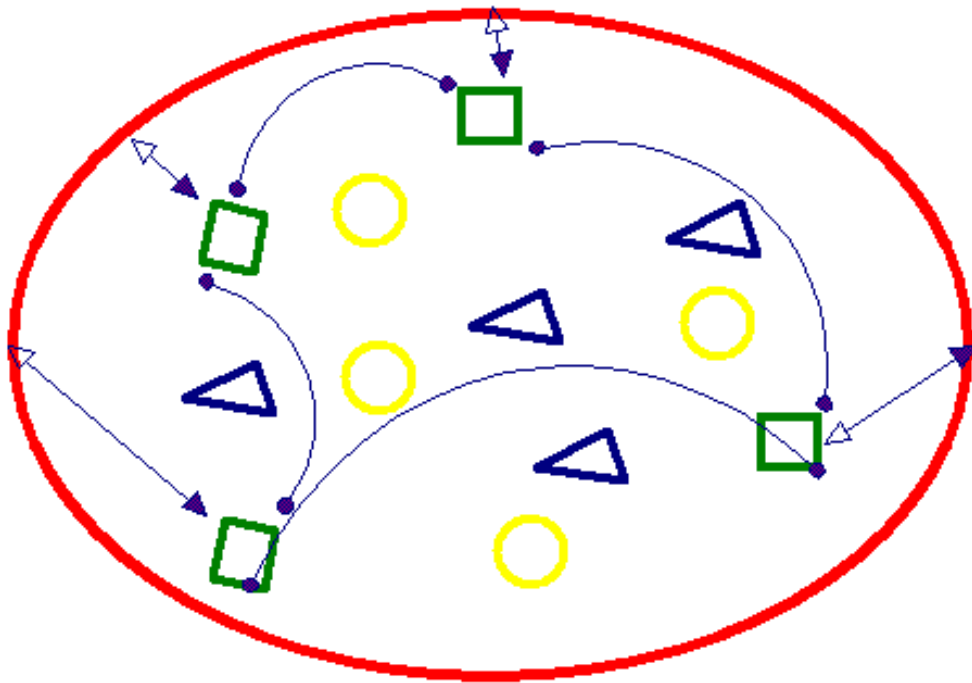


Coordination between Mind and Body

- ▶ Two independent systems (systems-theoretically, not necessarily ontologically, although even that would be possible)
- ▶ That are coordinated non-locally through entanglement correlations



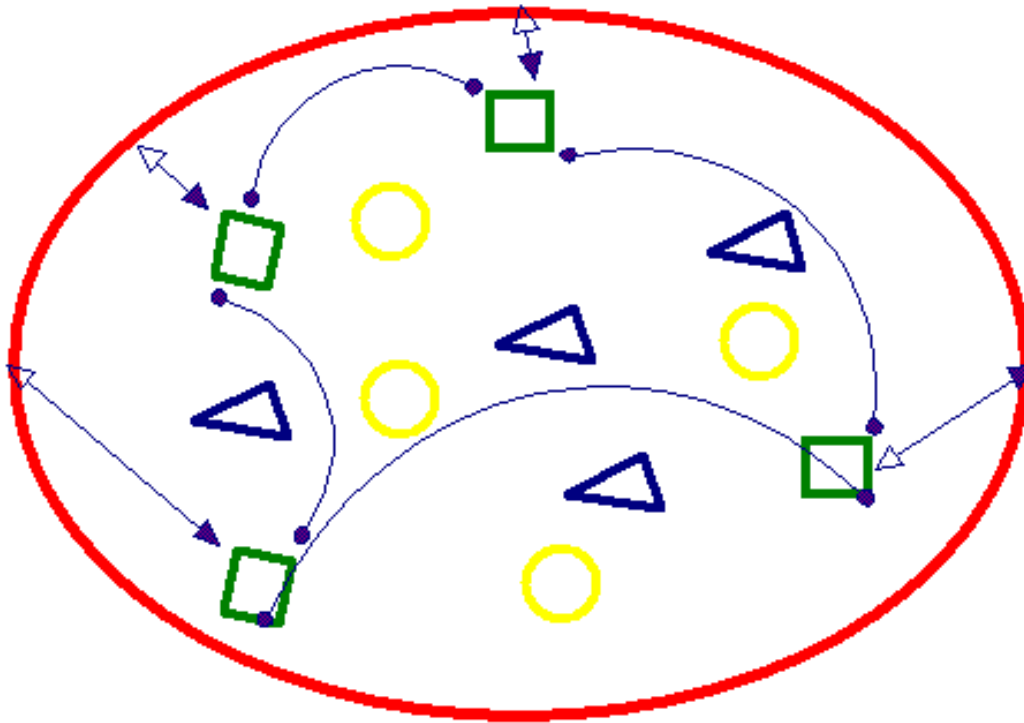
Non-local Coordination of **Physical** System



Complementarity
between
process (global)
and
structure (local)
or
individual
and
connectedness:
Physiological
coordination



Non-local Coordination of Mental System



Complementarity
between
process (global)
and
structure (local)
or
individual
and
connectedness:
Physiological
coordination



Generalised Entanglement as Non-local Coordination Between Mental and Physical

Individual Person

complementarity between connectedness (global) and individual (local)

observables

