Embodied Meaning Making: From the origins of intentions to shared meaning-making

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VIG: An Intervention Whose Time Has Arrived
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"Every mental phenomena is characterised by what the Scholastics of the Middle Ages called the intentional (or mental) inexistence of an object, and what we might call... reference to a content, direction toward an object... or immanent objectivity." (Franz Brentano, 1874, p. 88).

Overview

• Principle 1: I like to move it!
  • Satisfaction in movement in acquiring ‘goals’.

• Principle 2: I like to move it with you!
  • Satisfaction in coordinated interpersonal sensorimotor acts, e.g. dancing

• Together: This gives meaning-making and social understanding in intersubjective engagement

Standard Model of Motor Intentionality as Means-Ends Relation

Standard Motor Intentionality Development:

1. First, any spontaneous action generates sensory effect
2. Then, a particular intentional action generates a particular sensory effect

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But these experiments look at external sensory effects produced by objects...

Toward a Primary Sensorimotor Intentionality

Actions are Prospective by Necessity

- biomechanical inertial forces necessitate prospective control (Bernstein, 1967; von Hofsten, 1993; 2004)
- actions are expensive; to act economically and with adaptive effect they must be guided by prospective perception (von Hofsten 1993; 2004; Lee, 1998; 2009)
- all units of action must be ‘goal’ directed (Lee 1998; 2009)

Brentano makes it clear that “every mental phenomena includes something as object within itself” (1874, p. 88).

That ‘something as object’ is the born of the necessity of prospective control.

Every action anticipates a ‘goal’, i.e. an object or its consequent effect

Every action presumes a motor-sensory contingency

Primary Sensorimotor Intentionality

Pre-reflexive, pre-conceptual.

Future-oriented.

Simple.

Neonatal Movement Analysis

Neonatal Unit Studio
Parent-infant motion, video, and audio capture:

- 500Hz Qualisys
- Double digital video
- Double digital audio

Testing for $\tau$ in Limb Displacements

A Normal Term Birth Baby, 480 movements
75% of arm movements prospectively controlled

- coupling in Limb Displacements

Primary Sensorimotor Intentionality:

A pre-reflexive, pre-conceptual
motor intentionality,
perceptually prospectively controlled.

Intentional Agency Evident at Start of 2nd Trimester

- first tentative signs at 8-10 weeks in the first spontaneous, coordinated limb movements (de Vries, Visser, & Prechtl, 1982; Prechtl, 1986)
- discrimination in action patterns of limbs in 14 week GA twins between twin-object, and self-directed movements (Castellino et al., 2010)
- action-planning evident in kinematics by 18-22 weeks GA (Zaia et al., 2007)
- behavioural evidence of 'bicycling', reaching, grasping, exploring, etc. (Piantelli, 2010)

Primary Sensorimotor Intentionality

- motor intentionality of
  - a pre-conceptual, pre-reflexive, perceptually prospective kind
- that enables
  - development from a primary noetic (not knowing/without intelligence) consciousness to
- perceptually aware:
  - (i) a viseroceptive awareness of vital, somatic need;
  - (ii) a proproprioceptive awareness of the body-in-action;
  - (iii) an exteroceptive awareness of the world of objects and other animals
Primary Sensorimotor Intentionality

- enables development of ‘sensorimotor intelligence’ (Piaget, 1953; 1954)
- through repetition of successful intention action
  - this is what Baldwin (1895) called the ‘circular reaction’

“The self-repeating or ‘circular’ reaction... is seen to be fundamental and to remain the same, as far as structure is concerned, for all motor activity whatever: the only difference between higher and lower function being, that in the higher, certain accumulated adaptations have in time so come to overlie the original reaction, that the conscious state which accompanies it seems to differ per se from the crude imitative consciousness in which it had its beginning.”
  (Baldwin, 1895, p. 23).

The Centrencephalic Me

- upper brain stem and midbrain region is seat of the integrative ‘core self’ (Merker, 2007; Northoff & Panksepp, 2008; Panksepp & Northoff, 2009; Panksepp, 2011)
- the core SELF at the midbrain and upper brain stem is anatomically subcortical, but functionally supracortical.
- connected to skeletonomusculature by ca. 14 weeks G.A.
- controls primary prospective action
- conscious and acts with felt appraisal (Penfield & Jasper, 1954)
- site of affective learning and memory (Winn, 2012)
- evidenced in anencephalic children
- and foetal prospective motor control before cortical lamination

The Centrencephalic Me

- a cortex is not necessary to
  - be conscious,
  - have feelings,
  - act with intentions,
  - perceive and appraise the environment,
  - engage socially and purposefully,
  - learn
- c.f. surgically decerebrate cats and rats (Wood, 1964)
Development of Sensorimotor Intentionality

- Cognitive development is a development from single action intentions (discrete actions) to projects of action units (serially ordered actions) (Pezzulo, 2011)
- Serially ordered action units organised from the beginning to produce distal goals (Jeannerod, 1999; Fogassi et al., 2005)
  - e.g. reach to grasp to place vs. reach to grasp to throw
  - N.B. deficit in prospective control in autism

Hierarchical Organisation of Sensorimotor Intentionality

<table>
<thead>
<tr>
<th>Level</th>
<th>Stage type</th>
<th>Description</th>
<th>Temporal range (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Action unit</td>
<td>A single continuous velocity to a goal, e.g. arm movement to a desired spatial location or physical object and initiation of multiple action units for a practical goal</td>
<td>200-1000</td>
</tr>
<tr>
<td>Secondary</td>
<td>Serial project</td>
<td>Coordination and serial organisation of sequential projects to achieve a higher, abstract, distal goal, e.g. creating a sentence</td>
<td>*1000</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Serial project</td>
<td>Requires memory, planning, abstract reasoning and imagination to enable distant goals to organise actions in the present.</td>
<td>*1000</td>
</tr>
</tbody>
</table>

Sensorimotor Intentionality

- Development of sensorimotor intentionality:
  - First intentionality in single action units (primary)
  - Then envelopes multiple action units to make secondary projects
  - Then projects of projects of action units (tertiary)
  - And so on as the child develops further cognitive skills, enables sophisticated planning for prospectively controlling the present moment to achieve future goals

Tools of memory, planning, abstract reasoning and creative imagination enable more complex and abstract sensorimotor projects.

Neonatal Sensorimotor Intentionality

- Tertiary Sensorimotor Intentionality – NOT YET PRESENT
  - Very rudimentary, vague
  - Requires memory, planning, abstract reasoning and imagination
  - Enables distant goals to organise action in the present.
  - E.g. planning how for a degree or job in the future

- Secondary Sensorimotor Intentionality – EVIDENT
  - Establishing and developing
  - Enables simple sensorimotor projects, e.g. walking or grasping
  - E.g. mobility toward the breast, coordinated motor acts in social engagements

- Primary Sensorimotor Intentionality – EVIDENT
  - Established and developing
  - Enables actions with improved muscle tone and experience-dependent neuromotor maturation
  - E.g. arm gesture, reaching control, gaze & head orientation

Toddler Sensorimotor Intentionality

- Tertiary Sensorimotor Intentionality – ESTABLISHING
  - Rudimentary beginnings becoming substantiated
  - Requires memory, planning, abstract reasoning and imagination
  - Enables distant goals to organise action in the present.
  - E.g. planning how for a degree or job in the future

- Secondary Sensorimotor Intentionality – EVIDENT
  - Established and developing
  - Enables simple sensorimotor projects, e.g. walking or grasping
  - E.g. mobility toward the breast, coordinated motor acts in social engagements

- Primary Sensorimotor Intentionality – ESTABLISHED
  - Established and improving
  - Developing precision with improved muscle tone and experience-dependent neuromotor maturation
  - E.g. arm gesture, reaching control, gaze & head orientation
**Child Sensorimotor Intentionality**

- **Tertiary Sensorimotor Intentionality – ESTABLISHED**
  - rudimentary beginnings becoming substantiated
  - requires memory, planning, abstract reasoning and imagination
  - enables distant goals to organize action in the present.
    - e.g. studying now for a degree or job in the future

- **Secondary Sensorimotor Intentionality – ESTABLISHED**
  - established and developing
  - enables simple sensorimotor projects, e.g. walking or grasping
    - e.g. feeding hand to mouth, coordinated motor acts in social engagements

- **Primary Sensorimotor Intentionality – ESTABLISHED**
  - established and improving
  - developing precision with improved muscle tone and experience dependent neuromotor maturation
  - simple intensional action
    - e.g. arm position, reaching against gaze & head orientation

**Sensorimotor Satisfaction: Joy in Successful**

**Secondary Sensorimotor Intentionality**

**Principle 1:**
I like to move it.

inherent satisfaction or joy in successful solo sensorimotor acts
(moving, grasping, walking, skiing, climbing, tight-rope walking)

**Principle 2:**
I like to move it with you.

requires two sensorimotor systems with two timing systems to be in step and in tune with each other to generate shared meaning and joy.

**Embodied, Non-verbal Narratives**

- narratives have a discreet, finite nature like goal-directed sensorimotor projects
- they
  - (i) initiate toward a shared, intersubjective ‘goal’
  - (ii) build in intensity as the project proceeds
  - (iii) reach a climactic point of maximal tension and release,
  - (iv) conclude and appropriate the effect of their activity, giving something new.
- the intersubjective ‘goal’ is the ‘coming together’ of two agencies in common meaning, creating coherence of affect, intention, and action between them (Stern, 1985; Trevarthen & Delafield-Butt, 2013)

**From solo sensorimotor projects to shared meaning-making**

“There is a series of hierarchies of organization; the order of vocal movements in pronouncing the word, the order of words in the sentence, the order of sentences in the paragraph, the rational order of paragraphs in a discourse. Not only speech, but all skilled acts seem to involve the same problems of serial ordering, even down to the temporal coordination of muscular contractions in such a movement as reaching and grasping. Analysis of the nervous mechanisms underlying order in the more primitive acts may contribute ultimately to the solution even of the physiology of logic.”

Co-created Sensorimotor Project

- shared projects of meaning-making
  - foundation of social learning
  - affective, sensorimotor, intentional
- initially the goal is not discreetly known
  - comparable to early prospectively guided sensorimotor intentionality
  - exploratory nature testing expectancies, c.f. foetal/newborn simple actions (anoetic)
- experience with individuals in contexts gives discreet goals, expectancies
  - enabling anticipation and prospective planning

Baby B & His Mother in the Neonatal Unit
(born at 28 wks, now at 36 wks GA)
**Neurobiology of Embodied Social Meaning-Making**

1. **Mind in action**
   - generative, affective, intentional engagement

2. **Mirror Neuron System**
   - mind reading by ‘direct neural resonance’

3. **Polyvagal System**
   - direct social autonomic regulation

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**The Mirada Neuron System**

*neural resonance of motor transduction.*

The same brain regions are equally active when

1. perceiving intentions in others’ acts
2. making the same intentional acts oneself
3. thinking about the same intentional acts

*(reviewed in Dakan, 2013)*

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**The Polyvagal System**

*Direct social regulation of autonomic systems* through facial expression and gesture *(Porges & Furman, 2011)*

- e.g. regulation of heart beat, arousal, anticipation to act, etc.

*Altogether we feel the other’s feelings and intentions* through direct social perception.

*This is an affective and embodied social understanding.*

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**Narrative Cycle**

- common goal gives prospective structure
- participatory completion gives shared joy and social learning
Autism as a Disorder in Intentional Movement and Affective Engagement

Evidence for Motor Deficit in Sensorimotor Intentionality:

1. Primary
   - e.g. touch an object (without a further, secondary purpose): Rinehart et al., 2001; Rinehart et al. 2006; Dowd et al., 2012; Mari et al., 2003; Nazarali et al., 2009.

2. Secondary
   - e.g. reach to grasp to eat (prospective chaining multiple action units: Cattaneo et al., 2007; Falcao-Dias et al., 2006; Hughes, 1996).

• Synchronization Across the Body for a Common Goal
   - e.g. whole body posture required prospective integration of all body movements into one coherent, purposive act (Schmitz et al., 2003; Hallet et al., 1993; Rinehart et al., 2006; Eposito, 2011; Calhoun et al., 2011; Nayate et al., 2012).


Non-verbal Autism-Therapist Narratives

‘Intensive Interaction’ therapist with an autistic teenager

The teenager has been, for several years, almost non-verbal, violent, anti-social, and even dangerous. She would bite and scratch her care-takers. She was chronically hospitalized and taken into a special home.

This session is the first and only meeting with this therapist.
Initiation Through Imitation
Initiation and Build Through Imitation.
A Complete, Co-created Narrative
Mutual Joy in Intersubjective Unification

Shared Understanding – Mind Reading
Emotions Exchanged or Inter-subjectivity: "Resonance"

Making Contact
- one's feelings and intentions made in actions are mirrored in the mind of the other (e.g. Winnicott, 1971) by 'direct neural resonance' (Gallese, 2001, 2004; Gallagher, 2008)
- they create a serial ordering that builds a shared sensorimotor project (Trevarthen & Delafield-Bubb, 2013)
- intensity reaches a climax of where simultaneous expression is given on both sides – togetherness (Delafield-Bubb & Trevarthen, 2013)
- this concludes the project, the two now holding that completed shared act in memory, generating attachment and companionship
- the shared act becomes an "object": a social sensorimotor schema giving embodied social cognition

Conclusions
- There exists an invariant Sensorimotor Intentionality
  - structures experience-dependent learning and development of cognition and social cognition.
  - 1st Level, single intention-actions (pre-conceptual)
  - 2nd Level, projects of intention-actions (becoming conceptual)
  - 3rd Level, projects of projects of intention-action (conceptual)
- Sharing sensorimotor projects generates social meaning
  - learning cultural expectations and patterns
  - structures attachment by companionship
  - creates shared joy and social understanding in embodied meaning-making
  - necessary for human life to thrive

Thank you.
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