**Internal Working Models**

Dima Anso 🡺 development of executive functioning; Anso & Scerif 2015 nature neuroscience reviews – visual cascades

Paul – role of the parent facilitating Bayesian learning perspective

Collection of anxiety behaviors 🡺 growth charts for SCARED; Mplus

**Pallini & Barcaccia (2014)**

* Attachment theory is interdisciplinary 🡺 key influences on Bowlby’s thinking
  + Psychoanalysis
  + Learning theory
  + Ethology
  + Jean Piaget
* Bowlby wanted to construct an **“open” theory** that is able to progressively taken on board and integrate new data emerging from diverse areas of childhood development
* **Influence of Piaget on Bowlby’s attachment theory**
  + “Our insight into the cognitive world that an infant and young child builds for himself and then inhabits and finally molds, will be greatly advanced by the concepts and research methods pioneered by Piaget” (Bowlby, 1979, p. 32)
  + **Cognitive development of the child through exploration activity**
    - Exploration facilitates extraction of information from the surrounding environment; aligns with animal models and ethology
    - Elements of exploratory behavior (defined by Piaget) 🡺 action, body orientation, manipulation, and experimentation
    - Noted the role of parents in favoring **exploration**
      * Parents are a source of exploration
      * Offer the child opportunities for exploration
    - Bowlby’s idea that stems from these Piagetian concepts 🡺
      * **Complementariness between attachment and exploration**
      * Secure attachment itself favors exploration behaviors
  + **Specific features in the process of building up the child’s symbolic capacities**
    - Progressive passage toward representation or “symbolization”
    - Toward the end of the first year of life, stimuli start to be mediated by symbolic thinking, allowing for the formation of reality representation
    - Symbolic capacity is grounded in object permanence
    - Bowlby (1969) 🡺 **progress from stimuli-response behavior governed by trial-and-error to goal-corrected behavior governed by insight**
      * ***This is how our schema learning task is set up***
* **Symbolic thinking and Piagetian object permanence 🡺** Process of acquiring symbolic capacity
  + **Differentiation between subject and object**
    - Infantile experience in the first few months of life is a mere sequence of stimuli existing only in the *here and now*
    - Capacity to discriminate between familiar and extraneous figures emerges ~6 months old
    - Lorenz’s imprinting concept is the basis for the concept of attachment, but Bowlby uses the Piagetian concept of object permanence as the basis for the functions of object recognition and recall
  + **Object permanence as the conceptual basis for separation** 
    - As the child develops the concept of object permanence, the child also develops the capacity of **person permanence**
    - Child is more capable of representing where the absence person is
    - Person permanence allows children to approach parent when they are nearby and to search for the parent when they are absent
    - Bowlby 🡺 **person permanence** used to understand the experience of children in the processes of **separation** from, or **grieving** over, the attachment figure
      * Cognitive uncertainty (oscillating attitude towards lost attachment figure) in bereaved children stems from **oscillating** between the **past memory** and **search** for attachment figure **in the present**
  + Potential of symbolic thinking on allowing **behavior regulation** on the basis of a represented goal and on understanding that other people may have goals that differ from one’s own goals
    - **Goal-corrected behavior** 🡺 children begin to realize the caregiver has goals of their own that do not involve the child and begin to “mold their behavior” to please or impress the attachment figure
* **Intentional thinking and Piagetian egocentrism**
  + Piagetian terms “intention” and “intentionality” analogous to “plan” or “goal”
  + **Goal-corrected behavior system** 🡺 behavior that is purposeful and directed toward a goal
    - More flexible, purposive, and responsive to feedback from the environment
  + **Mentalizing** 🡺 Capacity to see something form another person’s point of view
    - Processing of figure out how to modify another person’s goal through goal-corrected behavior
    - Attribute to the other person the capacity to make plans
    - Infer from available clues what the other person’s goals could be
    - Modify goals set by the other person
  + **Attachment behavior** 🡺 construed as attempts to influence the way in which the caregiver behaviors toward the child
    - Child formulates plans that will modify the caregiver’s plans, so that caregiver will change their behavior and approach the child
* **Internal working models**
  + Analogies between the Piagetian concept of **schemata**, which implies the development of knowledge through a process of assimilation and accommodation, and the Bowlbian concept of **internal working models**
  + **Key assumptions**
    - All feelings and knowledge have a history
    - Therefore, external influences do not represent an entirely new beginning but rather an external influence always **assimilates** to all that has happened before
    - External influences may modify the subsequent course of history by providing an impulse to move in a partly new direction
    - Bare facts do not exist, but only *interpretations*
  + **Key issue** 🡺 ***how assimilation takes place and the way in which old and new factors combine***
    - Things are not retained in memory exactly as they are, but rather as a **schemata** of actions or operations derived from one another
    - Schemata have **constant adaptation** to the present and a structure that is continuously oriented in the direction of **equilibration**
      * **Equilibration** – Piagetian concept; cognitive balance of new information with old information that involves **assimilation** of information to fit within an individual’s own existing schemata and **accommodation** of information by adapting their way of thinking
  + Bowlby and Piaget agree on how they conceptualize **current behavior** as being affected by the past in the following ways:
    - Past affects present 🡺 The present to which a behavior is a response is assimilated and structured (or interpreted) in terms of the past
    - Present affects past memories 🡺 Ongoing dynamic assimilation and restructuring the past in terms of the present
  + ***Affective schemata is similar in terms of the continuous structuration*** 
    - **Piagetian’s equilibration process is analogus to Piaget’s description of the process of structuring and ongoing modification of internal working models**
    - Representative models of reality have an analogous evolution through the elaboration of cognitive experience and the elaboration of socioaffective experiences
      * Are the mechanisms really the same?
    - *Allusion to problem of affect and representative/operational schemata*
  + **Internal working models** (Bowlby, 1969)
    - Internal working models conceptualized as schemes of habitual and generalized interactions which people form from attachment relationships that tend to persist of time
    - Internal working models are the outcome of the process of **internalizing of representations** relative to attachment
    - Internal working models are constructed in the first years of life, through the **progressive internalization of attachment experiences, behaviors, emotions, and thoughts through experiments on themselves and others**
      * Based on real experiences have during daily interactions with parents
      * *What are the mechanisms of internalization of representations from attachment experiences?*
    - Internal working models used to make **predictions** about the behavior and motivations of the attachment figure and formulate successive affective bonds (affection of one person for another)
      * **Predictions can persist or be disconfirmed by experience**
      * In the case of disconfirmation, internal working models undergo further modification and updating
        + Usually involves the constant introduction of minor changes
        + Sometimes drastic adaptation is required when there is an important modification in the environment
      * *Studied with a prediction error task design?*
    - **Individuals reconnect new affective relationships to what is known, reshaping new affective experiences according to their attachment representations**

**Pietromonaco & Feldman Barrett (2000)**

* **Internal working models concept**
  + Mental representations consisting of expectations about the self, significant others, and the relationship between the two
    - Content includes **knowledge** about details (e.g., what happened, where, and with whom) or interpersonal experiences and **affect** associated with those experiences
  + **Functions** 
    - Help individuals predict and understand their environment
    - Engage in survival-promoting behaviors (e.g., proximity maintenance, establish psychology “felt” security)
  + Assumption of attachment theory (Bowlby, 1969, 1973, 1979, 1980) 🡺 humans form close emotional bonds in the interest of survival, and these bonds facilitate the development of internal working models (mental representations of the self and others)
  + Internal working models are the hypothesized mechanism through which attachment behaviors are transferred to different relationship partners throughout the life span
* **Content of internal working models**
  + Internal working models include specific content about attachment figures and the self
  + **Internal working models of the self**
    - Derive from beliefs about how acceptable the self is in the eyes of early attachment figures (which is **gauged by the responsiveness of attachment figures**)
    - Children with attachment figures who are readily available, responsive, and reliable 🡺 develop a representation of the self as acceptable and worthwhile
    - Children with inconsistent or unresponsive attachment figures are assumed to develop a view of the self as unacceptable and unworthy
    - Most research examining views of the self are assessed in terms of global positive and negative feelings about the self, but in reality, the self is dynamic and multifaceted structure that varies with the situational context
      * *OPPORTUNITY FOR EMA METHODS?*
  + **Internal working models of others**
    - Expectations about who will serve as attachment figures (i.e. who to turn to when in need of security)
    - How accessible attachment figures are
    - How attachment figures will respond to them when needed
  + **Different attachment styles reflect different interpersonal experiences**
    - Ainsworth Stranger Situation paradigms 🡺 observational studies that assume behavioral patterns of children who are separated and then reunited with attachment figure are thought to stem from different internal working models
      * **Secure** – children who approach mother willingly and are easily comforted
      * **Avoidant** form of insecurity – children resist contact with mother after separation
      * **Anxious-ambivalent** form of insecurity – anger or difficult to comfort
    - **Four adult attachment styles** (Bartholomew & Horowitz, 1991) 🡺 based on self-reports from adults of how their relationships generally are (vs. behavior)
      * Results attachment styles result of combining positive or negative model of the self with a positive or negative model of others; these represent prototypes that individuals may fit to a greater or lesser degree depending on where they fall on each internal working model dimension
      * **Secure** – positive models of both the self and others; report feeling comfortable with closeness and intimacy
      * **Fearful**-**avoidant** – negative models of both the self and others; report a fear of and desire for closeness
      * **Preoccupied** – negative model of the self and positive model of others; characterized by a desire for a high level of closeness and by a fear of abandonment
      * **Dismissing**-**Avoidant** – positive model of the self and negative model of others; uncomfortable with closeness and overly self-reliant
  + *Evaluations of the self made after specific everyday interactions, and rate their views of how interactions went to assess their views and expectations of others … way to assess cognitive aspects of internal working models in an EMA study?*
* **Structure of internal working models**
  + Internal working models thought to be stored in a well-organized representational structure
* **Operation of internal working models**
  + Internal working models are thought to involve processes that influence what information individual attend to, how individuals interpret events in their world, and what they remember 🡺 direct attention and behavior
  + Processes hypothesized to operate outside of conscious awareness

**Bretherton (1999)**

* **Internal working model**
  + Have a relational, hierarchical structure
  + Functions – interpret ongoing events, guide action, forecast future
* **Representational processes**
  + **Model building** – brain builds working models of its environment; need to have hypotheses to understand human behavior; statistical learning (assess statistical regularities in the environment)
  + **Model testing** - hypothesis testing and adaptation/assimiliation based on prior; Bayesian learning; prediction error
* **Development**
  + Internal working models may initially “work” in terms of nonverbal, somatosensory-affective implicit memory processes
  + **Daniel Stern** (1985, 1994) – conceptualized how sensorimotor-affective interpersonal relational patterns that infants seem to develop over the course of interactions with caregivers
    - Succession of hypothetical structures (e.g., representations of interactions) that are generalized
    - “**protonarrative envelopes**” that incorporate emotional, perceptual, and behavior components into procedure memory patterns
* Internal working models as “**event schemas**”
  + Event representation theories about **scripts** and **prototypes** (Schank & Abelson, 1977; Schank, 1983)
  + **Event representations** – skeletal frameworks that incorporate sequentially organized information on who did what to whom, when, where, how, and why
  + Criticism – event representations may not capture

**Long, Verbeke, Ein-Dor, & Vrtička (2020)**

infants construct "internal working models" of self and parent in tlie attachment relationship. The function of these working models is to predict and interpret a caregiver's behaviour.   
  
Attachment system is often activated in times of need, danger, or distress because it is a deviation from homeostasis  
- Trigger attachment strategy - seeking physical proximity to the attachment figure and maintaining until threat passes  
  
"Default state" of attachment-derived internal working models (IWMs; Mikulincer & Shaver, 2007)  
**- Individual develops a model that predicts feelings of security in attachment relationships**- Caregivers allostatic support is not only experienced as rewarding itself, but it's also associated with additional rewarding qualities because allostatic co-regulation is often accompanied by provision of soothing, comofrt, nutrition, etc.  
- Positive self-model arises predicting the child's ability to elicit care from attachment figures when needed  
  
When supportive caregiving is absence or inconsistent  
- Individual begin to employ "secondary" attachment strategies associated with insecure orientations: avoidance and anxiety  
- Attachment avoidance - "other-IWM" predicting attachment figure absence and/or sustained stress (continued deviation from homeostasis) despite interactions with close significant others  
- Avoidant self-model - self-reliance; individuals learn to sooth themselves through distancing from the source or stress or regulating emotions with denial, inhibition, or suppression; DE-ACTIVATION of attachment system  
  
- Attachment anxiety - hyper-proximity seeking to attachment figure whom they are reliant on for allostasis co-regulation; often arises when caregiving is inconsistent where social co-regulation occurs sporadically but unpredictably (intermittent reinforcement)  
- "other-IWM" perceives attachment figure as necessary for achieving felt-security despite repeated experiences of rejection  
- Anxious self-model - helplessness; hyper-activation of attachment sistem  
  
Social Defense Theory (Fonagy, 2001)  
- Different attachment orientations may be adaptive at the social level when it comes to responding to threats  
  
Functional neuro-anatomical model of human attachment (NAMA, Vrticka, 2017)  
- Importance of bio-behavioral synchrony in human attachment behavior  
- Early experiences shape the structure and function of the brain through a neuro-enviornmental loop of plasticity (Callaghan & Tottenham, 2016)  
- Social baseline theory - being with others is associated with a default, low energy state  
  
Prototypical attachment pathway  
- Activation of prototypical attachment pathway occurs when there is a threat perceived (internally, externally) and it triggers threat detection and appropriate initial fear response -> maintained by deviation from homeostasis and neural representation as a salient signal   
- Fear response and prompts proximity seeking toward a caregiver  
- Social allostasis co-regulation occurs once the caregiver reacts appropriately and sensitively to child's signals - will be experienced as rewarding (due to abolishment of fear response) and additional caregiver-related rewards (soothing, comfort, etc.) -> social interactions with caregiver associated with feelings of safety and security  
- only applies when stressor is removed  
  
Prototypical secure attachment pathway  
- Secure individuals are able to use both co-regulation and self-regulation flexibly dependent on predictions made by IWMs  
- Flexibility is the most advanced stage of emotion regulation  
  
Prototypical avoidant attachmetn pathway  
- IWMs of avoidance - characterized by negative other-model and positive self-model to compensate for unavailability of others  
- Avoid circumstances where the attachment system is likely to be activated  
- IWMs predict caregiver unability and absence of social allostatis co-regulation  
- Requires early detection and hypervigilence  
- More independent self-regulation (vs emotion/allostasis co-regulation) through inhibition or emotion suppression  
- Heightened default state of biological readiness due to expectation of ahving to deal with stressors alone  
  
Prototypical anxious avoidant pathway  
- IWMs are negative self-model reflecting helplessness and ambivalent other-model due to repeated rejection and wish for social co-regulation that intermittently results in felt security  
  
  
NAMA functional model  
- Affective evaluation network - aversion and approach components that are in a dynamic balance  
- Aversion module (Extended salience network) - activated during threats that are both social (exclusion/rejection, social stress, conflict, sadness due to social loss); amygdala, hippocampus, insula, anterior cingulate cortex, anterior temporal pole  
- Aversion module is activated during:   
1. threat detection and initial fear response  
2. Subsequent fight/flight response  
3. social distancing  
4. felt insecurity / pesistent homeostasis deviation associated with failure of social allostatis co-regulation  
5. detection of negative states of others?? empathy  
  
- Approach module (reward-related, primarily dopaminergic areas) - ventral tegmental area, substantia nigra, ventral striatum, ventromedial PFC/OFC  
- Promotion aspect and neuroception of safety; maintains approach-oriented motivation to foster closeness to others and attainment of felt security  
- Other neurotransmitter/peptide systems - oxytocin and vasopressin, endogenous opioids, serotonin  
  
- Cognitive control network - maintains conscious representations of others, beahvioral regulation and decision-making; top-down intentional neural mechanisms  
- Emotional self-regulation model - situation selection, attention deployment, re-appraisal, response modulation; lateral, dorsal, and middle PFC/OFC  
- Mental state representation model - ToM; representations of internally focused information about others; cortical midline areas such as medial orbitofrontal/PFC, PCC, and precuneous as well as lateral temporal regions (e.g., STS, TPJ, STG, fusiform gyrus)  
  
Dynamic balance between affective and cognitive evaluation networks in terms of a push-pull mechanism  
  
  
Experimental manipulations  
- Presence/absence of a social safety signal (e.g. caregiver, holding hands, photo)  
- Attachment security priming effects - saw positive or negative emotions displayed by unknown faces and had to rate these faces on valence following primes; semantic conceptual priming (subliminal sentence primes containing nonsense information or unpleasant attachment experiences)  
- Attachment security in relation to brain measures; emotional Stroop task, face processing, infant cry listening  
- Greater N2 (stronger expectancy violent) during re-inclusion phase of cyberball following social exclusion pbase  
- Social feedback processing - anticipation and receipt; expliciting measure tehse components  
- Expectations for their partners positive regard were confirmed or violated either in a positive or engative direction; receipt of unexpected X feedback

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