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Bronfenbrenner's Bioecological Model of Human Development

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Key Learning Objectives

1. To describe elements of the bioecological model of human development and their transactions.
2. To appreciate the historical context of the bioecological model and identify how it has evolved since its first inception.
3. To evaluate the relationship between the bioecological model, occupational science and occupational therapy practice.
4. To recognise the complexities of adopting a transactional bioecological model in practice.

Theoretical Core: Developmental science and person-environment concepts

Developmental science has always played an important role in contributing scientific knowledge to inform occupational therapy, not just as it relates to child development, but for understanding human evolution across the lifespan. Historically, occupational therapy concepts reflected a fundamental orientation towards ecological theories that always positioned the person alongside or in the context of the environment. This foundational perspective has continued to advance over decades, informed by evolving interdisciplinary understandings of the embodied and embedded nature of human development and occupation across the lifespan.

However, regarding child development, earlier occupational therapy theory was primarily informed by developmental psychology, with its more linear and universal perspective of the person and occupation in the immediate environment. For example, in 1970, the USA Eleanor Clark Slagle prestigious lecture awardee Lela Llorens proposed a developmental theory of occupational therapy, influenced primarily by classic developmental psychologists such as Gesell and Erikson (Llorens, 1970). This foregrounded the internal mechanisms of the child for delayed development (Humphry & Wakeford, 2006). During the 1990s and 2000s, a shift was evident, with the emergence of new ecological models in which the essential influence of the environment was incorporated more centrally into practice (Christiansen & Baum, 1997; Dunn et al., 1994; Law et al., 1997).

These developments did not happen in a vacuum, however. Within developmental science, contemporary theories of child development in the 1980s and 1990s were recognising the importance of context (how nurture influences 'nature') resulting in the emergence of an integrated view of development (Bronfenbrenner, 1993; Rogoff, 2003). Within this perspective, knowledge of children's occupations and human development required the understanding and application of ecological theories and concepts relating to the contexts and environments in which occupations are enacted. This chapter explores arguably the most influential ecological transactional model for psychology, sociology and possibly occupational therapy, Bronfenbrenner's bioecological model of human development (Bronfenbrenner & Morris, 2006). The chapter begins with an historical overview of the model, including some of the critique of the theory since its first inception. We then examine how it contributes to understanding human occupation as a transactional process. This is followed by exploration of sample studies that have adopted a bioecological lens in occupational therapy research. A case study is presented showing how the model can intensify contextual understandings and consequently strengthen occupational therapy

practice. We argue that applying Bronfenbrenner's bioecological model of human development can enable practitioners to implement more authentic and impactful solutions, responding to issues of occupational development in childhood for the 21st century.

Bronfenbrenner's Bioecological Model of Human Development

There is no 'one' Bronfenbrenner model: instead, his early ideas evolved and were adapted over time, although Bronfenbrenner is perhaps best known for his original (1979) model. This identified layers of the child's ecology from the most proximal, day-to-day environments (microsystem), through increasingly more distal layers emphasising interactions between different settings (mesosystem, exosystem) and outwards to wider societal factors (macrosystem), recognising the co-influencing nature of all layers on the child. Later (1986a), he included a fifth system identifying the importance and influence of time and history, both personal and sociocultural (chronosystem).

These systems are often represented as a series of concentric rings (see Figure 1), and an extensive range of researchers and practitioners from a variety of disciplines has drawn on them to conceptualise their work (Hayes et al., 2023). However, Bronfenbrenner's model has been updated several times since its original exposition, to incorporate biological components, temporal concerns, a central focus on relationships and interactions, and a stronger understanding of the synergistic, dynamic, interconnected nature of the multiple and complex factors that interact to influence human development. It is now referred to as the bioecological model of human development (Bronfenbrenner 1993; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2006). Nevertheless, many writers continue to draw solely on the 1979 model (Navarro et al., 2022), but we argue that in engaging with the bioecological model it is important to ensure a thorough understanding of all its phases. This builds a stronger understanding of the evolution of the model, and the importance of engaging with its most

recent form, as it provides a more robust understanding of the complex interrelationships of key elements.

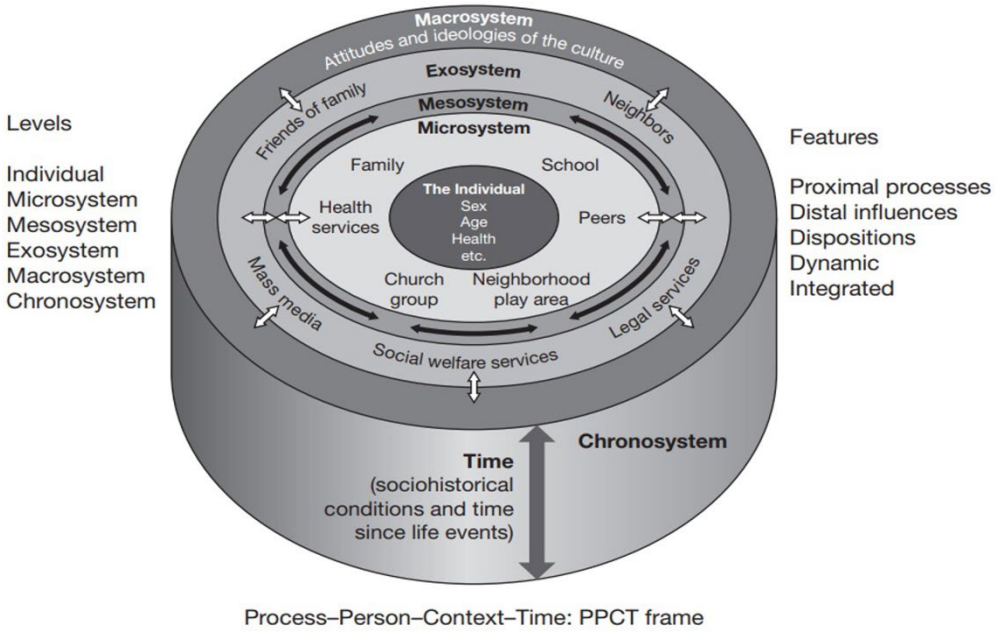


Figure 1: The complete bioecological model of development (Hayes, O'Toole and Halpenny, 2023, p.14)

The most up to date bioecological model (Bronfenbrenner & Morris, 2006) operates through a multi-layered approach, at the centre of which is the child, viewed by Bronfenbrenner as an active agent in his or her own world. Through the power of transactions and relationships (termed 'proximal processes') over time, the personality traits, temperament, motivations, genetic inheritance, and dispositions of the child influence and are influenced by the other levels of the bioecological system. A child's dispositions may be 'generative', inviting positive responses from others and so in a cyclical fashion supporting development of future generative dispositions, or 'disruptive', inviting impatient, aggressive, or other negative responses from others, potentially leading to exacerbation of challenges in the future (Bronfenbrenner & Morris, 2006). This later model synthesised the levels of child, micro-

meso- exo- macro- and chrono-systems as well as the fluid interactions between them, into four key elements to be used both in understanding child development, and in structuring research and practice: Process, Person, Context, Time (PPCT). Within this approach, each element must be examined individually and in terms of their synergies and interactions (Bronfenbrenner & Morris, 2006).

Essential elements of transactional processes are incorporated in the amended model, emphasising the interplay between properties of Process (relationships and interactions), Person (dispositions and other personal characteristics), Context (micro, meso, exo and macro-level influences) and Time (both personal and sociohistorical) (PPCT). This emphasises the need to research and practice across interconnected aspects of the child's environment. Bronfenbrenner highlighted that while the emphasis on context had become accepted as essential, there was now not enough emphasis on the child; he argued for redressing this balance to ensure consideration of the child-in-context in a transactional approach (Bronfenbrenner & Morris, 2006).

Key constructs: How bioecological theory impacts occupational engagement

To understand the potential of the bioecological model for occupational engagement, several core concepts must be explored: a) the bioecological model as a transactional approach; b) networked, synergistic systems; c) developmental-validity and development-in-context; d) proximal processes and e) developmentally instigative characteristics (Bronfenbrenner & Morris, 2006).

The Bioecological Model as a Transactional Approach

Bronfenbrenner's work has insights to offer occupational therapy, as it takes a step further into the conceptualisation of the intertwined nature of genetic and environmental influences on development, showing that they are so intertwined from the moment of conception as to

be almost inseparable (Hayes et al., 2023). The emerging field of epigenetics shows how genes are 'switched on' by environmental experiences, and Bronfenbrenner was among the first to provide a theoretical mechanism by which this happens: 'proximal processes'[1] or relationships and interactions, as the means by which environmental factors act upon the developing individual and vice versa (Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2006). This may be the seminal achievement of bioecological theory - not only the understanding that nature and nurture synergise but also providing a *mechanism* by which these processes actually work. To operationalise this transactional perspective, we need to understand more deeply the networked system as envisioned by Bronfenbrenner.

The networked system

The networked system developed by Bronfenbrenner in his later work refers to interconnectivity, synergy and dynamism between contexts and individuals over time (Hayes et al., 2023). While some writers have criticised bioecological theory due to perception of a static 'nested' system, others have argued that this synergy was always implied in Bronfenbrenner's work from the beginning (Tudge et al, 2021). Bronfenbrenner highlights not just the impact of static contexts on children's development, but also the synergistic interrelatedness of individuals and the multiple contexts in which they are situated. This focus on synergy yields an impressively fluid, dynamic model built on '*bidirectional, synergistic interrelationships*' (Bronfenbrenner & Morris, 2006, p. 799), allowing us to begin to unravel the complexity that is human development.

Emphasis on exploring not just *within* settings but also *between* them is key in understanding this networked system, as elements within and across systems operate synergistically so that factors impacting on occupations and outcomes are 'more than the sum of their parts' rather

[1] Proximal processes are outlined later in the section

than simply additive (Hayes et al., 2023). However, Bronfenbrenner acknowledges that this integrated view of child development should not stop researchers from focusing on one aspect of the environment, but we must analyse the system in which it exists and operates (Bronfenbrenner, 1993). This requires a shift to valuing developmental validity, and natural learning environments [NLE] as sources of and sites for practice (Dunst et al., 2006; Trivette et al., 2010).

Developmental validity

One of Bronfenbrenner's core ideas that continues to hold value for understanding practice in occupational therapy is the concept of *developmental-validity*, which grew along with his thinking about development-in-context. Development-in-context is not just about a systems approach to considering child development, but also demanding '*convergence among disciplines of the biological, psychological and social sciences as they bear on the evolution of the individual in society'* (Bronfenbrenner, 1979, p. 13). Developmental validity relates to the core principle that new learning can only be 'valid' when it is observed in typical settings. For example, a toddler who learns to drink from a cup in childcare can only be said to be able to do this task when it is also carried out at home. In research, this principle is highly important as activities observed in laboratory settings may not be a true measure of a child's development. When measured in one context, children may appear to lack competence, whereas in other circumstances they may be very competent.

This developmental validity issue is evident in occupational therapy practice when it is clinic-based rather than situated in family homes or schools, where children seem to perform differently in different settings. To counter this challenge, some early intervention services have promoted natural environments as important sites for service provision. This has led to the development of ecocultural programmes in home and community settings and increased

insights into the effectiveness of strengths-based, capacity-building approaches (Trivette et al., 2010). Applying an ecological approach in occupational therapy has strong evidence for better outcomes in early intervention (Stewart, 2009), but it is also important to understand the proximal processes that take place within these contexts.

Proximal processes:

Proximal processes refer to specific transactions, activities or occupations that occur in the proximal environment (Table 1).

Table 1: Features of Proximal Processes (Bronfenbrenner & Morris, 1998).

1. For development to occur, the person must engage in activity.
2. To be effective, there must be regularity in doing activity over extended periods of time.
3. Regular engagement must continue long enough for the activity to become increasingly more complex.
4. Bidirectionality in process of change.
5. Includes interactions with objects and symbols.
6. Moderating influence of proximal process (content, timing, effectiveness) influences change over time.

To be developmentally supportive, transactions must be reciprocal with due attention to characteristics of the person and those of the proximal environment, and they must become more complex over time. Proximal processes shape and effect development and occupational engagement depending on these characteristics. The proximal environment includes social and physical processes and structures that support development, with a central focus on the relationships and transactions experienced. Consideration for proximal processes is congruent with occupational therapy practices that address family routines and relationships as

fundamental to enhancing occupational engagement for children (Kellegrew, 2000; McNamara & Humphrey, 2008).

Developmentally instigative characteristics

Finally, the concept of *developmentally instigative characteristics* needs to be addressed, which refers to characteristics of the individual child. These characteristics relate to aspects such as temperament and disposition, sensitivity or reactivity to the environment, knowledge, ability and skills, and agency. While some are genetically determined, they also relate to the ability of the child to employ their abilities and adapt them to the demands of human life (see case illustration below for further insight). For occupational therapists, this is not a typical approach to determine the child's abilities as we typically focus more on motor, sensory, cognitive skills, rather than considering disposition and temperament (e.g. O'Sullivan et al., 2018), but bioecological theory shows that such personal characteristics can in fact be crucial for determining outcomes.

Summary

Bronfenbrenner's bioecological model has evolved into a synergistic, dynamic portrayal of how factors related to interactions and relationships (process [P]), dispositions and genetic inheritances (person [P]) and proximal and distal environments (context [C]) that transact over time [T] to influence development and learning. Implications for applying a PPCT framework to occupational engagement are that all four elements are required, process needs to be separated from environment, and transactions need to be reciprocal over time with due attention to characteristics of the person (Bronfenbrenner & Morris, 2006). Understanding that no one factor operates in isolation to determine outcomes is also a crucial element of this approach for occupational therapists.

Evidence supporting use and/or effectiveness

In exploring how this model has been used to support the study of children's engagement in occupation, there is a significant body of evidence available. Studies have identified the influence of impoverished environments on child development when children are exposed to more than six month periods of institutionalisation (Cermak, 2001; Lin et al., 2005), and longer stays in such institutions (which were typically environments of low resource with low levels of stimulation for the child) were associated directly with more significant developmental delays. Other evidence shows that children of similar ability may thrive or flounder depending on the presence or absence of a nurturing carer or secure home environment (Shonkoff & Phillips, 2000). Therefore, it is now acknowledged that, as predicted by bioecological theory, multiple potential developmental pathways exist for each individual child.

Development is consequently not a universal, linear process but is co-constructed and influenced by multiple factors from within and beyond the child in their specific socio-cultural-spatial-historical-political contexts. In occupational therapy literature, this more holistic and dynamic perspective on child development has been supported, as previously noted, in early intervention. It was also further expanded by writers like Lawlor (2003), Humphry and Wakeford (2006), and Pierce (Pierce et al., 2009), who associated an ecological approach with sociocultural psychology primarily, and the need to examine multiple elements of transactions in daily life, in the context of societal influences and cultural practices. Given this backdrop, Bronfenbrenner's bioecological model has an authentic fit with occupational science theories, and with occupational therapy for children, both for research and practice.

The literature on the use of Bronfenbrenner's model in occupational science and occupational therapy shows surprising breadth of application. Examples exist from research to practice, for children and adults, and also for informing occupational therapy education. The model has

been frequently deployed to frame research and analyse data, mostly using the original ecological model (1979), with emphasis on understanding multi-layered influences on occupation. For example, Bronfenbrenner's ecological model was cited in a study of children at risk of developmental delay in Israel, where researchers identified the negative influence of the school environment on movement abilities, due to lack of opportunities for play and exercise at a structural or policy (macro) level. Here the theory was used to strengthen the rationale and the importance of the study findings (Golos et al., 2011). Similarly, the multi-layer system was used to analyse data in a study of families of children with autism in South Africa (Reddy et al., 2019) which identified the resources and support beyond the family (at meso and macro level) that were needed to strengthen service provision. For educational research, the multi-layered system was adopted to analyse interprofessional learning for health and social care students in the UK, and researchers documented that it helped them become more sensitised to the different spheres of influence and their potential impact on student learning (Bluteau et al., 2017).

Similar examples exist in research that applies the ecological model to systematically summarise evidence. One study used this approach to examine work transitions for vulnerable groups of adults in Canada (Antao et al., 2013). The ecological model enabled the researchers to document multiple inter-related and co-influencing factors preventing and promoting employment at each system level to better understand gaps in practice. In another study of children's services, the model enabled researchers in South Africa to map findings relating to care-givers' role in early childhood programmes according to the different levels (Ayob et al., 2021). Their work highlighted the lack of adequate support for caregivers at a policy and community level, calling for more government involvement.

Fewer studies have used the more recent evolution of Bronfenbrenner's bioecological model which focuses on PPCT in respect of the multi-layered system. One example was an

occupational science study which examined play occupations in Ireland as they develop in family contexts (Lynch et al., 2016). Using this model, researchers were able to gather evidence of transactional processes and multiple influences over time as they shaped the emergence of play in infants. However, it may be that the full potential of the dynamic, synergistic, up-to-date bioecological model has not yet been fully exploited for occupational therapy.

Application: Case Illustration

This case study describes the occupational profile and life situation of Jenny[2], aged 10. On assessment by the occupational therapist, Jenny was identified as 'definitely different' to her peers across auditory, vestibular, touch and multi-sensory domains of sensory processing, with moderate neurodiverse traits. Later multi-disciplinary assessment confirmed a diagnosis of autism. A PPCT analysis based on Bronfenbrenner's bioecological model may support practising occupational therapists to understand and respond to her needs and strengths in context.

Process (P)

The central relationships in Jenny's life are with her family – her mother, father, sister and brother. There is relatively good understanding in the family of Jenny's needs but also recognition of her strengths, and Jenny is a very much-loved child. She has a wide range of friendships and ample opportunities to engage in progressively more complex reciprocal interaction through free play and more structured activities such as sports teams, music lessons, etc.

[2] Pseudonym

Person (P)

Jenny's occupational profile shows some difficulties with motor coordination on testing but these difficulties are not impacting on function. She is kind and empathetic and has a very caring nature. She is artistic, with a keen eye for beauty and patterns. She has low auditory threshold and tactile defensiveness that can lead to sensory overload and seeks movement to help self-regulate. She has rigid routines and rituals in daily life and finds new experiences or changes in plans very challenging. She experiences intense anxiety and has exhibited extreme episodes of school refusal.

Context (C)

Microsystem

Jenny lives with her family in a middle-class area of an Irish suburb where she plays freely with (appropriately) limited adult supervision, climbing trees, building dens, playing self-directed games. She attends the local primary school and plays on the local football team. She has some access to a Special Needs Assistant [SNA] to provide movement breaks and other supports.

Mesosystem

Most of the children from Jenny's home environment also attend her school, as does her brother, creating linkages for Jenny between home and school. To support Jenny with the transition into school each day, her SNA meets her at the school-gate, interacts with Jenny, her parent and her brother, and walks with her into school.

Exosystem

Access to primary care services including occupational therapy and autism services is chronically underfunded and inaccessible in Jenny's area. Jenny's parents have the

knowledge and capacity to firstly recognise her needs and secondly to advocate for her within an increasingly inaccessible public system. Jenny is not directly involved in the extensive advocacy work of her parents on her behalf, or in the interactions between her parents and primary care professionals, or in funding and policy-making decisions with regards to access to services, but each of these may nevertheless significantly affect her outcomes.

Macrosystem

Jenny is a white, middle-class child of the dominant nationality who speaks the dominant language, and as such is unlikely to experience any racism or prejudice that could impact on her outcomes. However, her gender (female) is likely to have significantly delayed recognition of her neurodiverse traits as understanding of autism in girls is only recently being developed and many assessment protocols still rely on traditional perceptions of autism based on studies of boys.

Time (T)

Chronosystem

Early intervention is internationally recognised as crucial for positive outcomes for children, but this has not been achieved for Jenny due to long waiting lists and lack of recognition of her needs.

Synergy

While the PPCT model allows us to identify separate factors that can impact functional outcomes for children, its key strength lies in helping occupational therapists to understand how the synergies and interactions between these factors may impact in ways that are ‘more than the sum of their parts’. There are multiple potential developmental pathways for each child and harnessing them effectively is vital for effective practice. Rather than being a linear

process of delivering an intervention directed at the child, therapists need to consider change at multiple levels simultaneously. Yet, to date, the frequency and intensity of intervention that this requires for the child, family and community, and the tools we can use to sensitively measure such change are not currently evident or developed for practice.

In this case study, while Jenny shows some challenges with motor skills on testing, there is little or no functional impact in her daily life, so the assessment is possibly an example of developmental invalidity as it was not conducted in a natural setting. For example, Jenny has many opportunities to practice and develop motor skills through free play with multiple children at home and involvement in team sports. In bioecological terms, this is an example of developmentally generative proximal process in the microsystem having a positive impact on the child's resource characteristics.

Equally, while consistency and predictability across different contexts have been shown to be important for all children, they are particularly important for a child like Jenny who finds engaging transitions exceptionally challenging. While school refusal is still a significant issue for Jenny, since the introduction of the SNA supports in the morning there has been a significant reduction, and attendance has improved, if not always for the full day. In bioecological terms, this shows how linkages in the mesosytem can impact on person characteristics, behaviour, and functional outcomes, and how support provided in context of the daily routines can impact change.

The dynamic nature of development is also evident in this case study. In bioecological terms, proximal processes (interactions with people, objects, and symbols) must be 'progressively more complex' in order to be developmental generative, and over time such experiences have exponential effects, so that Jenny's proximal processes, both in terms of supportive

relationships and in terms of experiences in the world, are crucial to her long-term functional outcomes.

On the other hand, delays in accessing services could potentially impact negatively on function through lack of early intervention and long periods without any access to appropriate assessment or therapeutic support. In bioecological terms, this shows how person traits and outcomes are influenced by events in the chronosystem.

Chapter Summary

In this chapter, the bioecological model of human development is explored. This model was conceptualised and developed over many decades by Urie Bronfenbrenner and was a game-changer in its time for the study of developmental science. Bronfenbrenner's theory contributed to the international shift in thinking among childhood theorists, from linear, universal models of child development to ecological transactional perspectives and emphasising the importance of context. There is a synergy between occupational therapy theory and Bronfenbrenner's work, since occupational therapy theorists concurrently position the person-environment-occupation together as transactional, co-constituting, synergistic elements of occupational performance. However, Bronfenbrenner adds further to our insights into such complex relationships in child development and provides further ways to consider the effect of proximal processes, developmental validity, and other concepts. Aligning Bronfenbrenner's ideas with occupational therapy therefore provides us with increased insights into how human development evolves over time, in context, strengthening our ideas about the inter-influences between the person, environment and occupation, and ultimately enhancing occupational engagement in home, school and community contexts.

Critical Discussion and Future Directions

Bioecological scholarship involves integration of multiple knowledges from biological and individual to socio-spatial-cultural and collective, and adopts a complexity science (Fogelberg & Frauwirth, 2010) or transactional approach (Aldrich, 2008; Fisher & Marterella, 2019). The implications are that both the child and the environment must be viewed as a co-influencing relationship that changes over time (Altman & Rogoff, 1987). Of note, environment in this case is not just the social environment, but all environmental forms such as physical, political, cultural, and so on, and each element has agency.

The bioecological model is proposed as one way to implement a transactional perspective in occupational therapy practice. To date the bioecological model has been used primarily to document evidence of complex processes from a multi-layered systems perspective and is shown to be an effective approach in framing complex research on practice contexts both for children and adults. However, the full potential for the use of Bronfenbrenner's model has not yet been realised as few studies draw from his more advanced thinking on synergies between the elements that constitute this transactional system, and the power of relationships and interactions. Perhaps with new insights emerging on occupational therapy as a complex intervention (Pentland et al., 2018), Bronfenbrenner's contribution to occupational therapy might find a new audience, and the full capacity of Bronfenbrenner's model to enhance approaches that address occupational engagement in occupational therapy might become more evident.

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