Negotiating Complexity: A Bioecological Systems Perspective on Literacy Development

Short Title: Negotiating Complexity

Dr. Elizabeth L. Jaeger

Assistant Professor

Department of Teaching, Learning, and Sociocultural Studies

College of Education

University of Arizona

1430 E. 2nd St.

Tucson, AZ 85721

520.626.2195

elizabethjaeger@email.arizona.edu

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Abstract

Background/Aims: Urie Bronfenbrenner's bioecological systems model [Bronfenbrenner & Morris, 1998/2006] is well-regarded in the field of child development. Although this model is not commonly used by literacy researchers, I argue that Bronfenbrenner's emphasis on the roles of personal characteristics, proximal processes, contextual systems, and historical time has explanatory power in the area of literacy.

Methods: I review this body of literature and describe a visual representation which clarifies the relevant aspects of the theory.

Results: Adoption of Bronfenbrenner's model increases the likelihood that literacy development will be understood as occurring at the site of transaction between cognitive processes and social practices. Literacy researchers who have applied this theory differ in the degree to which they have attended to Bronfenbrenner's guidance relative to adequate research practice and, as such, findings from this research range from less to more theoretically sound and useful.

Conclusion: As contemporary literacy researchers consider employing Bronfenbrenner's theory to frame their work, it is necessary for them to account for all aspects of his rich and complex model.

Contemporary researchers have studied the range of factors that play an influential role in literacy development.[1] Much of this work focuses on cognitive elements such as decoding

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[1] In the discussion that follows, I generally use the word *literacy* (rather than *reading* or *writing*) whenever possible because this is the more inclusive term; however, *reader* or *writer* is used when referring to individuals engaging in literacy practices.

ability and listening skill [Hoover & Gough, 1990], but considering these internal aspects alone

provides a severely constrained view of literacy practice. Of at least equal importance are

contextual variables, such as interactions in the home, at school, and in the community, as well

as a range of class, race, and gender factors. Of particular interest are works that explore links

across these influences [Gaitan, 2012; Zuze & Reddy, 2014]. Among the ways that scholars

theorize how such influences contribute to a child's literacy trajectory is through the use of

ecological models [Chao & Mantero, 2014; Gutierrez, Bien, Selland, & Pierce, 2011]. Although

developmental psychologist Urie Bronfenbrenner [Bronfenbrenner & Morris, 1998, 2006] said

little about literacy per se, his work has, explicitly or implicitly, inspired many of these models.[2]

I argue that Bronfenbrenner's theory is a useful frame for describing literacy

development because it offers a comprehensive explanation of literacy experiences,

demonstrating how developing readers' individual characteristics transact with both proximal

and distal influences to craft their literacy ecology. Nevertheless, application of

Bronfenbrenner's work in the context of literacy research is challenging. This is due, in part to

the fact that he repeatedly referred to his theory in terms of circles [Bronfenbrenner, 1977] or as

a series of nested systems, comparing them to the ubiquitous Russian dolls, the smaller of which

fit within the larger ones [Bronfenbrenner, 1979]. This metaphor has been interpreted by some

researchers [e.g., Singh, Sylvia, & Ridzi, 2015] as meaning that the developing child "sits"

within microsystem which sits within mesosystem which sits within exosystem and so on. With

a careful reading of Bronfenbrenner's descriptions, however, this interpretation quickly breaks

down. Microsystems do not "sit" within mesosystems; rather, mesosystems exist at the overlap

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[2] Within this text, I consistently reference Bronfenbrenner & Morris's 1998 handbook chapter because it is the first of his writings to include a fully comprehensive description of his bioecological systems model. The 2006 version does not differ significantly from the 1998 one.

between two or more microsystems. Similarly, if the simple nesting view is adopted, the child would be contained by the exosystem; but exosystems are, by definition, systems of which the child is not a member (e.g., parental workplace). A clearer visual representation of the theory would go a long way to alleviating this confusion.

In this article, I begin with a summary of Bronfenbrenner's model of human development, as it has evolved over time, and his recommendations for appropriately applying his model as a foundation for research. Then I situate Bronfenbrenner's theory within the field of literacy and provide examples of the ways in which this theory has been utilized within literacy research to date. Finally, I suggest a series of figures designed to clarify how the model might be more usefully applied within literacy research and suggest forms that research might take.

The Evolution of Bronfenbrenner's Bioecological Model of Child Development

Bronfenbrenner was one of the first North American theorists to address what he felt to be a profound gap in the field of developmental psychology—the role of context in development. He argued that, because contexts differ, it may be inappropriate to apply findings obtained in relatively controlled settings (e.g., laboratories or clinics) to other more complex settings (e.g., classrooms or neighborhoods) [Bronfenbrenner, 1995]. As he famously stated, "Much of developmental psychology is the science of the strange behavior of children in strange situations with strange adults for the briefest possible periods of time" [Bronfenbrenner, 1976b, p. 2].

After a brief historical overview[3], I will describe Bronfenbrenner's bioecological model with references to its application in the field of literacy. As early as 1961, early precursors of future thinking appeared in Bronfenbrenner's work as he described a study in which the effects

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[3] A more extensive discussion appears in Rosa and Tudge [2013].

of parental discipline practices were mediated by social class and gender. By 1973, he was

describing a range of systems that would, by 1976, come to be known as micro-, meso-, exo-,

and macro-systems, terms he borrowed from Brim [1975]. He also spoke of close interactions

between children and adults [Bronfenbrenner, 1976a] that he would later refer to as *proximal*

processes [Bronfenbrenner, 1988], and carefully define in his 1993 paper with Ceci.

Development across time was specified in his bioecological theory in 1994 [Bronfenbrenner &

Ceci, 1994] and his 1998 handbook chapter with Morris included the relevance of the historical

time period in which an investigation occurred (termed *macro-time*). In this way,

Bronfenbrenner's general focus shifted from context to person to process and time variables.

The Role of Contextual Systems

Bronfenbrenner [1976a] suggested that development could only be understood within the

context of a series of nested systems. He described four contextual systems: *microsystem,*

mesosystem, exosystem, and *macrosystem. Microsystems* are proximal contexts of which the

child is an active member such as home, school, peer group, and community groups, such as

churches or recreation centers. Microsystems, Bronfenbrenner suggests, can be calm, stable, and

relatively predictable, including routines such as a nightly bedtime story—and, thus, conducive

to development. On the other hand, they can be frenetic, unstable, and chaotic—thereby serving

to undermine development [Bronfenbrenner & Evans, 2000].

A child is, of course, a member of more than one microsystem. Bronfenbrenner termed

the intersection of two or more microsystems the *mesosystem*. There may be little interaction

among members of a child's various microsystems, as is the case when a breakdown of

communication occurs between parent and teacher. In other instances, interaction may be strong

and frequent; in this situation, the microsystems reinforce each other [Bronfenbrenner & Morris,

1998]. Events occur physically within a single microsystem (e.g., reading on a Kindle at home),

but they are conceptually meso- in nature, as experiences from a range of contexts often color a

person's thinking (e.g., comparing Kindle-reading to use of an I-pad at school).

Systems of which the child is not a member also affect development. Bronfenbrenner

called these *exosystems*. An oft-cited example of an exosystem is the parent's workplace. An

employer sensitive to family needs may provide generous leave benefits for new parents,

allowing them to attend more fully to caring for a newborn (including singing and other verbal

interactions that serve as precursors to print literacy), and lowering the level of stress in the

home. If, however, a parent must return to work within weeks after birth, stress levels are likely

to increase. The reciprocal nature of this process becomes evident when the worker—short on

sleep and long on guilt—is so distracted that s/he cannot effectively perform the duties expected

by the employer. In this way, the child affects the exosystem, even as it affects the home

microsystem.

Surrounding all the other systems is the *macrosystem*. The macrosystem includes

elements such as language and patterns of communication. It may also include destructive

practices such as discrimination based on class, race, gender, age, sexual orientation, and

(dis)ability. Within a given macrosystem, there are expectations about the roles people play, the

activities they engage in, and the way they interact with each other [Bronfenbrenner, 1976]. In

this way, the macrosystem of which the child is a part has important implications for literacy

development.

Although each of these systems is crucial to development in and of itself, more important

are the interactions among systems. Macrosystem factors such as a downturn in the economy,

for example, may entail a job search (change in exosystem); this activity causes a shift in family

routines, including those associated with literacy, with parents in and out of the home at irregular times (home microsystem). It may even require moving to less expensive housing in a neighborhood served by a different school with altered literacy expectations (school microsystem and, potentially, home-school mesosystem).

The Role of the Developing Person

Bronfenbrenner was dissatisfied that scholars citing his work focused almost exclusively on the context aspect of his ecological model and with the research that had resulted from this error. He stated, "In place of too much research on development 'out of context,' we now have a surfeit of studies on 'context without development'" [Bronfenbrenner, 1986, p. 288]. In response to his concerns about the over-emphasis on context and the de-emphasis of agency within these research exemplars, the developing child—varying widely in biological and psychological characteristics—now assumed a more evident place as active agent in Bronfenbrenner's evolving model. Two children raised in similar contexts might have very different paths through life and the children would play an active role in constructing those paths [Bronfenbrenner & Morris, 1998].

Bronfenbrenner classified personal attributes as *demand*, *resource*, and *force* characteristics. *Demand* characteristics, such as age, race, gender, physical attractiveness, and certain aspects of behavior, invite or discourage reactions from the environment, reactions which influence development. *Resource characteristics* include low birth weight or persistent illness on one hand and particular abilities and knowledge on the other. These attributes, although less readily apparent, may be more powerful than demand characteristics. Bronfenbrenner attends most closely to *force characteristics*—combinations of cognitive, social, emotional, and

motivational factors associated with temperament and personality. All of these factors may

make it more or less likely that parents, for example, may wish to talk with or read to children.

Bronfenbrenner recognized that characterizing development as a function of a child's

individual attributes alone was every bit as problematic as context-only models [Bronfenbrenner

& Crouter, 1983]. He believed that it was important to account for both personal and

environmental factors in development.   Environments change people (the external is internalized

and transacted) and people change environments (the internal is externalized and transacted)

[Bronfenbrenner & Ceci, 1994].

The Role of Proximal Processes

Bronfenbrenner's growing interest in the processes associated with the person/context

transaction was foreshadowed in his earlier work. As early as 1973, he argued that "the

psychological development of the child is enhanced through his involvement in progressively

more complex, enduring patterns of reciprocal, contingent interactions with persons with whom

he has established a mutual and enduring emotional attachment" (p. 119). Not until the early

1990s, however, did Bronfenbrenner emphasize the fundamental importance of these patterns.

Such processes, Bronfenbrenner [1993] argued, are responsive to the child's needs and, as such,

have the potential to assist the child in developing self-control, coping with stressful situations,

learning new knowledge and skills, and establishing and maintaining healthy connections with

others. In short, these processes nudge the child just beyond her/his current level of functioning

and, in this way, approximate Vygotsky's zone of proximal development. Bronfenbrenner's list

of exemplars included a range of processes from soothing a baby to reading to sports to acquiring

new knowledge.

The proximal process construct has several key elements that warrant elucidation. First, these processes increase in complexity. A parent reads a short book to a toddler one day and a slightly longer one a week later. Second, the interaction is reciprocal and the child is an actor in the process; in the above example, the toddler's ability to engage with the parent's reading of the first book influences the parent's decision to select a longer one. Third, the interaction can, of course, occur between the child and another person, but it can also occur with enticing objects that invite "attention, exploration, manipulation, elaboration, and imagination" [Bronfenbrenner & Morris, 1998, p. 997], such as a toy or a parent's briefcase, and symbols such as those found in a book or on an I-pad. The timing of proximal processes is important; they are most productive when sessions are of a reasonable length and occur on a frequent and predictable basis [Bronfenbrenner & Ceci, 1993].

The Role of Time

Although Bronfenbrenner had always attended to change and continuity and had explored what he then called the *chronosystem* as early as 1986, time became a significant element in his bioecological systems model with the publication of the second version of his *Handbook of Child Psychology* chapter [Bronfenbrenner & Morris, 1998]. In this chapter, he focused on "the changing expectations and events in the larger society, both within and across generations, as they affect and are affected by, processes and outcomes of human development over the life course" [Bronfenbrenner & Morris, 1998, p. 995].

Proximal processes are affected by the historical period in which they occur. For example, 20 years ago a child with a diagnosed reading disability would have spent the preponderance of her/his time in a resource room populated with several other similar children, a special education teacher, and, potentially, a teaching assistant. Today, that same child is likely

to experience a full-inclusion service model, spending the day in a regular classroom surrounded by as many as 35 students of varying needs. The proximal processes occurring in the two settings would be strikingly dissimilar. In the resource room, the child may have a more intense relationship with the teacher and materials are more closely suited to her/his level of achievement. In the regular classroom, the teacher will have more students to attend to and curriculum may suit the child only if adapted; however, the potential for enriching relationships with other children in the class—children with a broader range of abilities and interests—is greater. Policy decisions reflect the historical time period in which they are made and affect proximal processes occurring within microsystems.

By 1998, Bronfenbrenner had produced the mature version of his theory: the Process-Person-Context-Time or bioecological model. He had come to view proximal processes—regular, ongoing, complex, reciprocal interactions between the developing person and the people, objects, and symbols present within a given microsystem—as the single most important factor in development. These processes are influenced by the individual characteristics of the developing person, by the range of contexts that surround her/him, and by the historical time period in which s/he lives. Over time, these aspects became more fully integrated in his recommendations for research design.

Bronfenbrenner's Primary Research Concerns

Bronfenbrenner focused primarily on theory development related to policy initiatives and engaged in relatively little empirical research of his own. Nevertheless, he had strong beliefs about the role of theory; theories are beneficial, he argued, to the extent that they serve as a foundation for research designs applicable in real-world settings. Bronfenbrenner suggested that a fringe benefit of an ecological model was its capacity to unearth unaccounted-for variables

[Bronfenbrenner, 1993]; that is, a researcher who undertakes a systematic analysis of all elements present within a situation may find explanations for unexpected outcomes in places s/he had not previously considered.

Ideally, a bioecologically-based research study would consider all aspects of Bronfenbrenner's model. This is not always realistic. The mature version of Bronfenbrenner's theory promotes a careful consideration of inter-related factors rather than an ill-fated attempt to include every one. Even if all variables cannot be known, much less captured, if the most salient variables are measured, the overall shape of the system can be inferred.

Bronfenbrenner regularly made additional recommendations for research protocols that would instantiate his theories. Early on [Bronfenbrenner, 1975], his advice was relatively general: studies should consider the interplay of context and activity and compare two systems or two system components. In 1976, his recommendations centered on locations for research sites: that selected sites should be outside the laboratory setting and reflect the social milieu of the participants. Bronfenbrenner also discussed the role of the researcher as participant and the ways in which two members of the setting could affect each other indirectly via a third person as well as directly. Along with Crouter [Bronfenbrenner & Crouter, 1983], he suggested selecting the participant sample with care, attending in particular to gender and socioeconomic status, and that studies move beyond a single case and a single microsystem to add more complexity—and, hence, more nuance—to the design. By 1986, Bronfenbrenner became more detailed in his recommendations: a study design was considered "optimal" if it included two contrasting settings and two contrasting groups of participants with differing personal characteristics and feelings about the context, and in which longitudinal data was collected. He recognized how difficult such a project would be, however, and insisted that his purpose was not to "establish a

set of criteria that every research should strive to meet" [Bronfenbrenner, 1986, p. 305].

Nevertheless, by 1988 he insisted that each investigation incorporate systematic data collection

about domains of development: context, personal characteristics, and the process through which

the other two are linked. The importance of including at least two macrosystems was on his

mind in 1989, but he dropped this requirement within a few years. In his 1998 handbook chapter

[Bronfenbrenner & Morris, 1998], Bronfenbrenner emphasized that the sheer number of factors

included in a research design was less important than demonstrating the interactions and/or

synergies of those factors. And he seemed to transfer more decision-making power to

researchers when he asserted: "The specific components of Process, Person, Context, and Time

to be included in a given investigation should be those that, from a theoretical perspective, are

maximally relevant to the research question under investigation" [Bronfenbrenner & Morris,

1998, p. 1007]. Ideally, they stated, it would include a minimum of two proximal processes.

Tudge, Mokrova, Hatfield, and Karnik [2009] offer additional recommendations based on

their reading of Bronfenbrenner's work. They suggest that, at a minimum, a research study

claiming to employ Bronfenbrenner's bioecological theory as a foundation should include at

least one proximal process and two of the following three components: (a) characteristics of the

person(s) involved, (b) at least two micro- or macro-systems, and (c) longitudinal data collection.

I adjusted their recommendation somewhat to emphasize variable interactions, deciding that my

criteria would be a proximal process and two of the following: (a) the way the proximal process

is affected by person(s) involved, (b) the way the proximal process is affected by the setting

(and/or inclusion of at least two settings), and (c) collection of longitudinal data. I also kept in

mind Bronfenbrenner's ideas about the nature of proximal processes—the interactions (a) are

regular and ongoing; (b) become more complex over time; (c) facilitate the development of both

parties; (d) are influenced by the parties' perceptions of the interactions; and (e) are influenced by a third party whose intent is to support the others [Bronfenbrenner, 2001]. I did not, however, employ these characteristics to exclude studies from my review, nor did I eliminate studies that failed to provide a detailed description of the bioecological model, reflecting my primary concern that the study employed Bronfenbrenner's theory in its execution.

Bioecological Systems Theory and Literacy Research

As Baker [2000] suggests, "The nature of literacy is characterized by the theoretical lens that is used to examine it" (p. 101). Although Bronfenbrenner had little to say about literacy processes, development, or instruction, I argue that his bioecological systems theory has the potential to serve as the foundation for literacy research because it promotes careful attention to the range of factors that influence literacy practices. Use of Bronfenbrenner's bioecological systems theory is not unheard of in the world of literacy research. Since the year 2000—by which time the mature version of his work, published in the 1998 *Handbook of Child Psychology*, was available—authors of well over 50 literacy research studies have cited Bronfenbrenner's theory in their work.

Following a process similar to that of Tudge, et al. [2009], studies to be considered for this review were obtained by using the search terms Bronfenbrenner/bioecological theory/ecological systems theory/process-person-context-time and reading/literacy in several data bases: Education Full Text, EBSCOhost, and PsycINFO. I searched the literature from 2000-2016 because authors of articles within this time frame would have had access to the most mature version of Bronfenbrenner's work, first published in 1998. The search netted 55 studies.

I went through three steps to reduce the data. First, I eliminated studies (18 in number) that cited Bronfenbrenner's work but either failed to use it as the theoretical foundation or

referenced context variables only. Then I eliminated the 17 studies that did not clearly employ

proximal processes in the design; this included one study in which the term was inaccurately

used in reference to any classroom interaction and four studies that described classroom practices

without offering data that the teacher/student interactions were intense enough to be considered

proximal processes. Because my focus was on what was accomplished in the studies, rather than

on what language was employed or the dates of Bronfenbrenner works cited, I included studies

in which the term *proximal process* was not used, but activities that clearly *were* proximal

processes were included.

Finally, I deleted the 13 studies that did not meet the remaining criteria of process-

person-context interaction and/or collection of longitudinal data. These studies fell into three

groups. Five studies [Hettinger & Knapp, 2001; Jordan, 2005; Justice & Kaderavek, 2003;

Norris, 2014; Sullivan, Hegde, Ballard, & Ticknor, 2015] addressed the interaction between

individual characteristics and process or between context variables and process, but did not

involve longitudinal data collection. Four groups of researchers [Galindo & Sheldon, 2012;

Koury & Votruba-Drzal, 2013; Niklas & Schneider, 2015; Singh, Sylvia, & Ridzi, 2015]

collected longitudinal data but did not explore person-process or context-process interactions; in

other words, they focused on linking a range of factors to pre/post achievement measures. The

first two of these studies consisted of an analysis of large, previously-collected data sets with the

intent to link a range of factors—including proximal processes—to achievement gains. Finally,

four studies [Bulotsky-Shearer, Fernandez, Dominguez, & Rouse, 2011; Froiland, 2011; Froyen,

Skibbe, Bowles, Blow, & Gerde, 2013; Roberts, Jurgens, & Burchinal, 2005] included

information about proximal processes but failed to meet any of the other criteria for inclusion;

that is, they simply linked a range of factors to achievement outcomes. After this winnowing

process, seven studies remained.

I condensed the data prior to analysis (see Table 1). Study aspects displayed in the table

were: most recent Bronfenbrenner work cited by the author, number of study subjects, settings,

and the elements of a strong research design, including basic criteria (interaction of persons

involved and the context with proximal processes, and collection of longitudinal data) and

characteristics of proximal processes (gain in complexity, facilitate development of both caring

parties, address parties' perceptions of the situation, and include a third party who supports the

others).

(Insert Table 1 about here)

An analysis of this literature produced a three basic patterns. One study [Barnyak, 2011]

fully examined process-person-context interactions, including informative details about

reciprocity within proximal processes, perceptions of those involved, and the role of a third

party, but the researcher did not collect data over time. deJong and Leseman [2001] considered

person-process variables and collected pre- and post-assessment data. Five studies [Connor,

Ponitz, Phillips, Travis, Glasney, & Morrison, 2010; Connor, et al., 2012; Connor, Son,

Hindman, & Morrison, 2005; Farrant & Zubrick, 2012; and Ponitz, Rimm-Kaufmann, Grimm, &

Curby, 2009] met all three criteria.[4] I will also review Hettinger and Knapp (2001), an unusual

case. Because this article describes the way in which Bronfenbrenner's theory has been used as

a frame for literacy research, the focus of this literature review is not the overall adequacy of

these studies, but rather the extent to which researchers met my understanding of

Bronfenbrenner's criteria for research employing his model.

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[4] It should be noted that, of these seven reports, only two [Farrant & Zubrick, 2012; Ponitz, Rimm-Kaufmann, Grimm, & Curby, 2009] included an explanation of the bioecological model in their papers.

Variable Interactions Without Longitudinal Data

Barnyak [2011] attended to the proximal process (not named as such) occurring between six young children (ages 2-7) and their parents during storybook read alouds. The author does not mention the role of individual characteristics as she introduces her study, but, in her results, she describes behaviors that differed by child and influenced the experiences of various parent-child dyads. She also notes that parents described ways in which they selected storybooks based on their child's interests, thereby highlighting the ways in which children's individual characteristics influenced parental text choice in a reciprocal way. She also compared what parents said about the read alouds they conducted at home with what she observed in the library or literacy-center setting, a context variable. Because of the close relationship she developed with the families, Barnyak served as a third party facilitator for their proximal processes—encouraging regular and ongoing literate interactions, and gaining information of child and parent perceptions about their interactions via interviews. She did not examine changes in read aloud practices over time which would have served as longitudinal data.

Person-Process Variable Interactions and Longitudinal Data

de Jong and Leseman [2001] investigated home reading practices for parents and their third grade children, video-recording three sessions for each of 69 families. They also measured children's oral vocabulary prior to the study and included pre- and post-evaluations of vocabulary, listening comprehension, decoding, and reading comprehension. Growth across measures could be predicted both by initial oral vocabulary scores (a person variable) as well as the quality of parent-child interactions.

Variable Interactions and Longitudinal Data

Four studies in this group were conducted by Connor and her colleagues between 2005

and 2012.[5] Research participants ranged from kindergarteners to second and third graders. The

research designs for these studies are similar, however, driven by Connor's primary interest:

how the intersection between students' characteristics and the instruction provided them predicts

achievement. The authors made a key decision about research design which allowed them to

temper complexity and increase sample size (ranging from 73 to 145). They did so by collecting

a minimal amount of data relative to proximal processes, ranging from one to three formal,

video-recorded observations. Although it was not the intent of these studies to investigate the

specific qualities of the proximal processes occurring in classrooms, it is difficult, as a result, to

fully understand the interactions that occurred or to come to any conclusions about the extent to

which the proximal processes in these classrooms gained in complexity, affected teachers as well

as students, and/or included a third supportive party.

Ponitz, Rimm-Kaufmann, Grimm, & Curby [2009] considered the ways in which the

quality of the classroom environment (a context variable) affected kindergarteners' engagement

and as a result, their reading achievement. They determined that reading growth could be

predicted from fall reading scores (a person variable) and the quality of teacher/student

interaction.

An interest in connections between person and context variables and growth in

vocabulary and early reading skills was the impetus for Connor, et al.'s [2005] study. Attending

to individual teacher/child interactions, they found achievement gains for these first graders were

affected by teacher responsiveness and focus on academic outcomes (person variables), as well

as the children's home and pre-school environments (context variables).

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[5] Connor's studies spanned 2004 to 2014, but most failed to provide clear and sufficient findings regarding the proximal processes that occurred in the classrooms studied.

Connor, Ponitz, Phillips, Travis, Glasney, & Morrison [2010] considered the interaction between use of an individualized instruction program and student self-regulation in first grade classrooms. Employing a measure of self-regulation called the Heads-Toes-Knees-Shoulders task, they concluded that self-regulation improved significantly only for students who initially scored in the low range on this assessment (person variable) and that the quality of program implementation (context variable) also influenced results.

Connor, et al. [2012] considered the possible links between instructional practices in science and growth in content knowledge, vocabulary, and reading achievement. The findings were complex, with types of science instruction (e.g., reading and discussion of expository text, hands-on experiments) producing effects that differed by grade level and initial level of achievement. This outcome suggested that one-size-fits-all science instruction may be problematic. For example, in terms of person variables, the researchers found that children with weaker initial scores benefitted more from reading expository text than those with stronger scores.

Finally, Farrant and Zubrick [2012] studied vocabulary growth among 2188 infants with a mean age of nine months when the research began, exploring the effect of parent-child book reading on that growth. They noted that the child's gender and temperament (person variables), as well as the quality of the home literacy environment (context variable), influenced the level of growth.

As noted previously, none of the investigations cited above offer us a detailed description of the proximal processes studied, despite the fact that they met all the criteria established for this review. Hettinger and Knapp [2001] studied a single child and collected no pre- and post-data. In addition, their paper cited only Bronfenbrenner's 1979 text and included only a limited

description of Bronfenbrenner's theory. I include it here because the actual research—a case study of a highly verbal vulnerable[6] reader—was more sophisticated in execution than might be expected given the limited theorizing, and offers an important contrast to the studies described above. The research report included an analysis of the child's individual characteristics and comparisons of his varied levels of competence in home, school, and summer program settings. In addition, both parent-child and teacher-student proximal processes were described in detail. The first author was clearly affected by the experience—demonstrating the reciprocal nature of the process— and served as a third-party influence on the parent-child proximal relationship by sharing her findings with the family. Were the strengths of this study to be combined with the breadth and rigor of the others included in this review, the potential impact of Bronfenbrenner's work within the field of literacy might be fully realized. I argue that one of the barriers to this realization, is the absence of a clear and functional visual representation that shows how his theory applies in the field.

A Visual Representation of the Bioecological Theory as It Supports Literacy Research

Bronfenbrenner never proposed a visual representation to demonstrate the wealth of inter-connections that his theory entails and enhance its explanatory power. An accurate representation would help to translate Bronfenbrenner's theory to the literacy context and clarify the transactions occurring within the various systems of the child's (literacy) world, by, for example, situating personal characteristics such as gender within the proximal process of parent-child interactive book reading at a period of increasing demands on family time. In doing so, it would support the design of research by assisting literacy researchers in their efforts to consider all factors relevant to differences in literacy achievement and engagement.

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[6] I employ the term *vulnerable reader* [Jaeger, 2015] to refer to those who, for a range of reasons, are most sensitive to disruptions within their literacy ecology.

Although Bronfenbrenner was not a literacy scholar, a key advantage of employing his bioecological systems theory as a frame is the level of specificity it adds to the description of reading and writing behavior, and, in conjunction, guidance for literacy teaching and learning. I have chosen to begin with the innermost of the nested system elements—the developing reader—heading outward to proximal processes, contextual systems, and, finally, the role of time. Although I focus on reading here, the same trajectory would apply to writing and other literacy practices, as well.

The Developing Reader

Each reader has unique demand, resource, and force characteristics (see Figure 1). Readers invite differing reactions from the environment, draw on various biopsychological assets, and exhibit contrasting temperaments. Even educational psychologists who have focused primarily on readers' internal processes [Anderson & Pearson, 1984; Hoover & Gough, 1990] offer a less detailed description of the many facets of readers' biological and psychological attributes and the ways in which those attributes influence their experience of text than does Bronfenbrenner (see Figure 1). A healthy and attentive child, for example, is likely to learn to read more easily than one who is plagued by repeated absences or who is distracted by every new sight or sound in the classroom.

(Insert Figure 1 about here)

The developing reader, as seen in Figure 1, is only the first element of the bioecological model. S/he "nests" within the proximal-processes layer of the model.

The Developing Reader as a Participant in Proximal Processes

Literacy-related transactions are, at their most productive, proximal processes. These processes involve the developing reader along with teachers, peers, and parents; objects such as

books and I-pads; and symbols such as print and pictures—all within a particular environment

(e.g., classroom, living room, or library).   Constructs such as the Zone of Proximal Development

[Vygotsky, 1978] are similarly referenced, but Bronfenbrenner explains the aspects of proximal

processes in greater detail. All interactions (person-to-person and person-to-object/symbol) are

reciprocal (i.e., people and non-person elements both facilitate change and are changed in the

process); the teacher, for example, both affects and is affected by the literacy practices of her/his

students. Literacy-related proximal processes occur on a regular basis across days and weeks

and are characterized by strong attachment between the individuals involved. By definition,

these interactions increase in complexity over time, as both parties increase in skill-level and

attentiveness to each other's needs, and are affected both by the personal characteristics of those

involved (ideally, including a third party who supports the other two) and the contexts within

which the proximal experiences occur. A father and son who frequently co-compose letters to

the child's grandparent is an apt example. This is a reciprocal process: the child learns a great

deal about effective communication and the parent gains an awareness of responses that serve to

facilitate their work, a sensitivity that carries into other day-to-day interactions. The letters will

tend to become more complex over time as the child grows in skill and confidence. And the

grandparent correspondent serves as the third party who, in replying to the child's letters,

supports their activity.

     Although literacy practices occur in homes, community centers, or other locations

frequented by the developing reader, for purposes of this article, I will focus on the school

environment (see Figure 2).

<div align="center">(Insert Figure 2 about here)</div>

Organization of instruction. Educators can structure a learning environment—say, a one-on-one tutoring setting—to facilitate proximal processes that provide both sufficient challenge and sufficient support. Foremost in importance may be the application of a gradual release of responsibility model of instruction [Pearson & Gallagher, 1983]. The tutor begins by modeling, and, over time, helps students to take on more and more of the work until, ultimately, they function independently. Another key attribute of a positive academic learning environment is the provision for trust, play, and trial and error. A setting in which both stability and levity are the norm allows the child to take risks without fear of failure. Finally, proximal processes should be responsive to the inherent differences among readers and tutors. If these processes are to effectively support literacy growth, they should be adjusted to meet the academic and personal needs and desires of individual children, and, in addition, be suitable for the peer or adult involved.

In such an environment, the developing reader transacts with texts, activities, and other readers on an on-going basis. She comes to expect a regularity and dependability in these transactions. In addition, she experiences these transactions as reciprocal. A tutor, for example, instructs the developing reader, but also looks to that reader to provide information about reading interests—interests that will serve to inform text and activity selection. Similarly, the reader exhibits an interest in finding books she will enjoy, but the texts themselves will play their part as enticing objects composed of decipherable symbols.

Certain activities appear to support proximal processes. Turner & Paris [1995] asked children how literacy activities influenced their motivation. They found that the most motivating activities were those which shared the following characteristics: (a) students used literacy for authentic purposes; (b) communication and enjoyment were emphasized; (c) students were

actively involved in the construction of meaning; and (d) students were able to set a goal, select

and organize information, choose a strategy, and assess the outcome. The same child attending

two different classrooms over the course of her/his elementary career—one including activities

consistent with the characteristics noted above and one without—is likely to have widely

disparate literacy experiences and, potentially, an erratic literacy-learning trajectory.

       Relationships with adults. Although proximal processes can occur without interacting

with another person, such an interaction is facilitative. Bronfenbrenner provides clear

information about what type of adult enables these processes. First and foremost is a keen

awareness of what is going on at any given moment in time within the literacy-learning space.

This is not a matter of developing perfect lessons and never deviating from them; it is about

crafting a possible plan, but remaining carefully tuned to the child's response to text/activity and

revising the plan as needed. The teacher adjusts his understanding of the task at hand in the

process of interacting with the child, emphasizing the reciprocity characteristic of proximal

processes.

       In addition, the teacher should be able and willing to take the child's perspective. If the

child is struggling with a strategy or concept, the teacher needs to conjure up some remembrance

of his own difficulty in order to fully understand and empathize with the emotional as well as

academic aspects of the child's current situation. The teacher "mirrors," or validates, the child's

experience. For example, as he witnesses the child's strategy use while reading, the teacher

names what is happening and why it is beneficial at this moment in time and with this particular

text. This allows the child to be cognizant of her own progress and to gain confidence as a

learner.

Third among the attributes of a supportive person is a sense of caring and commitment to the developing reader. There is substantive evidence that a child's sense of security with teachers and tutors predicts positive motivational and academic outcomes [Ostroskey, Gaffney, & Thomas, 2006]. And the adult must not care for the child just because she is well-behaved or a good student, but because she *is*. As Bronfenbrenner [2005] insists, "In order to develop normally, a child needs the endearing, irrational involvement of one or more adults in care of and in joint activity with that child" (p. 262). Even within two similarly structured classrooms, the quality of the relationship between adult and child influences literacy development.

Relationships with peers. Peers may serve as proximal process partners and it is crucial that the reader's relationships with these peers are supportive and reciprocal. If these connections are negative, they have the potential to hinder literacy development [Hall, 2007]. A strong sense of classroom community allows readers to benefit from peer interactions. For example, the first graders in Dixon-Krauss's [1995]] study read with their slightly older second grade buddies and their relationships, as much as the texts they read and the activities in which they engaged, served to support literacy development in a reciprocal way for both sets of students. In contrast, even if a classroom is well-organized with a range of rich experiences and the teacher is warm and facilitative, strained relations between a child and her/his peers may interfere with literacy learning.

By the mid-1990s, Bronfenbrenner viewed proximal processes as the "engine" driving development. Fully cognizant of the importance of other factors—the "fuel" supplied by personal characteristics and the ever-expanding systems that affect and are affected by the developing person— he nevertheless embraced proximal processes as the single most important positive factor contributing to development [Bronfenbrenner & Ceci, 1994]. Of potentially

greatest significance for educators, it is, in addition, the element most within our circle of

influence.

The proximal-process aspect of Bronfenbrenner's model, pictured in Figure 2, "nests"

within micro- and mesosystems, demonstrating the influence of the broader context on the

developing reader.

The Developing Reader Situated Within Micro- and Mesosystems

A given process is *physically* located within a particular microsystem and the developing

reader has differing experiences depending on the microsystem in which he is situated. At

school, he is expected to read academic texts and complete assignments independently. At

home, family members encourage the child to read instructions, recipes, bus schedules, and

newspaper articles—all actions intended to serve practical purposes. Spending time with peers

involves the reading of digital texts and communication via social media. Reading in church,

synagogue, or mosque may serve to facilitate a stronger religious bond. Accordingly, the child

comes to view reading as a demonstration of achievement, practical application, communication,

and/or sacred connection. The act of reading is, however, never actually situated within a single

microsystem. It occurs, in a *conceptual* sense, at the intersection of all the microsystems of

which the developing reader is a member—what Bronfenbrenner terms the mesosystem (see

Figure 3).

(Insert Figure 3 about here)

Let us imagine that one of the developing child's parents reads aloud to him each evening

at bedtime. They share a special interaction and the parent makes a concerted effort to select a

picture book that the child will enjoy. He sits on the parent's lap, asking questions and making

comments as the story progresses. This is what being read to looks like in the home

microsystem—a proximal process, indeed.

When the child enters kindergarten, he experiences something referred to as a read aloud,

but the activity does not quite match his schema. Although the teacher sits on the floor with the

children, they are required to sit in a circle at her feet and discouraged from sitting on her lap.

She stops and asks the children to predict story events at regular intervals and they are expected

to respond by raising their hands and waiting to be called on. Physically speaking, the reading

occurs in the classroom microsystem, but the developing child may experience it as a

mesosystem event if the somewhat conflicting experience of home read alouds lurks in the back

of his mind.

The next year, the child is considered old enough to spend the night at a friend's house

and experiences yet another version of "read aloud." In this household, one parent reads to the

children while the other parent cooks dinner. There are several older children in the family—all

of whom are likely to get underfoot in the kitchen if the reading material is not to their liking—

so a chapter from one of the Harry Potter books is the common choice. The developing reader

raises his hand, as he would in school, to ask about aspects of the plot that confuse him, but the

older siblings grow impatient, and he quickly desists. Neither of his previous read aloud

schemata seem to apply in this context. The mesosystem has now expanded to include a peer

microsystem as well as that of home and school. The child now holds a more expansive view of

what a literacy practice such as "read aloud" entails. He recognizes similarities among these

three iterations of the same practice (e.g., another person reads aloud a text of some kind and the

child is expected to listen), but also differences (e.g., in some situations the practice is more

interactive than others). These experiences cultivate within the child a certain adaptability and promote, at a simple level, the notion that literacy is situated within particular times and contexts.

The developing reader's micro- and mesosystem reading experiences "nest" near a variety of exosystems and within the more expansive macrosystem. Most likely to be ignored in documenting the reader's experience, these factors can, in fact, play a profound role in development.

The Developing Reader Situated Within the Influence of Exosystems, the Macrosystem, and the Historical Time Period

A reader's literacy experiences are influenced by a range of exosystems: systems of which she is not a member, but which affect her nonetheless. These exosystems are represented by triangles located closer to and further from the mesosystem, depending on the significance of their influence (see Figure 4). The reader's experiences are also affected by a host of macrosystem structures related to class, race, gender, culture, and language, bounded by the box in Figure 4.

(Insert Figure 4 about here)

Exosystems include the parent's workplace, the health care system, and school boards, to name a few; these are aspects of the child's experience rarely addressed by other theorists. If a change in work schedule requires the parent who is generally responsible for the nightly read aloud to be absent from the home at the developing child's bedtime, the other parent— potentially employing differing read aloud practices—may take over or skip the routine altogether. The child may influence the parent's workplace as well if the desire to participate in their shared bedtime ritual serves to distract the working parent from career tasks. Access to health care may go a long way in assuring that a child is well enough to attend to instruction.

The district school board is another example of an exosystem. If, in response to a misreading of the National Reading Panel Report (National Institute of Child Health and Human Development, 2000), this body implements a heavy diet of direct instruction in phonemic awareness, classroom read aloud time is likely to be the first victim.

Macrosystem factors also play an important role in literacy development. Children of color are less likely to find books with characters that resemble them within classroom libraries and these books may have a disproportionate number of male or female characters. Neighborhoods populated by less affluent families are unlikely to be served by bookstores and, even were such resources present, families may be unable to afford them.

The influence of the historical time period is relevant here. Adoption of the Common Core State Standards with their emphasis on expository text may incline teachers to read aloud more non-fiction and the child's literacy experience will change substantially. The Common Core's focus on close reading will demand different skills than those required to make connections to personal experience.

Unexplored Intricacies

Of course, what is most difficult to grasp from this relatively systematic account is the intricate transaction of all these factors. Tinkering in one spot has repercussions anywhere and everywhere else. A child characterized by anxiety will not respond in the same way to otherwise effective proximal processes and supportive contextual systems. Similarly, two children lucky enough to engage in effective proximal processes both at home and at school may exhibit different literacy outcomes depending on whether their families have the means to rent or purchase a home within school attendance boundaries and stay there through the full school year.

Bronfenbrenner's theory of development is, indeed, complicated. He chose explanatory power over simplicity.

Bioecological Systems Theory and Its Potential for Literacy Research

In acknowledging the fundamental complexity of his theory, Bronfenbrenner saw as useful projects that are less than fully comprehensive but whose researchers are explicit about which of these factors are considered and which are not [Tudge, et al., 2009]. Nevertheless, he hoped for more. What might a literacy-related research design employing all elements of the bioecological theory of development look like? Because considering the many factors included in Bronfenbrenner's theory may be most beneficial for readers who struggle, they are the focus of the study—and the potential studies—described below.

Exploratory Studies

I worked for a full school year with a diverse group of fourth-grade vulnerable readers in a small, urban school on the West coast of the U.S.: three boys and one girl; two Latina/os, one African-American, and one Chinese-American. In this institutional review board-approved study, I tutored them one-on-one twice per week and also taught them once each week in a small-group setting in which the children conducted research on a topic of interest and wrote and illustrated books. They also participated in discussions of picture books and short stories [Jaeger, 2012].

I collected a wealth of data in an effort to obtain a broad and deep picture of these children and their literacy development:

- Person: Student interviews and measures of achievement such as a modified miscue analysis focused on a range of individual characteristics, including literacy strengths, challenges, beliefs, and experiences.

- Process: Audio- and/or video-recordings of the tutoring and small group environments provided evidence relative to proximal processes such as (a) the increasing complexity of our shared work, (b) the growing personal attachment and reciprocal nature of our interactions, and (c) the ways in which each child's individual characteristics affected those interactions.

- Context: Observing students in their classrooms alerted me to the ways in which they influenced and were influenced by that context. I interviewed the children's parents, collecting information regarding their own literacy practices and beliefs about their children as readers within the home microsystem, as well as the mesosystem interactions with school microsystem practices). Finally, I gathered information about the school the children attended (racially/ethnically diverse and majority low socioeconomic status) and the neighborhood in which it was located (of similar make-up to the school).

- Time: In addition to tracking student progress across a school year, I also considered the role of the historical time period. At least two major factors were relevant here. The school district was just emerging from a long period of commitment to a scripted reading program that influenced literacy acquisition for the students in their cohort. Also, few bilingual programs were available at this time—none in this particular school—which may have affected the experiences of the two English learners in the study.

This study generated information about a range of elements affecting the progress of vulnerable readers: their skills and personalities and interactions within the tutorial, small group, and classroom contexts.

Analysis of achievement and engagement data suggest that this may be a promising intervention model. What was more interesting, however, was the interaction of factors

involved. The limited number of participants disallowed any sweeping generalizations, but there were, for these children, connections among system elements. For example, the child who was most outgoing tended to prefer and learn more in the small group setting, whereas the most reserved student gravitated toward one-on-one experiences (a person/proximal process connection). The child who was quiet and reticent in his classroom was confident and competent at home (a context/proximal processes connection). The child who viewed himself as an effective reader in third grade during a time period in which the scripted, phonics-focused reading program dominated classroom instruction was mystified by the shift to meaning-based instruction in fourth grade (a time/proximal process connection).

This study exhibited some advantages when compared with those cited in the literature review. Unlike the study conducted by Barnyak [2011], data were collected across time. Unlike the remaining studies reviewed here, it attended to the details of the proximal processes involved, speaking to (a) ways in which tutoring sessions grew in complexity, (b) ways in which the experience affected both tutor and tutee, (c) students' feelings about the tutoring interactions, and (d) ways in which third parties such as parents and classroom teachers supported the tutoring approach. It also referenced the potential effects of the historical time period in which the study occurred. In comparison with Hettinger & Knapp's 2001 investigation, the study provided additional detail with regard to the ongoing proximal processes. It also included more than one child so person-process interactions could be considered, as well as including in the analysis data collected at multiple points in time.

What is needed, however, is additional concatenated research—studies that support or challenge these findings. A replication with a similar population would prove helpful in teasing out potential false positives in the original research, as would studies with younger or older

students, exclusively speakers of English as a first language, or in differing contexts such as a rural area. With the wide range of variables under consideration, a premature leap to confirmatory research would be ill-advised until many of the variables associated with exploratory research have been eliminated. For example, a study in a similar context characterized by literature-based instruction might either emphasize or eliminate the role of the scripted reading program in findings of the initial study.

Confirmatory Studies

After a range of exploratory studies have been conducted, a larger-scale, confirmatory study might be designed to investigate the influence of systems factors found to be relevant in these exploratory studies for a larger number of vulnerable readers, but, likely, in a less intense way. Students and families would complete surveys (and, in some cases, participate in interviews) intended to obtain data relating to the child's race, age, gender, family SES, birth and health conditions, native language, parental employment, and availability of health insurance; this data corresponds to the person and exosystem aspects of Bronfenbrenner's model. Children would be systematically observed in multiple contexts—potentially home, classroom, and community center; researchers would investigate the proximal processes occurring within each setting and any communication across settings (mesosystem characteristics). Community demographic information similar to that obtained for individual children and families would be collected, contributing to an understanding of the role of macrosystem factors. Finally, the role of societal characteristics unique to this historical time period—say, high unemployment or low availability of family support services— could be explored.

This study might answer questions such as:

- How are proximal processes in a range of literacy microsystems similar? How are they different?

- Are rich home literacy environments, and the proximal processes occurring within them, more or less important for developing readers as compared with rich classroom environments?

- How can literacy-related proximal processes occurring in home, school, and community center microsystems be adjusted to meet the needs of children with particular individual characteristics?

- What systems elements are most significant for vulnerable readers at various ages?

A study that considers a wide range of literacy-related variables—potentially employing hierarchical linear modeling (HLM) analysis [Lindley & Smith, 1972; Teo, 2012]—would best approximate Bronfenbrenner's preference for research that embraces the complexity of development. Utilizing HLM for data analysis would allow for the exploration of the nested nature of variables such as child, class, and school [Draper, 1995]. As Osborne [2000] notes, HLM makes no presumption of variable independence and avoids the tendency to minimize the effect of either individual student or group effects characteristic of aggregation and disaggregation respectively. This process, well-suited to analyzing quantitative data within literacy research, is able to incorporate multiple variables within each level of "nesting," can be used with cross-classified data (e.g., student school and student neighborhood), and can demonstrate development over time [Beretvas, 2004]. HLM is able to determine differences in and across clusters and explain the percent of variance associated with each [McCoach, 2010].

This analytic approach has been employed in studies using Bronfenbrenner's theory. Connor, et al. [2010] used HLM to account for the relationship between individual student

variables such as literacy skills or problem behaviors and classroom variables such as time spent in instruction. Connor et al. [2012] used this approach to explore connections between individual student variables, such as content-area knowledge or vocabulary, and classroom variables such of type and amount of science instruction. Nevertheless, as noted earlier, neither of these studies offers detailed information about the proximal processes occurring in the instructional settings: to what extent they grew in complexity or affected teachers as well as students. These aspects might be included in the HLM calculations, as well.

Conclusion

In this paper, I reviewed Bronfenbrenner's bioecological systems theory and traced the way in which it has been applied in literacy research to date. Then I provided a visual representation, relevant for literacy as well as more general developmental research, that captures the nuances of his work. Next, I offered an example of how this representation served as a foundation for a small-scale study that included many of the aspects of Bronfenbrenner's theory. That study demonstrated that student literacy strengths and challenges, the proximal process interactions with a tutor and with peers, the role of home and classroom microsystems (as well as their mesosystem interactions), various exosystem and macrosystem factors, and the historical time period held the potential for explanatory power in the children's literacy engagement and achievement. Finally, I speculated on the ways in which exploratory research such as that described might inform larger-scale confirmatory research.

Bronfenbrenner was not, nor did he purport to be, a literacy scholar. One will not find within his work specific recommendations for assessment strategies, instructional practices, or advice on engagement with text. What he does offer, however, is a view of experience as a

complex and nuanced process amenable to systems thinking: a view that applies to the field of literacy as well as to development writ large.

Acknowledgements

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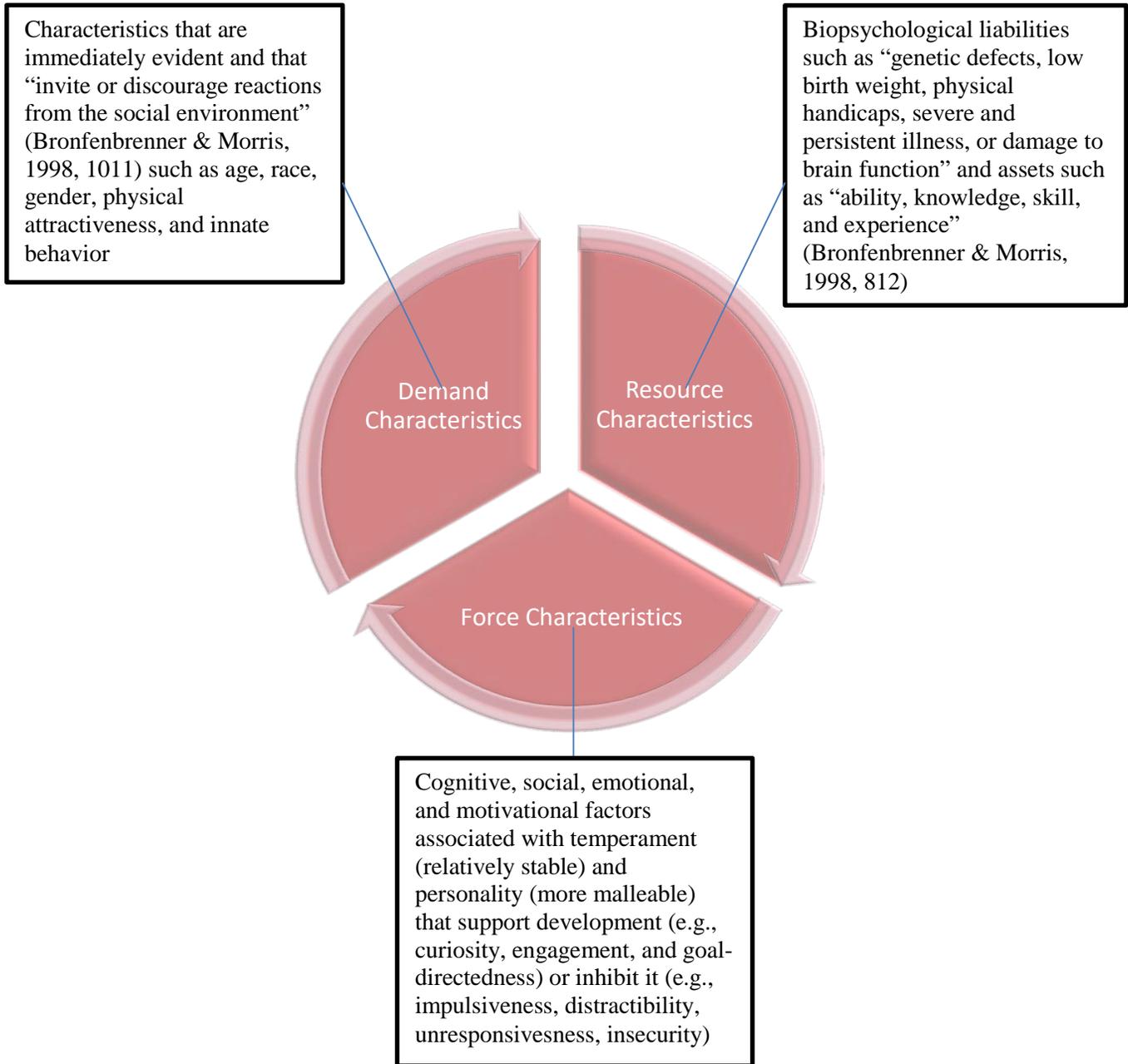
    10.1016/j.ijedudev.2013.10.002

Characteristics that are immediately evident and that "invite or discourage reactions from the social environment" (Bronfenbrenner & Morris, 1998, 1011) such as age, race, gender, physical attractiveness, and innate behavior

Biopsychological liabilities such as "genetic defects, low birth weight, physical handicaps, severe and persistent illness, or damage to brain function" and assets such as "ability, knowledge, skill, and experience" (Bronfenbrenner & Morris, 1998, 812)

Demand Characteristics

Resource Characteristics

Force Characteristics

Cognitive, social, emotional, and motivational factors associated with temperament (relatively stable) and personality (more malleable) that support development (e.g., curiosity, engagement, and goal-directedness) or inhibit it (e.g., impulsiveness, distractibility, unresponsivesness, insecurity)

Figure 1: The reader's personal characteristics

Teacher, tutor, peer, etc.

Teacher/tutor/peer characteristics will be as variable as the reader's: e.g., patient, committed, and knowledgeable vs. impatient, distant, and unprepared

Reader

Literacy Practices

Text

Activity

Text characteristics include: genre, vocabulary load, structure, syntactic complexity, font type and size, presence or absence of pictures, paper/ink vs. digitalized print

Activity characteristics include: open-ended vs. closed, individualized vs. collaborative, authentic vs. contrived, meaning-constructing vs. reproductive, print-based vs. multimodal
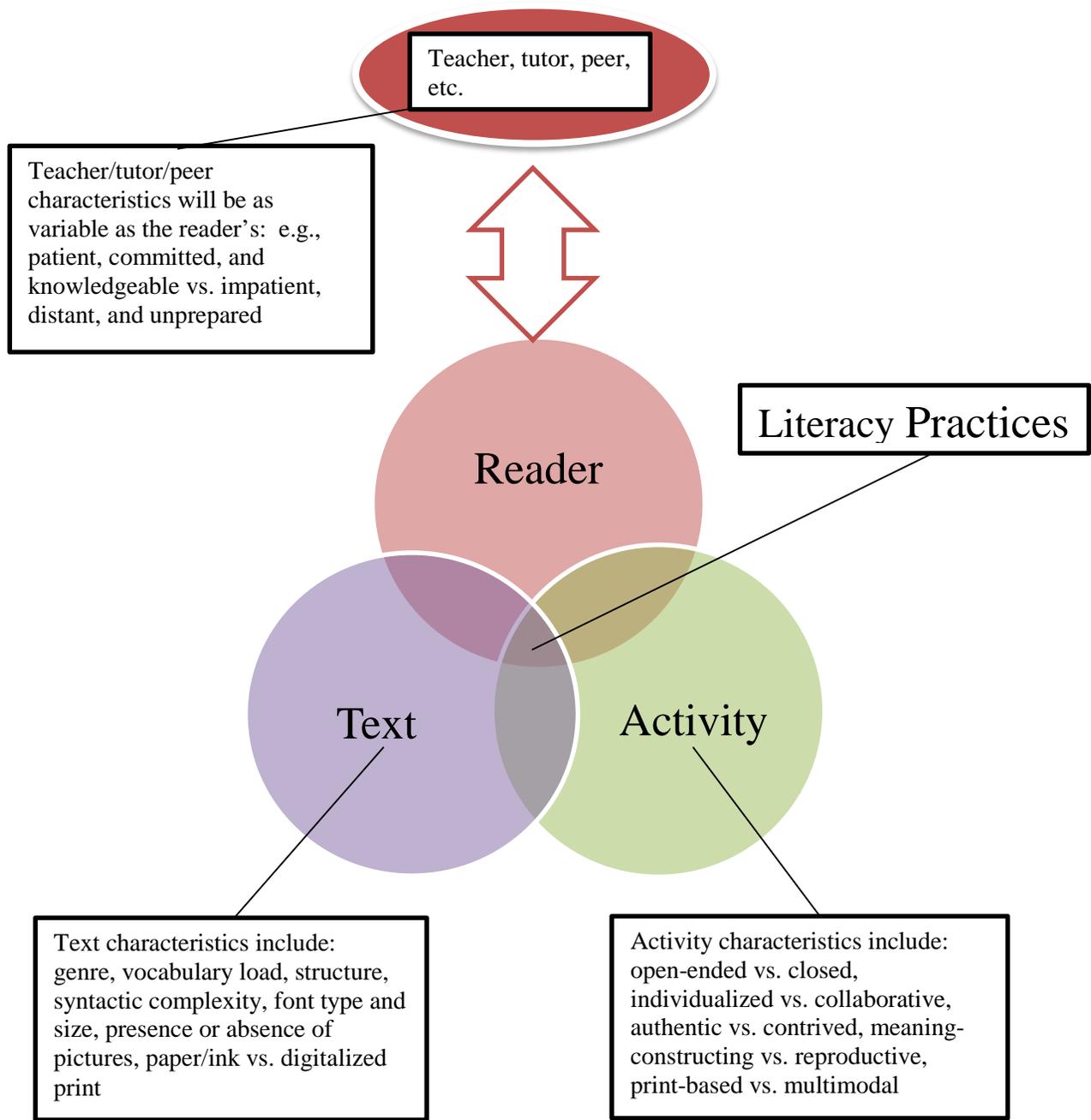
Figure 2: The reader within a school-based proximal process
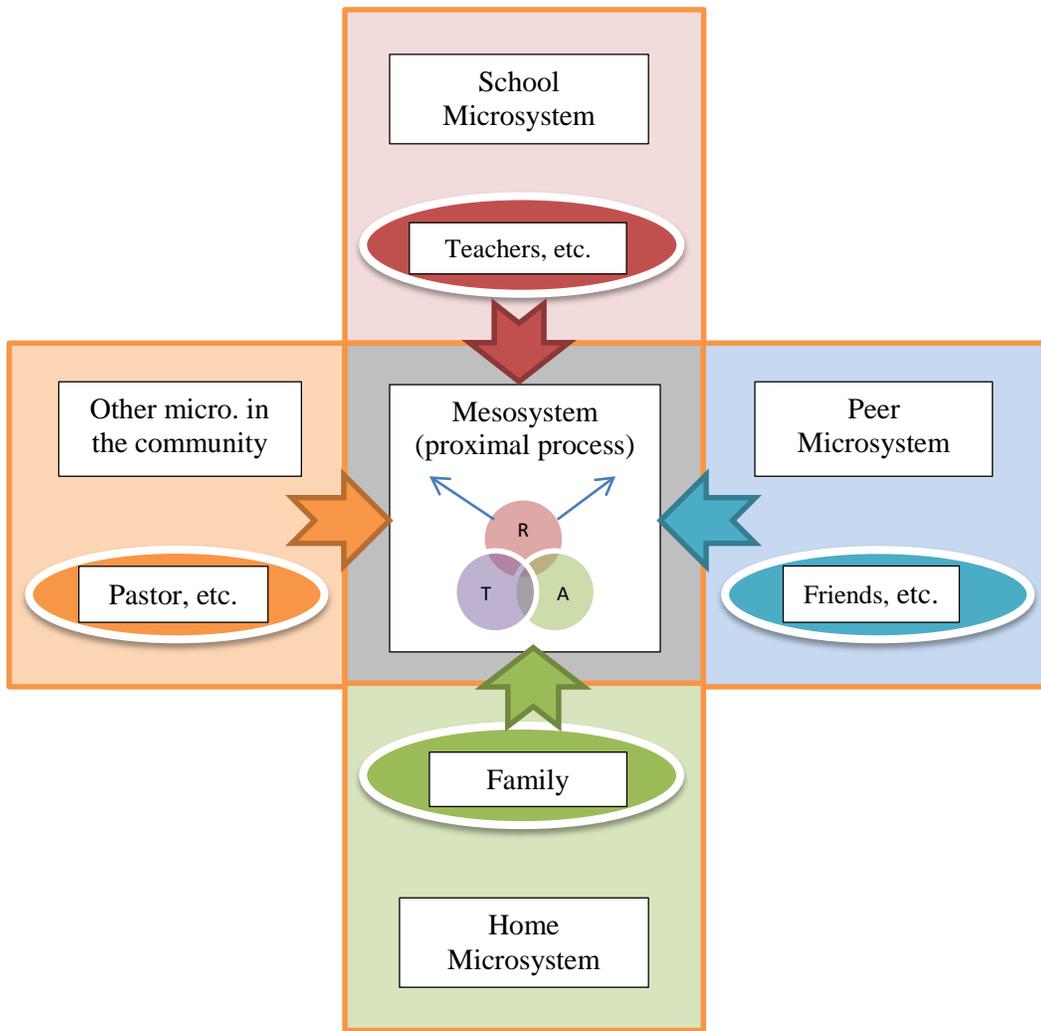
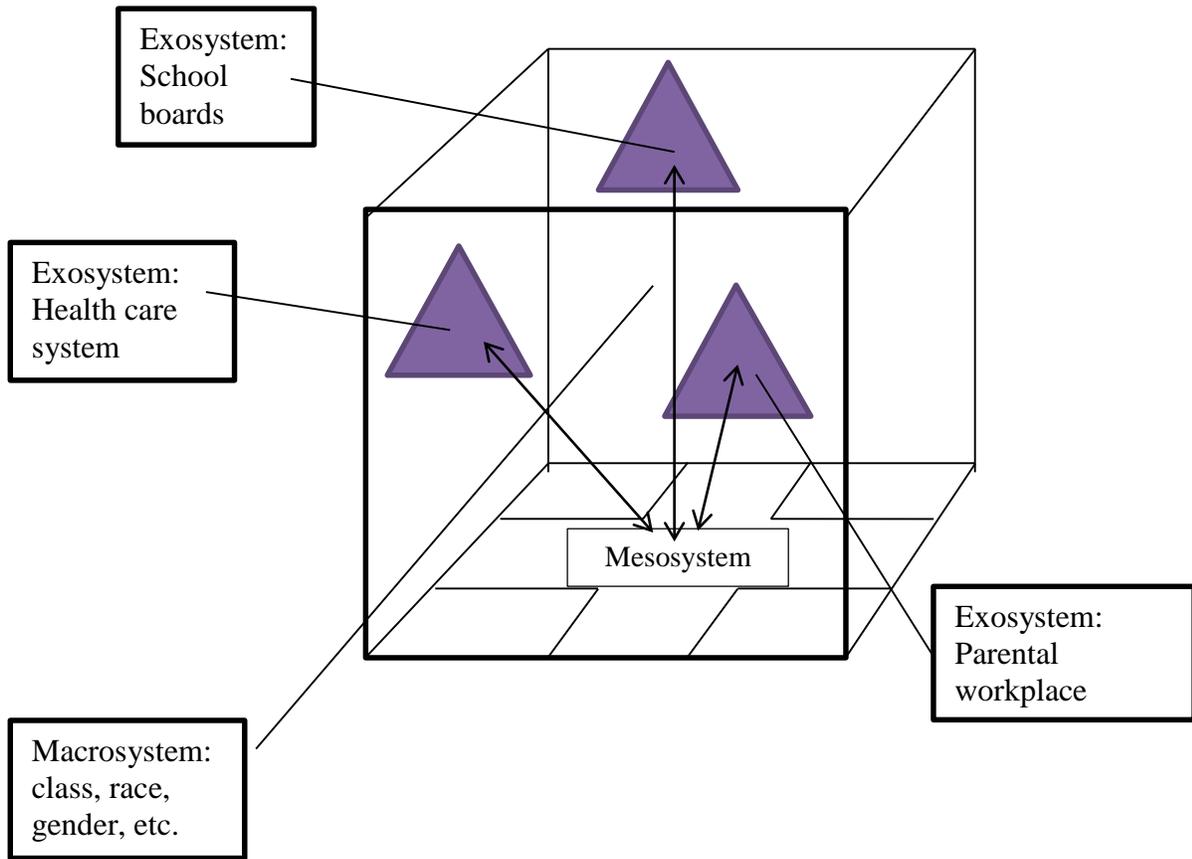**Figure 3: The literacy mesosystem (interaction of microsystems)**

Figure 4: The impact of exo- and macrosystem forces