Developmental Linear and Nonlinear Patterns of Loneliness: A Literature Review

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Abstract

A review of literature related to loneliness in children and adolescents revealed that this multidimensional phenomenon contains different developmental patterns. These patterns are developmental changes that occurred systematically in linear or nonlinear forms. The study of well-documented research showed that the patterns of loneliness in children and adolescents change in terms of different cognitive, emotional and social factors. In this paper, it was deduced that when only one aspect of loneliness is studied, the probability of linear patterns will increase, whereas, inserting different dimensions of loneliness or other factors into the study will change the patterns of loneliness from linear to nonlinear. It was also demonstrated that loneliness is not well-adapted to the growth model of development (GMD). Amongst various aspects of loneliness, the cognitive aspect of loneliness is more adaptable to linear pattern rather than its social aspect.

Scientists believe that all events in the universe do not occur haphazardly. The events are the result of prior causal factors. In the world of mathematics and physics, when we say Y happens if X happens (or Y is the function of X), it indicates that there is a logical relation between X and Y, and this relation is not coincidental. Even in chaos theory the term of ‘butterfly effect’ indicates that there are
causal relations between phenomena (Bishop, 2009), although chaos theory hardly follows the principle of predictability (Hoefer, 2010). This logical relationship is a general rule which is identified as one of the features of determinism. Even in the science of probability, incidents follow the rules of determinism and predictability. However, probabilistic rules are not definite. Determinism is a “doctrine or a definite assumption that posits all events, physical or mental, including all forms of behavior are the result of prior causal factors” (Corsini, 1999, p. 270). It is also defined as the principle of sufficient reason. That is, “everything has a sufficient reason for being and being as it is, and not otherwise” (Leibiz’s view cited in Hoefer, 2010, p. 2). The principle of sufficient reason indicates determinism (Hitchcock, 2011).

In addition to determinism, science follows another significant assumption which is “regularity” or “order”. This assumption expresses that there are logical regularities (orders) among phenomena that scientists tend to find, describe and explain them within theories. The implication of these theorems is that there are systematic prototypes of relationships among phenomena which are named “ordered patterns”. These ordered patterns amongst all phenomena, physical or mental, lead scientists to establish rules, either in definite ways or in probabilistic models. Since the order among phenomena is not just linear, nonlinear order can be identified between events; both characterize the patterns of relations among phenomena. Specifically, in linear patterns there are equations whose graphs are straight lines which are also named in mathematics linear functions, such as Y=mx + b. In contrast to linear patterns, nonlinear patterns do not have graphs with straight lines and deals with cubic functions such as Y = ax³ + bx² +cx + d, a ≠ 0 or quadratic functions such as Y=ax² + bx +c, a ≠ 0. Fortunately, there is a chance given to humans by Mother Nature: that is, scientists can explore these ordered patterns, and describe them in integral models.

Reviewing psychological and developmental studies (Baumeister, 1988; Matthews, 1982; Shields, Cohen, & Parra, 2011) reveals that researchers are interested in finding patterns in mental phenomena. This interest is rooted in the nature of science, in which exploring, characterizing and capturing, and explaining systematic prototypes among human phenomena within a theory is central (Wiersma et al., 2009). In this regard, the purpose of this paper is to explore the linear and nonlinear patterns of loneliness as a multidimensional phenomenon. The basic assumptions underlying this purpose are:
1) The nature of physical and mental phenomena follows two principles: “determinism” and “regularity” (order).
2) The law-like regularity emerges from logical patterns among phenomena.
3) Each developmental phenomenon is the result of prior causal factors.
4) The patterns of physical and mental phenomena such as loneliness are either linear or nonlinear.
5) The linear and nonlinear patterns of phenomena can be deduced by virtue of empirical methods, analytical-deductive methods or a combination of qualitative and quantitative methods: e.g., empirical-phenomenological method (Berguno, Leroux, McAinsh, & Shaikh, 2004).
6) Apart from the general models of human development theorized by grounded theories (Demetriou et al., 1998, pp. 9-13), each phenomenon like “loneliness” can be composed of different developmental patterns either adaptable with a general model of development or not.

Since in the dynamical system model both linear and nonlinear patterns can be expected (Bishop, 2009), and because the psychological system of human is a dynamic system, it is assumed that loneliness as a psychological phenomenon has both linear and nonlinear patterns depending on developmental influential factors and trajectories. Therefore, based on these assumptions and through reviewing scholarly research, the genetic, social and cognitive patterns of loneliness in children and adolescents are studied developmentally.

**Loneliness**

Loneliness is defined as a core condition of emotional pain that appears when an individual feels misunderstood or rejected by others (in children it happens mostly by peers or family members), and the main characteristic of this feeling is a sense of not having proper “social partners for interpersonal activities, particularly activities that give children the sense of social integration for emotional intimacy” (Solomon, 2000, p.161). Regarding childhood loneliness, this phenomenon is also defined as “an affective experience in which the individual is aware of being apart from others and vaguely aware of needing others, along with the experience of having social relations that are not emotionally supportive or satisfying either quantitatively or qualitatively” (Tur-Kaspa et al., 1998, cited in Allen-Kosal, 2008, p. 2).

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Most definitions of children’s loneliness have emerged from the way children describe and experience their loneliness. A review of children’s descriptions reveals that three components are involved in loneliness: distressed feelings, social rejection, and references to self (Chipuer, 2004). These components demonstrate that loneliness in children is a multidimensional phenomenon including cognitive, affective and social dimensions. A review of literature related to children’s and adolescents’ loneliness reveals that this multidimensional phenomenon has different developmental patterns (Bullock, 1998; Chipuer, 2004; Hawkley & Cacioppo, 2010; Galanaki, 2004; Shields, Cohen, & Parra, 2011; Solomon, 2000).

Similar to changes in social needs across development, loneliness changes through development with systematic patterns. For example, Kochenderfer-Ladd (2001, cited in Shields et al., 2011) have demonstrated that the “pattern of change in loneliness during kindergarten and from kindergarten to grade three has stability” (p.26). Contrary to the middle childhood, this pattern of change in loneliness increases sharply during adolescence. The literature on loneliness in children and adolescents reveals that this phenomenon has different linear and nonlinear patterns in genetic, social and cognitive domains.

**Genetic Patterns of Loneliness**

Neuropsychologists, biologists and the other experts who concentrated on biological factors of loneliness are also interested in finding the genetic patterns of loneliness. They use different variables (e.g., genes, gender, age, twins, or comorbidity with other disease such as depression) and methodology to study the possible patterns of loneliness genetically. A study regarding loneliness involving 8000 Dutch twins shows that “genetic factors can contribute 48% of the variance in loneliness for adults (average age 32.7 years) and 50% for children” (Boomsma et al., 2005, cited in Allen-Kosal, 2008, p.12). This range of variance shows that in both adults and children almost 50% of variation of loneliness is genetically expected. To support this idea, it is noted that half of the component of loneliness in children and adults is approximately genetic with estimation of 48% to 55% (Van Roekel, Scholte, Verhagen, Goossens, & Engels, 2010, p. 747). When 5-HTTLPR genotype (a functional polymorphism in the promoter region of the serotonin transporter gene) in longitudinal research was studied (Van Roekel et al., 2010, p. 752), it was found that the developmental changes in adolescents’ loneliness have genetic underpinning occurring in a systematic pattern. Since 5-HTTLPR genotype has two forms, short allele and long allele, these genotypes are assumed to
create two different patterns of development in adolescents’ loneliness. Adolescents with a short allele display stability in their loneliness over time, whereas adolescents with a long allele show decrease in their loneliness (Van Roekel et al., 2010, p. 752). In adolescence, both patterns of change are linear, rather than nonlinear (see figure 1). These patterns were found in both genders, but in Van Roekel’s et al. study girls showed more stability in loneliness than boys.

![Figure 1: The development of loneliness for the different 5-HTTLPR genotypes (adapted from Van Roekel et al., 2010 p.752)](image)

Apart from the genetic studies (e.g., 5-HTTLPR genotype -Van Roekel’s et al., 2010), the patterns of stability and instability of loneliness were supported by non-genetic studies (Sheilds et al., 2011). For example, it has been found that there is “a general stability in loneliness during kindergarten and from kindergarten to third grade of school age” (Kochenderfer-Ladd et al., 2001, cited in Sheilds et al., 2011, p. 26); in contrast, “this pattern increases sharply during early adolescence” (Fontaine et al., 2009, cited in Sheilds et al., 2011, p. 26). This pattern is shown hypothetically in figure 2.
These findings show that loneliness follows a relatively linear pattern in the first stages of development (childhood and early adolescence). However, based on Van Roekel’s et al. (2010) study and Fontaine’s et al. (2009, cited in Sheilds et al., 2011, p.26) research, it can be deduced that when the whole trajectory of loneliness from childhood to late adolescence is scrutinized, the developmental pattern of loneliness appears to be relatively nonlinear. These changes are shown hypothetically in figure 3.
Regardless of the role of genotype and gender, the comorbidity of loneliness and other disorders such as depression has motivated researchers to study the interactional patterns between loneliness and other disorders. Considering the association between loneliness and depression, and because depression has genetic roots, researchers assumed that loneliness has genetic foundations (Qualter, Brown, Munn & Rotenberg, 2010). This view comes from the fact that loneliness has a “pattern of sequential comorbidity with depression” (Qualter et al. 2010, p. 498). This pattern emerges from the positive linear correlation between loneliness and depression (Brage, Meredith, & Woodward, 1993) or between loneliness and most depression symptoms that show a strong type of comorbidity (Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006).

All these findings reveal that biological aspects of loneliness follow genetic and linear patterns in the cross-sectional study of development (e.g., adolescence), with the exception of some stages of development (e.g., from childhood to late adolescence). If we assumed that the whole trajectories of loneliness from childhood to late adolescence follow a relatively nonlinear pattern, it is deduced that loneliness as a unique phenomenon is not completely harmonized with the growth model of development (GMD) in which it is assumed that development has a linear pattern throughout the life-span as it is hypothetically shown in figure 4. According to GMD, development is seen as being “genetically programmed and directed by processes of maturation” (Demetriou et al, 1998, p.10). Regarding the genetic foundations of loneliness, it is assumed that loneliness is also genetically programmed and is “beneficial for the evolution of organism similar to other biological constructs such as thirst, hunger or physical pain” (Cacioppo et al., 2006, cited in Masi, Chen, Hawkley & Cacioppo, 2011, p. 219), but loneliness is not directed by maturation in a linear pattern completely through the life-span.

![Figure 4: Growth model of development](Demetriou et al, 1998 p.11).
Although loneliness has been assumed to be an inherited state of distress, it is influenced and activated by social factors such as positive or negative peer functioning. For individuals of all ages, patterns of change in loneliness may occur as a function of immigration (Kirova, 2001), positive or negative peer functioning (Sheilds et al., 2011), or losing parents or friends. Additionally, it is demonstrated that children’s early social and emotional experiences happen in the context of the family; therefore, the quality of parent-child relationships play a powerful role in the development of children’s loneliness. Considering the influence of social factors on loneliness (Solomon, 2000), it is reasonable to expect nonlinear patterns in the social domain of loneliness.

Nonlinear Patterns in Social Aspect of Loneliness

The experience of loneliness (e.g., frequency of painful loneliness) is related to social interactions between individuals (Chipuer, 2004; Solomon, 2000; Galanaki, 2004; Sheilds et al, 2011). It also has a positive correlation with physical separation (e.g., loss, dislocation, and temporary absence), and psychological separation (e.g., conflict, rejection, broken romantic friendship) as well as association with social withdrawal (Allen-Kosal, 2008). In other studies, it is demonstrated that the quantity and the quality of relationships play permanent roles in both understanding and experiencing loneliness (Masi et al., 2011). For example, friendship, as a type of social interaction that follows changeable patterns, influences loneliness across human development in two qualitative and quantitative ways. Friendship is a “form of close relationship that involves enjoyment, acceptance, trust, respect, mutual assistance, confiding, understanding and spontaneity (Santrock, MacKenzie-Rivers, Leung, & Malcomson, 2005, p. 390). DiTomasso (2001, cited in Santrock et al., 2005) demonstrated that first-year university students who show higher rates of loneliness can overcome it as they make friends and adjust to university life. All these facts indicate the significant role of social interactions in loneliness.

In this regard, it is assumed that the social aspect of loneliness as a unique pattern will change during the different stages of development. This alteration can follow a nonlinear pattern which is supported by the changes that occur in two developmental domains: social and emotional. Considering the processes of development, the experience of loneliness in young children (especially in kindergarten) happens when they are physically separated from others or when the number of friends (especially in interpersonal activities like play) decreases remarkably. During late childhood and adolescence, this trend is reversed; that is, not only
the number of friends, but also the quality of friendship influences the experience of loneliness. Especially for adolescents, the quality of friendship (e.g., intimacy, love, and romance) is more important than the number of friends. This hypothetical nonlinear pattern is shown in figure 5:

In addition to the social aspect of loneliness, self and emotional aspects are central to this study in order to find the patterns of change in loneliness through development. These aspects refer to the degree to which children understand the meaning of loneliness and how they experience loneliness emotionally. It has been found that children use three references to explain their experiences of loneliness: self-reference, social-reference, and emotional-reference (Chipuer, 2004; Masi et al., 2011). For example, in self-reference they use the following features of their experiences: ‘not being taken for who you are’, ‘being in your own world’, and ‘being different’.

Their emotional description of loneliness consists of feeling silly, empty, upset, disappointed, and depressed, whereas their social description includes having no one with whom to talk, having no friends, and having no one with whom to play (Chipuer, 2004; Galanaki, 2004; Solomon, 2000). When the age of participants and their experiences of loneliness are scrutinized, a developmental pattern can be deduced. This pattern shows that children tend to
attribute their experiences of loneliness to social factors, especially in middle childhood, whereas, adolescents tend to attribute their experiences of loneliness to their “selves” (self-reference). The process of changes in their description of loneliness reveals very interesting nonlinear patterns which are assumed to be related to the multidimensional aspect of loneliness. Furthermore, these patterns of development can be demonstrated by changes that occur in self-image and self-concept during adolescence. These hypothetical patterns can be shown as in figure 6.

![Figure 6: Hypothetical patterns of social, emotional and self references of loneliness](image)

**Cognitive Pattern of Loneliness**

The degree to which children perceive, conceptualize or understand their own emotional states represents children’s cognitive ability in expressing and explaining their various emotional experiences. Researchers tend to name this ability “emotional expressiveness”. This term represents an ability with which children identify, analyze, and explain their understanding of emotional experiences (Bosacki, 2007). The key point in this issue is how this ability develops through the life-span, especially through childhood and adolescence. Regarding the feeling of loneliness, contemporary studies reveal significant facts about how children understand the concept of loneliness, as well as its differences from other concepts such as aloneness and solitude (Chipuer, 2004; Galanaki, 2004).

Some researchers demonstrated that children aged 4 to 11 have a clear understanding of being lonely, and that they are even able to distinguish among different feelings of loneliness, being alone, and solitude by giving clear description of their feelings and situations (Bullock, 1998). This understanding of loneliness becomes
clearer with age (Galanaki, 2004; Solomon, 2000). The current view of children’s understanding of loneliness is more compatible with cognitive developmental trajectories through which children experience and describe loneliness based on their cognitive ability which follows a general linear pattern.

In the processes of cognitive development, children’s perceptions of loneliness are reliant on physical circumstances surrounding them such as the number of friends or peers on the playground, whereas adolescents have more metaphoric descriptions of loneliness; for them the quality of relationship is a major determinant of feeling lonely or alone. This metaphoric description stems from abstract thinking which is characterized during adolescence. Since this ability (abstract thinking) is directly related to “concepts” which are the constituents of thoughts (Eric & Stephen, 2011), the role of language in an individual’s descriptions of mental or cognitive states should be considered. Regardless of the fact that some concepts are dealing more with the emotional domain or that they seem to be more emotional rather than cognitive (e.g., sadness, happiness, dejection or loneliness), the understanding of the meaning of those concepts is more cognitive. Therefore children’s ability to conceptualize loneliness is more cognitive and dependent on language development which follows linear cognitive patterns (see the hypothetical figure 7). Often cited studies demonstrate this pattern perfectly. For example, researchers indicated that children’s awareness of differences among “loneliness”, “aloneness” and “solitude” will increase from childhood to adolescence (Chipuer, 2004; Masi et al., 2011; Solomon, 2000).
Sequential Cyclic Patterns of Loneliness

Examination of the association between loneliness and other emotional, cognitive and social phenomena reveals noteworthy sequential cyclic patterns. For example, the relationship between loneliness and peer rejection (Shields et al., 2011; Goswick & Jones, 1982, cited in Chipuer, 2004) or the association among loneliness, peer rejection and bullying (Berguno, Leroux, Mcainsh & Shaikh, 2004) shows that there is a sequential cyclic pattern in the social domain of loneliness. For example, peer rejection can create the feeling of loneliness and then this emotion generates more social isolation. Subsequently, the separation of lonely individuals from peers increases the feeling of loneliness within a dysfunctional cyclic pattern (see figure 8).
Since loneliness is affected by different factors and can also have an effect on various behaviours (Allen-Kosal, 2008; Masi et al., 2011), it is assumed that when different variables are taken into account, the sequential cyclic patterns of loneliness become more complex. An example of this complexity can be found in Hawkley’s and Cacioppo’s (2010) model of loneliness. This model displays a sequential cause-and-effect pattern. They argue that perceived social isolation is equivalent to insecure feeling. This unsafe feeling can generate a type of hyper vigilance by which an individual tends to perceive additional social threats from the environment. This perception activates negative cognitive biases through which they feel more anxious with negative social expectations. Accordingly, lonely individuals try to withdraw from others, leading to mental disorders because they feel that their environment is threatening and withdrawal is the best strategy (see figure 9). The consequences of this pattern are many, and include mental health difficulties such as “hostility, stress, pessimism, anxiety and low self-esteem” (Hawkley & Cacioppo, 2010, p. 220).
The structural equation procedure (SEP) is one of the effective methodologies by which sequential cyclic patterns between phenomena are studied. Using this method, Prezza, and Giuseppina Pacilli (2007) demonstrated that there is a unique pattern of relationship among fear of crime, sense of community, and loneliness. In this pattern, play and autonomous mobility were estimated to be effective predictors within the relationship. In their study, it was found that “more autonomy and play in public areas during childhood influences more intense neighborhood relations, a stronger sense of community, and less fear of crime and, in turn, these latter variables consequently reduce feelings of loneliness during adolescence” (p. 165). Scrutinizing these studies reveals that when the covariance of multiple variables with loneliness is studied, the patterns of relationship tend to be more complex, nonlinear and sequential.

**Conclusion**

Based on the reputable studies used in this paper, the following points can be summarized: 1) loneliness as a multidimensional phenomenon has different linear and nonlinear patterns in terms of cognitive, social and genetic factors; 2) when only one aspect of loneliness (e.g., cognitive aspect) is studied, the chance of linear patterns will increase, whereas inserting different dimensions of loneliness synchronously into the study will change linear patterns to nonlinear ones; 3) the scrutinizing of current studies of loneliness revealed that loneliness is not completely adaptable to the growth
model of development; and finally, 4) the cognitive aspect of loneliness is more adapted to linear patterns rather than its social aspect. Although some patterns were discussed, many related patterns remain to be explored (e.g., by adding different variables such as gender). Therefore, it is suggested that the developmental patterns of loneliness and its adaptation to general models of development should be studied empirically.
References


