



Advancing understanding of person-environment interaction in later life: One step further



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ABSTRACT

Purpose: This paper reconsiders the existing conceptual frameworks and models in environmental gerontology and takes a step forward towards a comprehensive and integrative understanding of person-environment (P-E) exchange processes in later life.

Design and methods: After briefly reviewing key existing models and important developments in the field, we move forward towards conceptual optimization and specification emphasizing on the processes of P-E exchange, outcomes of these processes and consideration of time, illustrated with three scenarios. The paper concludes with an outlook on future directions.

Discussion and implications: The conceptual framework presented here advances previous theoretical work in P-E exchange in later life by incorporating the constructs of agency and belonging representing the processes, identity and autonomy as outcomes and linking them with the primary components, i.e. individual, social, built environmental and technological factors. Case studies of older adults' representing a range of functional status in multiple settings illustrate the application of the conceptual framework's key components. The framework also explicitly addresses the relevance of the temporal aspect in P-E exchange.

Introduction

Environmental gerontology emerged during the 1960s with now-classic work of Lawton and Simon (1968), stating the environmental docility hypothesis, which provided a better understanding of the interrelations between older persons and their physical-social environments, and how these relations shape outcomes in later life (e.g., Wahl & Gitlin, 2007; Wahl & Weisman, 2003). Over 25 years have passed since Parmelee and Lawton diagnosed environmental gerontology to be in a “languishing state” ((Parmelee and Lawton, 1990) (p. 483), both with respect to its conceptual foundation as well as the related empirical evidence. Since then the field has substantially grown conceptually and empirically, as can be seen in core publications over the last two decades (e.g., Golant, 2011; Rowles & Bernard, 2013; Rowles & Chaudhury, 2005; Wahl, Iwarsson, & Oswald, 2012). An overview of conceptual developments in environmental gerontology over the last two decades has been presented earlier, for instance in Handbooks (e.g., Scharlach & Diaz-Moore, 2016, chap. 21; Scheidt & Windley, 2006; Wahl & Oswald, 2010, 2016) or Annual Reviews (e.g., Chaudhury & Oswald, 2018; Wahl, Scheidt, & Windley, 2004).

Lawton and Nahemow (Lawton, 1998; Lawton & Nahemow, 1973) initially described behavior and well-being primarily as a function of the level of personal competence and environmental press which evolved as the Ecological Theory of Aging (Scheidt & Norris-Baker, 2004) and offers high empirical value for various sub-group populations and setting types (e.g., Wahl et al., 2012; Wahl & Gitlin, 2007). Other theoretical concepts that address the level of P-E fit or lack thereof on several domains of P-E exchange include the congruence model of P-E fit suggested by Kahana (1982) and the complementary/congruence model proposed by Carp and Carp (1984). A critical message inherent in P-E fit concepts is that the level of behavioral competence in a certain domain corresponds with the given level of environmental press (e.g., barriers at home), leading to adaptation (fit) versus maladaptation (lack of fit). This also means that establishing qualified P-E fit assessment opens a major research and practice perspective for those who are especially at risk in later life (e.g., Iwarsson & Slaug, 2001, 2010).

Experiential processes of P-E exchange are grounded in conceptualizations and theories of residential satisfaction addressing, for instance, variations in subjective global evaluations of the residence

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due to age of the inhabitant, geographic location, or manifestation of place evaluation processes (Aragonés, Francescano, & Gärling, 2002; Pinquart & Burmedi, 2004), although criticized due to its normative character and ceiling effects (Fernandez-Ballesteros, 2001). Theories of place attachment and identity (Altman & Low, 1992; Rubinstein & Parmelee, 1992) emphasize experiential aspects in a more differentiated way. Place attachment is not only related to attitudes, but also to a gamut of processes operating when people form affective, cognitive, behavioral and social bonds to the environment (Brown & Perkins, 1992), thereby transforming “space” into “place” (Altman & Low, 1992; Rowles, 2006; Rowles & Watkins, 2003).

Cognitive and emotional links with a place (in particular, home) may become manifest through processes of reflecting on the past, symbolically represented in certain places and cherished objects within the home (e.g., “embeddedness”; Rubinstein, 1989, 1990). Place attachment and meaning of place have been empirically explored mainly via qualitative methods (Rowles, 1983; Rubinstein, 1989, 1990; Sixsmith & Sixsmith, 1991), but there have also been efforts to quantify aspects of the meaning of home (Kaspar, Oswald, & Hebsaker, 2015; Oswald & Kaspar, 2012). More recent conceptual models have attempted to comprehensively address both behavioral and experiential P-E processes in later life. Golant’s model of Residential Normalcy emphasizes residential decision-making processes in later life from an individual perspective by highlighting subjective environmental experiences of residential comfort and mastery, as well as related adaptive coping strategies to maintain or achieve residential normalcy (Golant, 2011), most recently with particular respect to smart technologies (Golant, 2017).

The overall goal of this paper is to take a step forward towards a more complex, comprehensive and integrative understanding of person-environment (P-E) exchange processes in later life.

A conceptual framework

As we move forward to a more comprehensive and integrative conceptual understanding of P-E exchange in later life, two overriding issues emerge. First, there is a need to link existing theoretical understanding based on the broad notion of ecology of aging with a more concrete accounting of the role the physical or built environment as a tangible and concrete reality. Although, the physical environment has been part of several noteworthy conceptualizations, e.g., by Bronfenbrenner (Bronfenbrenner, 1979), Lawton, Golant, Wahl, Weisman and others, aspects of the physical environment in terms of a coherent and integrated “place” (e.g., housing, healthcare settings, work environments, neighborhood) and specific physical environmental characteristics (e.g., urban form, land use, streetscape, housing density, spatial layout of home, interior design) tend to get overlooked (e.g., Scharlach & Diaz-Moore, 2016, chap. 21). Second, we believe that the conceptualization of P-E interchange process could benefit from an explicit incorporation of the cognitive-affective-behavioral dimensions following prior seminal work by Graham Rowles, Bob Rubinstein, Malcom Cutchin and others (e.g., Cutchin, 2004; Rowles, 1983; Rubinstein, 1989), that characterize the *underlying purpose* of any exchange (e.g., independent functioning, social interaction, mobility). It is important to contextualize and ground the abstract conceptualizations of P-E exchange process in activities of daily living and lifestyle behaviors to increase the relevance of a conceptual framework for empirical research and applied decision-making.

In this paper, we build upon the conceptual framework presented by Wahl and Oswald (2010, 2016, chap. 31, most comprehensively presented in Wahl et al., 2012) and incorporate additions to address the two issues discussed above. This framework has been selected for expansion as it has several notable strengths, which can be capitalized on as we move forward to a more comprehensive framework. The key components and strengths of that model include: linking ecology of aging theory with human development theory, incorporation of agency-

belonging (A-B) dynamic, and inclusion of a life course perspective. All of these threads of that framework expand our understanding of the P-E exchange as a more holistic and dynamic phenomenon. However, a critical look at the framework suggests a few areas of potential expansion. For example, to address the first aim, the tangible role of the physical environment on the P-E processes is not distinctly identifiable in the construct of “environmental resources” (see Wahl et al., 2012). “Environment” is conceptualized as representation of both physical and social environments, as a corollary to the understanding of ecology of aging. It would be useful to disentangle P-E resources to have a clearer understanding of the dynamic interplay between *individual* characteristics and the *physical and social environmental* features. In other words, it is important to more explicitly address the role of the *raw materials* of P-E exchange as we delve into the discussion of the *nature* of the PE exchange process. With respect to the second aim, an additional area for possible conceptual advancement from the Wahl et al. (2012) framework is to dig deeper into the nature of agency and belonging dynamic. For example, one could raise the question: how is agency-belonging interplay influenced by the external versus internal processes, i.e. influence of environmental challenges and opportunities versus intrinsic or teleological needs in a life span developmental perspective and as well different between different P-E dimensions? These are some of the issues that we intend to examine in this paper as we move the discussion forward. Several related questions are worth exploring: how is agency-belonging interplay influenced by the external versus internal processes, i.e. influence of environmental challenges and opportunities versus intrinsic or teleological needs in a life span developmental perspective and as well different between different P-E dimensions? We delve into a few of these questions in the proposed conceptual framework presented here.

Our suggested framework (Fig. 1) has three interrelated sections: the components of P-E interaction, P-E processes and environment-related outcomes. P-E interactions represent four components that interact with each other at a fundamental level. These are: *individual characteristics*, *social factors*, *physical/built environment* and *technological systems*. These components have been addressed in an integrated way in previous conceptual work by several environmental gerontologists, including Wahl and Lang (2006), Calkins and Weisman (1999), and Rubinstein & de Medeiros, 2004. The ensuing P-E process directly draws from the Wahl and Oswald approach in bringing in the dialectic interaction between *agency* and *belonging*. In the current framework, we argue that in order to better understand A-B dynamics, it is important to address the specific dimensions of P-E interaction that emerge from the previous section. These dimensions are based on the function(s) or goal (s) of an interaction, e.g., independent functioning, social interaction, mobility, safety and security, continuity of self, or pleasure and joy. Contextualizing the A-B interaction process within these dimensions provide us a better grasp of the variability and patterns inherent in the range of A-B interactions. Finally, drawing from a developmental perspective, P-E interaction outcomes are captured with the broad concepts of *identity* and *autonomy* as interdependent dual outcomes without concealing potential other outcomes, such as social participation or wellbeing as it was specified in the model by Wahl et al. (2012). Our goal in this paper is to further explore the salience of identity and autonomy in the P-E exchange and its opposing trends (Wahl & Lang, 2004). In sum, this framework is based on four core assumptions for an enriched and more comprehensive understanding of P-E interaction:

- (1) Components of the person and the environment need to be made explicit in terms of their “ingredients” for this interaction;
- (2) The dynamic interplay between individual characteristics and environmental features reflects processes introduced as Agency and Belonging and underlying purposes of daily life;
- (3) Exchange processes between the person and the environment is considered with respect to outcomes of Autonomy or Identity;
- (4) The role of time is considered on the level of the distinct situation as

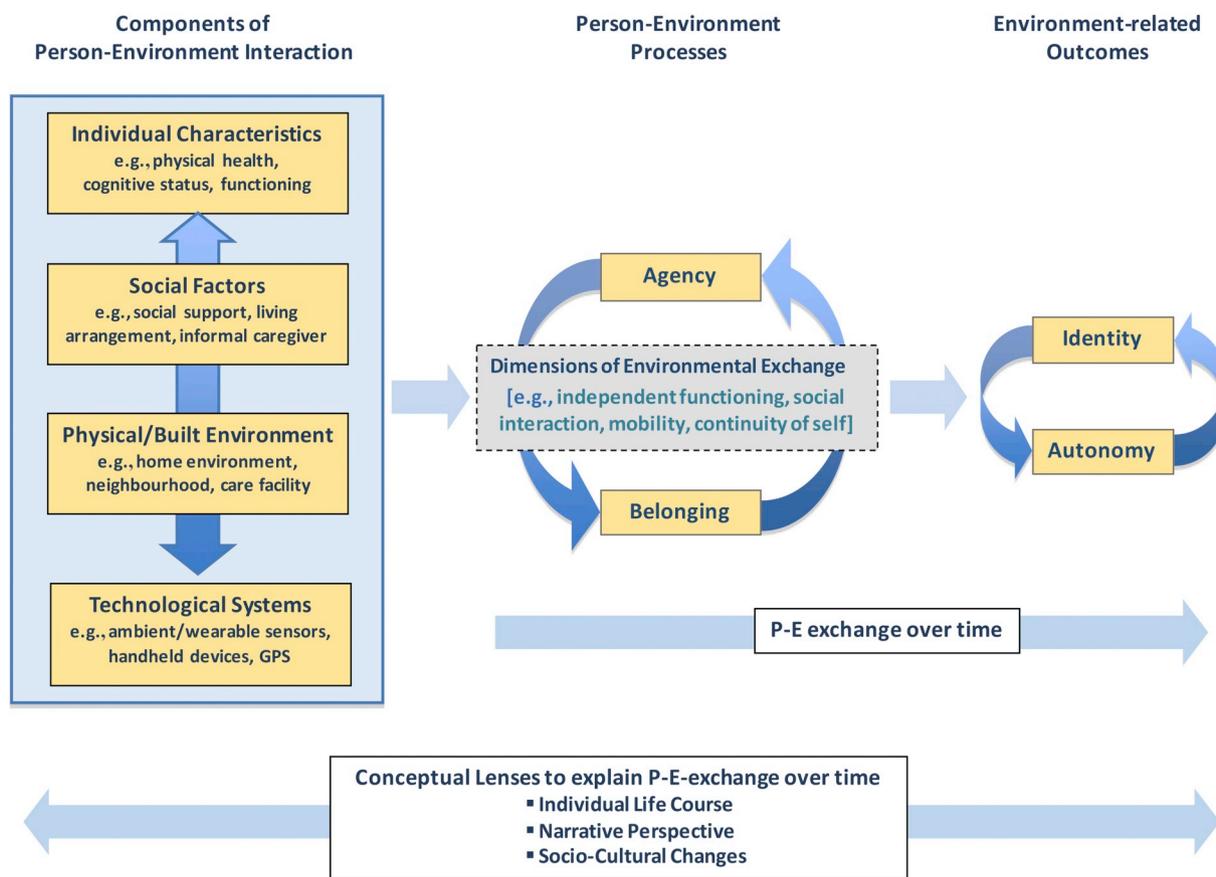


Fig. 1. An integrative conceptual framework of person-environment exchange.

well as on the levels of the individual life course and socio-cultural changes.

Primary components of person-environment interaction

An understanding of P-E interaction needs to begin with a discussion of the primary characteristics of the fundamental components and their interactions. The components of P-E interaction, i.e., individual characteristics, social factors, physical/built environment and technological systems need to be briefly identified here before a discussion on the nature of their interaction. First, we need to acknowledge the broad variability in older persons' physiological and psychological health status, sensory and motor capacities, functional capabilities, gender, age, ethnicity, class and personal psychosocial characteristics. In any given instance of P-E interaction taking place either at a cross-sectional time or across an extended time period, several factors including older adult's health status, functional capacity, socio-cultural background, life history, lifestyle, goals, preferences, interact in a multi-faceted and complex way with the physical, social and technological environments or systems. For the purpose of this paper, as per Dannefer, we define physical and social environment as "the totality of the diverse range of phenomena, events and forces that exist outside the developing individual" either linked to other persons or to the material and spatial sphere (Dannefer, 1992, p. 84). The physical environment, for instance home environments, neighborhoods, parks, seniors housing, care facilities, can be identified and taken into account in multiple ways, which include: scale (i.e. proximate, room, home, neighborhood, cityscape); environmental aspect (i.e. architecture or physical structure, spatial characteristics, interior design elements such as furnishing or lighting fixtures, sensory qualities such as sound or lighting); stability (i.e. fixed, semi-fixed or non-fixed features). There is no universally agreed upon definition of "social environment;" nevertheless, the social

environmental factors are generally recognized to include multiple levels of social contacts and relationships along with the quantity and quality of those relations. The social environment influences behavior by "shaping norms, enforcing patterns of social control, providing or not providing environmental opportunities to engage in particular behaviors, reducing or producing stress, and placing constraints on individual choice" (Institute of Medicine, 2003). Finally, the role of technology in influencing the quality of life for older adults has gained increased attention over the last two decades. The term "Quality of Life Technologies (QoLT)" has been introduced to focus on the effect of technology various aspects of individual QoL (Schulz, 2013).

In general, the existing conceptual frameworks or models in environmental gerontology (and perspectives in environment-behavior studies and environmental psychology) that include both physical and social environments tend to emphasize the physical over the social environment (see Wahl & Lang, 2004 for a thorough discussion on this topic). On the other hand, there are conceptualizations that attempt to address both physical and social contexts with equal merit, but the depth of analytical contribution tend to remain at a higher level of abstraction without any meaningful untangling of the diversity within either the social or the physical environmental factors. The role of social and physical environmental factors in interaction with each other depends on a variety of parameters, e.g., individual characteristics (i.e. physical health, cognitive status, biography, goals, preference), social factors (i.e. cultural norms, living arrangement, social support) and physical environmental features (i.e. home, neighborhood, urban space, barriers, sensory qualities). In addition, interaction and uptake with assistive and health related technology systems is an increasingly common occurrence impacting the quality of life. The unique combination of the parameters from these components represents a complex, multifactorial and dynamic interaction process that contributes to behavior and experience. Lastly, both theoretical understanding and

empirical evidence suggest that objective and subjective dimensions of P-E interaction need to be accounted for in order to have a comprehensive understanding (e.g., Oswald, Wahl, Schilling, & Iwarsson, 2007; Wahl & Oswald, 2010, 2016). Consequently, the nature on P-E interaction would be a result of a dynamic interplay, at the first level—between the objective-subjective aspects intra-personally, and the second level—between the person and the socio-physical environment.

Dimensions of environmental exchange - agency & belonging

In order to address the complex interactions of P-E processes in later life, we emphasize the interplay of two processes—belonging and agency, as they were introduced in existing recent models and empirically supported as well. Wahl and Lang explicitly addressed this interplay of P-E exchange processes over time in their SPOT model “Social-Physical-Places-Over-Time” (Wahl & Lang, 2004, 2006), assuming opposing trends of the intensity of both processes from middle adulthood to very late life. We would like to differentiate the assumption of these general trends by adding a more fine-grading situational perspective on the interplay of agency and belonging. Following Bandura's definition, *agency* refers to the process of becoming a change agent in one's own life by means of intentional and proactive behaviors imposed on the physical-social environment (Bandura, 2006). Whereas other related constructs, such as assimilative coping strategies emphasize dealing with stress or negative life events, agency is defined as the general capacity of self-regulation embedded in environmental determinants (ibid.). The focus of agency is on goal-directed behaviors related to making use of the objective physical-social environment, such as environment-related cognition and perceived control over the environment, including reactive and proactive aspects of using, compensating, adapting, retrofitting, creating, and sustaining places, which is especially important in old age because of decreasing functional and cognitive capacity. In particular, agency as a psychological dimension refers to the process of behaving with intentionality.

In contrast, *belonging* incorporates all non-goal-oriented cognitive and emotional aspects that make a space a place, covering the full range of subjective evaluations and interpretations of place as well as cognitive and emotional representations of P-E constellations related to places (Oswald & Wahl, 2013, 2019; Rowles & Watkins, 2003; Wahl & Oswald, 2016). That is, belonging reflects the experiential connection of attachment and bonding with the physical environment (e.g., home as a refuge, personally meaningful objects), social environment (e.g., family members, community of people) as well as an integration of physical-social environment (e.g., Rowles, 1983; Rubinstein, 1989). Going further, processes of belonging predominantly rely on the cognitive and emotional evaluation and representation of physical and social environments, as well as processes of attachment to places over time leading to patterns of place meaning. The affective orientations can be diverse including positive, negative, ambivalent and mixed, depending on the unique and subjective experiences of the physical and social environments. Also with respect to potential interventions, belonging is not always considered to be effective, e.g., with respect to fixed mindsets, behavioral rigidity and hindered flexibility.

While the intensity of social-physical *agency* in the long run decreases over time, social-physical *belonging* increases at the same time, although situational variation with opposite trends may occur. At a fundamental level, the A-B dynamics is shaped and defined by all components of P-E interaction (i.e. individual characteristics, social factors, physical environment and technological systems), as discussed in a previous section. At the level of P-E exchange processes in everyday life, agency and belonging are intertwined and the A-B relation can be represented in various dimensions of quality of life, such as autonomy, independent functioning, social interaction/connection, privacy, mobility, safety and security, continuity of self, stimulation. These dimensions of quality of life or “therapeutic goals” are well-established in environmental gerontology literature to conceptualize and inform

planning and implementing physical environmental design decisions and social or programmatic interventions (see Lawton, 1986; Calkins, 1988; Calkins & Weisman, 1999; Cohen & Weisman, 1991; Regnier, 2003; Zeisel et al., 2003). These quality of life dimensions are conceptually and heuristically broad to represent the range of individual health and functioning status (e.g. high functioning, mobility limitations, cognitive impairment) and environmental settings (e.g., home, community, long-term care facilities).

There is a dynamic tension in which an older individual engages with the socio-physical-technological environment to achieve a certain goal or accomplish an activity. For example, daily functioning as represented by the Activities of Daily Living (ADLs) and the Instrumental Activities of Daily Living (IADLs), involve agency and belonging interaction, albeit in varying levels of their engagement. Carrying out one's ADL in the home environment may engage one or multiple aspects of individual agency, i.e. intentionality, forethought, self-reactiveness and self-reflectiveness (Bandura, 2006). At the same time, emotional or attachment aspects of belonging can interplay in fostering or hindering the process. The routine and regularity of daily activities shape the emotional belongingness to these activities, and in turn, interact with one's agency to initiate and complete such activities (e.g., Rowles & Watkins, 2003). Additionally, phases of increased agentic behavior (e.g., while learning a new skill) may alternate with phases of decreased agency; the same is possible for belonging, which for instance may drop considerably after the relocation of a close neighbor and the risk of loneliness increasing at the same time. However, increased activities of denial and rationalization would not be interpreted as increased agency, but as decreased processes of self-reactiveness and self-reflectiveness instead.

The dynamic is likely negotiated as one's physical and cognitive functioning declines in later life. Functioning challenges associated with a decline in health would likely affect one's level of effective agency to decrease along with a parallel increase in the value of the affective aspects of belonging. Finally, agency and belonging offer conceptual merit in helping us understand the optimization component (as opposed to compensatory) of P-E exchange processes. One's agency is more likely to be active and effective if the socio-physical environment is optimal, i.e. at a higher level of environmental press than the adaptation level (Lawton & Nahemow, 1973). At the same time, opportunities for increased and new forms of attachment can positively affect belonging (e.g., supportive neighborhood based social network, accessible and safe home environment) (Wahl & Oswald, 2016), which in turn, might contribute to optimization of the P-E exchange. The aim to specifically address and to better understand the dynamics of *agency* × *belonging* seems to be in line with other adaptations of the model provided (Wahl & Gerstorf, 2018; Wanka, 2017).

Environment-related outcomes

The earlier conceptual framework by Wahl and Oswald (2010) and Wahl and Oswald (2016, chap. 31) emphasizes that environment related outcomes echo fundamental developmental tasks in later life, namely, to remain independent for as long as possible, as well as to maintain one's integrity in identity. Autonomy and identity have long been established as developmental outcomes in later life. In the context of P-E exchange, *autonomy* can be expressed through a variety of expressions, such as, maintaining personal independence in ADLs and IADLs, mobility, social engagement, community participation and the desire to age in place. The notion of autonomy is integrally associated with the need for security, which is challenged with conditions of comorbidities and decline in functional status. In finding an acceptable level of autonomy, without compromising security, the Selective Optimization with Compensation (SOC) theory (Baltes, 1997) help us understand older adults' psychosocial processes. The issue of selection, optimization and compensation is fundamentally dependent upon agency and belonging, which in turn shape the sense of autonomy.

One's *identity*, represented as a central force that provides the bridge between social structures and individual attitudes and behaviors (George, 1998) is a fundamental developmental component that contributes towards personal wellbeing. Identity is particularly strong in the context of home environment and may be manifested through several modalities, such as personalization in the home environment, conduct of daily activities and social interactions based on patterns of preferences and habits formed over many years, deep sense of emotional attachment in which one's home becomes an extension of one's self. The processes and outcomes of environment influencing the identity has been notably captured in various concepts, such as "insiderness" (Rowles, 1983), "entexturing" and "environmental centralization" (Rubinstein, 1989), and "environmental mastery" (Golant, 2011). To understand the relevance of these developmental outcomes, it is also important to acknowledge their interrelated nature. An older adult who possesses a level of self-efficacy would likely exercise increased self-determination in her or his lifestyle and activities is more likely to positively impact her/his autonomy and self-esteem. Maintenance of identity is also enhanced by one's autonomy to age in place or having a meaningful role in one's relocation to a care home or congregate housing. The concepts of *agency* and *belonging* are not exclusively used with respect to later life. Other fields of social and health sciences have made use of the A-B dynamic in explaining social exchange, health-related outcomes, successful aging, stress and coping but also identity, although not always explicitly related to later life (e.g., Ouwehand, de Ridder, & Bensing, 2007; Tesch-Römer & Wahl, 2017; Thoits, 2011, 2013).

A-B processes and their influence on outcomes of autonomy-identity are illustrated with three scenarios: Jon - who lives alone in a two-story house, Sophie - who lives in a suburb of a North American city, and Amber - who lives with dementia and in a long-term care facility. Table 1 introduces the three scenarios representing these three older adults with varying levels of physical and cognitive functioning situated in three distinct socio-physical contexts (i.e. home, neighborhood and care facility).

These scenarios are meant to bring to life the key concepts of the conceptual framework and the framework's three sections, i.e., the components of P-E interaction, P-E processes and environment-related outcomes. The scenarios are based on three older adults who represent diverse individual characteristics, social factors, physical environments and technological systems (components of P-E interaction).

Let's take the case of Sophie to illustrate the key concepts and their interrelationships of the conceptual framework. As for *primary components of P-E interaction*, we note that Sophie is 83 year old, lives alone, had a recent hip surgery, has mobility limitations and cognitively alert. These reflect her individual characteristics. In her physical environmental context, she lives in a suburban neighborhood which lacks pedestrian infrastructure to support safe walking; there is no nearby amenities and no access to public transportation within walking distance from her home. Socially, Sophie relies on her daughter and a neighbor to get to the doctor's office, pharmacy and other amenities.

In *agency and belonging* aspects of the PE processes, Sophie's dependency on her daughter and a close neighbor has reduced the frequency and spontaneity of going out. Getting out of the home needs to be coordinated with other's convenience and schedules. She feels this arrangement has compromised on her independence in going out whenever she wants, which has been emotionally challenging for Sophie affecting her sense of belonging to her home and community. In terms of ambivalent affects of belonging, although Sophie benefit from maintenance of previous levels of social exchange with her friends she seems to be restricted to do this within the setting of her church and the familiar weekly church gatherings which restrains her from exploring other avenues of social exchange. After a month of the surgery, she started getting out and walk with a cane in the nearby 2-3 blocks. However, the neighborhood is not supportive of walking as there is no sidewalk on most of the streets, the crosswalk timing is too fast for her

and there are no benches to sit. These physical environmental conditions affect her agency to be independently mobile in the immediate vicinity of her home even to support her need for regular mild physical movement. The challenges of walking in the nearby neighborhood area is frustrating for Sophie and may have negatively contributed to her sense of belonging to the community. For environment related outcomes of *autonomy and identity*, Sophie's level of autonomy has been reduced in independent decision-making for activities in the community and social interactions. Also, the unsupportive neighborhood physical environment has compromised her autonomy of independent mobility in the nearby areas. Dependence on others for community engagements, social life and functional mobility related challenges have affected Sophie's identity of an independent and strong woman. These changes in lifestyle have prompted her to consider the possibility of relocation to a more supportive congregate living arrangement, e.g., assisted living. On the other hand, she is still the same loving mother and generous person.

The scope of these illustrations are limited in terms of their western urban-suburban-institutional contexts. It is important to acknowledge that the physical environmental, socio-cultural contexts and their salience on the PE processes and outcomes would vary depending on other countries and/or cultures. Nevertheless, the three scenarios are presented to elucidate the interaction processes among these components of the conceptual framework, i.e., interaction among the P-E components understood with the concepts of agency and belonging (processes of P-E interaction), and contributing to autonomy and identity (environment related outcomes). The concepts and their interrelationships of the framework have heuristic value in understanding the P-E exchange processes and translational value in implementing services, social support and/or environmental changes in a comprehensive and meaningful way. In other words, the examples can be considered as paradigmatic sets of empirical operationalizations of our framework.

The role of time in the model

The temporal perspective has been addressed in the original framework (e.g., Wahl et al., 2012) with respect to the parallel time lines of the individual life course and the historic changes. Another important contribution addressing the temporality of P-E interaction is the socio-physical place over time SPOT concept in Wahl and Lang (2004). Here we briefly expand that discussion to further our understanding of the role of time on P-E interaction across the adult lifespan; however, the conceptual richness of this particular aspect and its implications on environment and aging research and policy development shall only be explicitly addressed in two specific perspectives.

In our framework presented here, we identify the role of time in two ways. First, we put certain emphasis on the role of time at the level of P-E exchange in daily life situations, changing over the lifespan, but particularly in later life with respect to a changing A-B dynamic and related outcomes (see Fig. 1, upper arrow). Only very briefly we want to address second on the level of different conceptual lenses to explain P-E-exchange over time (see Fig. 1, lower arrow).

With respect to the upper arrow, A-B dynamic is shaped by the individual level and environmental changes that take place over the lifespan, but manifests in specific everyday situations (see our examples in Table 1). This addresses small scale natural time frames of everyday P-E exchange, such as days, weeks or months. It is argued that there is a dynamic interaction and tension between the two psychological forces at any given time with increasing importance of belonging and decreasing importance of agency aspect over time (Wahl & Lang, 2004). As an older adult's health declines and functioning impacts activities of daily living in very old age, the belonging aspect of this dynamic might serve as a more important resource to act as cognitive-affective-prosthetic for the limitations in her/his ability to exercise personal agency. As the physical environment can serve as a prosthetic element to compensate for functioning challenges, so could a strong sense of

Table 1
Scenarios of person-environment exchange according to the integrative conceptual framework.

Scenario 1: home	P-E processes	Agency	Belonging
Jon is 85 years old, widowed and lives alone in a two-story house for the last 45 years. His pulmonary disease has substantially reduced his physical endurance or stamina level. It takes more than 2 h for him to complete a bath. Jon also has difficulty to independently manage household tasks such as cooking, laundry and basic cleaning.	Dimension of independent functioning	Jon's chronic conditions has resulted in increased difficulty and time in completing ADLs or self-care activities of daily living He focuses on one thing at a time, paces himself to not become too tired and acts with caution, e.g., the bathroom poses high demand and risks for Jon in his baths/showers Jon decided to stay out of the upper level of the house, as it became inaccessible for him He loves the freedom to decide what he likes to do or not at home Having his mobile phone beside the bathtub allows Jon to call his neighbor and old friend "just in case," who does the same thing Jon has reduced his action range considerably and now focuses his daily life in two places within the home, which can be considered as his "control centers" during the day and in the evening	He is familiar with all obstacles in his home and moves on an "auto pilot" mode, enabling him to maintain his beloved habits of cooking and bathing, which in turn, strengthens his sense of belonging in the home Being able to still take care of himself gives him a feeling of deep satisfaction and pride He enjoys sitting in his bathtub reminiscing family memories in this home
	Dimension of social interaction	Autonomy In general, Jon has maintained his autonomy by adaptive behaviors and environmental regulations. With adjustments in his outlook on activities, he maintains temporarily stable independence and personal control on key activities of daily living and lifestyle aspects.	Identity Jon's cognitive health, his longstanding familiarity contributing to a deep sense of belonging, along with social contacts and a set of joyful memories have helped him continue his sense of self-identity, as reflected in his enjoyment in the home.
	Dimension of mobility		While moving around at home slowly, he enjoys his memories of past activities and a vivid family life linked to each room and furniture which makes him feel at home
	Outcomes		
Scenario 2: neighborhood	P-E processes	Agency	Belonging
Sophie is an 83-year woman who lives alone in a suburban neighborhood in North America. The neighborhood's streetscape is not pedestrian friendly and amenities are not close by. After having a recent hip replacement surgery, Sophie is undergoing physical therapy. She has not resumed driving, as there have been some post-surgery complications. Due to the lack of public transportation option, Sophie relies on her daughter who lives in the same city and a helpful neighbor to take her to the doctor's office, pharmacy and other amenities.	Dimension of independent functioning Dimension of social interaction	Sophie's dependency on her daughter and a close neighbor for her functional and social outings has reduced the frequency and spontaneity of her going out. Getting out of the home needs to be coordinated with other's convenience and schedules. She plans 2-3 weeks in advance for her visits to the doctor, clinic, grocery store and shopping. Sophie is not able to go to her church on all Sundays now, which has been her primary setting for social interactions until now. Sophie participates in an e-learning program offered through the local library, in which she is learning to use a program for easy communication with people in her network.	The compromise on her independence in going out whenever she wants has been emotionally challenging for Sophie. As a highly social person, she misses the weekly church gatherings and informal exchanges with her longtime friends. Also, not being able to keep up with the volunteering work has created a sense of void in her life. Sophie feels somewhat depressed as she is recovering from the hip surgery, which might contribute negatively to her sense of belonging in the home. The challenges of walking in the nearby neighborhood area is frustrating for Sophie. She also realized that most of the amenities and destinations in her neighborhood are not within easy walking distance from her home. These experiences have negatively affected her sense of belonging with the community.
	Dimension of mobility	After a month of the surgery, Sophie started to get out of her home and walk with a cane in the nearby 2-3 blocks. The built environment is not supportive of walking as there is sidewalk on only one side of the street; also, there are no benches to sit and the overall streetscape is aesthetically unappealing.	Identity High level of dependence on others and mobility related challenges have impacted Sophie's identity of an independent and strong woman. The psychological toll of significant reduction of mobility and social interactions on her sense of self indicating the possibility of relocation to a more supportive congregate living arrangement. On the other hand, she is still the same faithful and family-related person and loving mother, as she always was.
	Outcomes	Autonomy Sophie's level of autonomy has been reduced in independent decision-making for doing outside activities in the community. The unsupportive neighborhood built environment has compromised her autonomy of independent mobility in the nearby areas. However, she can maintain and even temporarily regain parts of her bodily autonomy through physical therapy.	

<p>Scenario 3: long term care facility</p>	<p>Amber is a resident in a traditional long-term care facility. With the cognitive decline that has accompanied with Alzheimer's Disease, she faces several challenges in carrying out daily activities. She also gets anxious and frustrated in not understanding what goes on around her.</p>	<p>P-E processes</p> <p>Dimension of independent functioning</p> <p>Dimension of social interaction</p> <p>Dimension of mobility</p> <p>Outcomes</p>	<p>Agency</p> <p>Amber feels very comfortable with one particular care aide who is very empathetic and patient with her. This care aide would bring out two sets of clothing for her and help her choose. She is also very understanding of Amber's attempts to put the clothing on by herself, although the process takes longer.</p> <p>Amber feels uncertain and awkward in the planned group activities, as she is unsure about what she is supposed to do. However, she likes to sit in one of the couches that are on the side of the main activity space. She likes to watch rather than actively participate.</p> <p>The long hallway outside her bedroom is very frustrating for Amber in going to the activity and dining space. If she takes a wrong turn, which happens quite often, she ends up at the end of a hallway with a closed door.</p> <p>Autonomy</p> <p>Amber is able to maintain a level of autonomy in her social interactions, however, she is limited in accessing personally meaningful activities. Her dementia related mobility challenges have resulted in significant decrease in personal control on where she can go within the care home environment. She needs a high level of externally controlled environment to provide her at least basic and situational safety in daily life.</p>	<p>Belonging</p> <p>With her care aide, Amber feels comfortable does not feel like being pushed as a patient, but treated as a friend or family member.</p> <p>She exhibits a sense of calmness and psychological security when she watches the group activities from the couch. This level of social engagement works well for her most of the time.</p> <p>Amber has liked to take walks in one of her old neighborhood streets and park 2-3 times a week. She feels the urge to walk, but gets frustrated in the institutional long hallways and with no place to walk outside.</p> <p>Identity</p> <p>At one level, Amber's positive relation with the care aide has supported her coping with her acceptance of personal care, resulting in a re-imagination of identity that is not reliant on independent functioning only. In some ways, her identity has evolved in acceptance of personal care support and comfort in watching activities as an observer. In some other ways, however, Amber is aware that she is about to lose parts of her identity due to dementia, which is psychologically challenging.</p>
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belonging in mediating the reduced role of personal agency. There is a need to explore and expand the notion of belonging from a personal level construct to a more inclusive one that acknowledges the social and collective dimensions of quality of life. Meaningful relations, inter-generational contacts, civic and community engagement, assigned roles and responsibilities, etc. can be considered as pathways to enhance and strengthen the sense of belonging on older adults also with respect to the subjective time perspective (e.g., [Gabrian, Dutt, & Wahl, 2017](#)).

It is important to note that as physical and/or cognitive functioning declines in later life, one's agency is impacted more in terms of its actual realization of action or expression of it, rather than the *intent* of action or personal control per se. We believe that it is important to acknowledge the distinction between the *physical challenges of staying functionally independent* and the *psychological and emotional needs or desires for exercising autonomy in one's own affairs*. In any event, one's agency and intensity of belonging are both influenced by the changing physical and social circumstances as well. Physical environmental changes over short to medium periods of time (e.g., weeks or months), such as, relocation to a congregate living arrangement (e.g. assisted living) or a care home and/or to a new community, home modifications, technological impacts and social environmental changes, such as relocation, retirement, loss of spouse and/or close friends, social roles, can reshape the nature of agency and belonging as independent psychological aspects. Most recently, the "Conceptual Framework for Studying Context Dynamics in Aging (CODA)" exemplifies how changes over time can be considered in an integrative view on P-E processes of agency and belonging ([Wahl & Gerstorf, 2018](#)).

The second two-headed arrow acknowledges conceptual approaches on a long-term temporal perspective, such as in a life course framework, which are useful as analytical lenses to understand the P-E interaction over time. The life course perspective ([Dannefer, 2003](#); [Dannefer & Uhlenberg, 1999](#); [Hinz & Marshall, 2003](#)) enhances our understanding of the accumulated effects of early life P-E interactions on the potentials and limitations of later life P-E interactions and associated outcomes and vice versa. Thus, time is not reduced to as chronological time flow from the past to the future, but understood in terms of a biographical backward-orientation to acknowledge the role of the individual, cohort or societal past in shaping present challenges of P-E exchange. For instance, this has been addressed from a transitional perspective on life course events, such as retirement (e.g., [Wanka, 2019](#)). On a psychological-affective level, environmental life history, e.g. living in a rural versus urban area might influence the preference for continuity in environmental situation at the community level. From a methodological viewpoint, narrative perspectives can provide useful tools and structures to understand the subjective constructions of particular P-E exchanges through autobiographical accounts of P-E interaction over time, also with respect to other categories of social difference (e.g., class, gender). Subjective time, including future time perspective, personal goals, or autobiographical memories have been consistently associated with health and well-being in later life as well ([Gabrian et al., 2017](#)).

Implications for future theory and empirical research

The conceptual framework presented in this paper advances previous theoretical work in P-E exchange in later life by: a) presenting the primary components, i.e. individual, social, built environmental and technological factors, b) incorporating the constructs of agency and belonging representing the P-E interaction processes, and c) integrating identity and autonomy as the outcomes. The process and outcome constructs need further operationalization and examination taking into account the variability of the primary components of the P-E exchange, e.g., individual factors and socio-physical settings, as well as potential setting-specific aims (e.g. at home versus in an institution) and age-related needs (e.g. for young old versus end-of-life situations). A new aspect addressed in this work, in contrast to other frameworks, is the

concurrency and complexity of effects and values of agency and belonging processes at the same time, which may open up the discussion towards intervention and preference of one process or the other vis-a-vis a targeted outcome.

Future theoretical work could focus on developing measures of agency and belonging processes, identity and autonomy outcomes as interrelated constructs in the context of P-E exchange. In tandem, there needs to be qualitative inquiries to explore the richness, complexities and nuanced relations among agency and belonging aspects, and their influences on identity and autonomy as developmental outcomes. The conceptual framework provides an opportunity for simultaneous exploration of interaction among P-E exchange components, processes and outcomes in various setting types and in different population groups. The relative significance and meaning of agency versus belonging, and identity versus autonomy is particularly intriguing given their dynamic, and sometimes contested, interrelationships. These dynamic tensions are likely to have additional layers of meanings and values for persons with dementia (in differing manifestations across the trajectory of dementia experience), older people with distinct ethno-cultural and/or social realities (e.g., elder migrants in Europe), elders with socio-economic challenges (e.g., low-income, health related stigma), LGBT older adults needing institutional care, among others.

Moreover, conceptual contributions from post-structuralism, critical gerontology and practice-theoretical perspective on aging would argue that in a conceptualization of P-E exchange processes, it is useful to widen the scope of concepts and empirical analyses to dissolve the ostensive dualism of person and place for better understanding of the aging experience beyond a mere rational-choice perspective. Among these are integrative environmental perspectives (e.g., Cutchin, 2004), ideas on “re-spacing and re-placing Gerontology” by addressing the impact of affect to better understand the relationality of space and place from a social geography/geographical gerontology perspective (e.g., Andrews, Evans, & Wiles, 2013), as well as theories on materiality and embodiment in everyday life from a micro-sociological perspective (e.g., Katz, 2018). In addition, advancements in the applied field of age-friendly community development (e.g., Buffel, Handler, & Phillipson, 2018), as well as challenges of aging in place associated with diverse contexts, political environments and marginal populations demand new perspectives on P-E exchange in late life from a community gerontology (e.g., Greenfield, Black, Buffel, & Yeh, 2019) and geographical gerontology perspective (Andrews, Cutchin, McCracken, Phillips, & Wiles, 2007; Scharlach & Diaz-Moore, 2016, chap. 21). Finally, the framework presented in this paper brings to the foreground the salience of longitudinal approaches in research design. Although the importance of longitudinal studies is pointed out in many empirical studies and several conceptual models previously, this framework specifies scenarios and associated issues that can be translated in hypotheses on the temporal aspect in P-E exchange to be tested in future empirical research.

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