

THIRD EDITION

HANDBOOK *of*

THEORIES *of*  
AGING

EDITORS

Vern L. Bengtson

Richard A. Settersten, Jr.

# CHAPTER 31

## Theories of Environmental Gerontology: Old and New Avenues for Person–Environmental Views of Aging

Hans-Werner Wahl and Frank Oswald

Development always happens in time and place. Although the time dimension has been extensively researched in developmental science, life-course research, and gerontology—conceptually, methodologically, and empirically (Baars, 2012; Baltes, Lindenberger, & Staudinger, 2006; Settersten, 2003)—the place aspect of development never became as central as the time dimension in social and behavioral aging research. However, it seems that the importance of space and place perspectives for aging is (re-)gaining prominence in gerontology (Rowles & Bernard, 2013; Wahl, Iwarsson, & Oswald, 2012). As we “move” (a spatial term) through our lives, we are also getting older, that is, getting more “distance” (another spatial term) from birth and less distance from death. We also start our lives in a broad variety of children playrooms, houses, apartments, gardens, and neighborhoods; then, we extend our life space to kindergarten and school environments; enjoy or suffer from job environments; buy or rent our own house or apartment in more self-selected physical–spatial areas (country of residence, urban, suburban, etc.) as compared to our early beginnings; execute our preferences for housing interiors, favorite objects, as well as for landscapes and leisure environments, for art and cultural environments, and for vibrant urban life or rural solitude.

Especially late in life, we probably meet unexpected spatial challenges (house too big, too many barriers, too distant from shopping area) and we may be forced to make a mostly undesirable transition to an assisted-living facility or a nursing home environment to spend another couple of years in what in the majority of cases is our “last refuge.” It is also obvious that the place dimension of aging comes with cognitive–emotional ties, some of which resemble ties to intimate social partners (see also Wahl & Lang, 2004). We may “love” our home, garden, book, or music collection compiled over decades, or preferred landscape or region, and may connect strong feelings of familiarity and comfort with the places we belong to, which may have become even parts of our own identity.

As it seems, such cognitive–emotional ties to personal artifacts and places grow stronger as we age, and relocation late in life therefore frequently is a painful event that we try to avoid despite awareness of its imminence (Granbom et al., 2014). Hence, many people in advanced old age not only lose their spouses, but also the places and artifacts in and with which they have spent decades of their lives. Eventually, one may regard this late losing of one’s long-standing environment as kind of a second “spatial widowhood.”

On the other hand, aging in place is experienced by many older adults as a strong—if not the strongest indication and “spatial expression”—of preserving one’s independence and autonomy. In a sense, one may even regard very old age to a large extent as a continuing struggle with the place in which one lives: How long can I as a frail and vulnerable person resist the hindrances of my place and when is the right point in time to leave this place-related “battle area”? Is housing adaptation a promising option? Or will I stay—whatever it takes—for me and possibly also my family? (Golant, 2015).

Places also shape our behaviors; they may, for example, stimulate or downgrade physical activity and provoke or hinder cognitive and emotional engagement at large. In old age, when functional competencies are on the decline, daily independence particularly depends on the quality of one’s environment, for example, in terms of compensatory modalities, such as a low number of home hazards and easy-to-access public transport.

Going further, at the macro level, our “aging” lives are also embedded within mega trends, such as new technologies, environmental pollution, urbanization, and global warming, with important differentiations according to which region/country/continent aging takes its “place.” For example, older adults belong to those sub-populations that are most vulnerable to global warming; this insight, together with demographical trends, may strongly impact how our urban environments—including sun shelter architectural measures or cooling by water in cities—will look in the future.

Theoretical issues related to environmental gerontology have found substantial early treatment in gerontology (Lawton, 1982; Lawton & Nahemow, 1973) and the striving for conceptual models continued until recently (Golant, 2014; Scheidt & Windley, 2006; Wahl, 2001; Wahl et al., 2012; Wahl & Oswald, 2010; Wahl, Scheidt, & Windley, 2004). In this chapter, we hope to add and provide some integrative perspectives to some of the enduring conceptual challenges in the area, such as place dimension while we age; what available theories in the ecology of aging (early and more recent ones) are telling us; and what kind of new impulses (e.g., increasing use of technology environments in older adults) for theory refinement in this area are needed. Can gerontology and life-course research at large (e.g., for models of life-span developmental regulation) profit from theories on aging and environments?

We also make attempts at several locations of the chapter to link environmental gerontology thinking with developmental, life-span, and gerontology theorizing at large. Due to the nature of the chapter, we mostly refrain from the detailed consideration of empirical data speaking to person (P) and environment (E) relations as people age, although empirical verification is of course a major issue for environmental gerontology theorizing (see also Wahl et al., 2012; Wahl & Oswald, 2010).

We also need to confirm that some of our thoughts elaborated in this work have already been introduced in other places over the last decade, although from different perspectives and with various foci (Oswald & Wahl, 2004, 2013; Wahl et al., 2004; Wahl et al., 2012; Wahl & Gitlin, 2007; Wahl & Oswald, 2010; Wahl & Weisman, 2003). Finally, given that environmental gerontology emerged during the 1960s with now-classic work such as Lawton and Simon’s (1968) early stating of the environmental docility hypothesis, we will refer to “classic” theoretical accounts still impacting current theory building and use, but also consider more recent ones, when it comes to conceptual contributions to environmental gerontology.

## ■ MULTIFACETED USE OF THE TERM “ENVIRONMENT” IN GERONTOLOGY: KEY EXAMPLES

“Environment” is a frequently used term in aging science across various disciplines and approaches, such as biogerontology, geropsychology, sociology of aging, geography of aging, or geriatric medicine. For example, environmental characteristics such as temperature, quantity of food, or environmental stress are of interest for biogerontology, because they may considerably shape the life span (Austad, 2009). Epigenetics, also a major branch of biogerontology, has come with a new and more differentiated understanding of gene–environment interactions, such as risk in family constellations or differences in economic setup that may or may not lead to gene expression (Campisi, 2005). Ryff and Singer (2009), in the last edition of the *Handbook of Theories of Aging*, have indeed made the intriguing argument that future behavioral research may be in a position to explain how people may select specific environments over their life course that may or may not elicit the expression of risk or protective genes.

*Geropsychology* argues that environment is primarily seen as an entity to be perceived and processed in order to come to adequate action as an aging individual. Environmental features are also researched mostly experimentally in geropsychology as “interference,” as older adults may have more problems disregarding the “less important” components of the environmental input in information-processing tasks (and therefore have more difficulties in cognitive processing, becoming slower and more error-prone; Lindenberger, Marsiske, & Baltes, 2000). It is also frequently argued in the cognitive-aging literature (Hertzog, Kramer, Wilson, & Lindenberger, 2008) that environments such as the workplace influence cognitive trajectories via differential cognitive stimulation and challenges connected with such environments. From a life-span perspective, the quantity and quality of early-life educational context are seen as an important factor driving cognitive reserve that may make individuals late in life more resistant to cognitive loss (Richards & Sacker, 2003). Moreover, one might argue from a psychological perspective that the environment could be considered as a stimulus for the improvement of aging and the unfolding of latent reserves (Colcombe & Kramer, 2003). Here, also frequent use of the term “enriched environments” as important to unfold latent reserve capacities of older individuals is made. Furthermore, environmental stress also plays a major role in geropsychology and may influence, for instance, the experience of a negative affect (Diehl, Hay, & Chui, 2012).

*Sociology of aging* perspectives often focus on the role of class, cohort, or socioeconomic context for outcomes such as health, well-being, or death, and address issues of social inequality (Phillipson, 2007; Scharf, Phillipson, & Smith, 2005) or social capital (Nyqvist & Forsman, 2015) with respect to the environment. Furthermore, social sciences’ perspectives mostly have social environments and social interactional patterns in mind. Environments have obviously always played a major role in *social gerontology* and *social relations* and aging research, but mostly as social environments (Antonucci, Birditt, & Akiyama, 2009). Considering interactions with one’s spouse and examining its impact on cognitive functioning, for example, can also be observed as a new trend (Hoppmann & Gerstorff, 2009).

*Geography of aging* may be, in a fundamental sense, considered “the” discipline able to address the physical and spatial environment, because space and space use are among the major issues of geography at large. Notably, as we show subsequently, major conceptual and empirical input to environmental gerontology came from geographers (Golant, 2015; Peace, Holland, & Kellaher, 2006; Rowles &

Watkins, 2010). As part of what has been titled the “spatial and cultural turn in human geography,” methods to explore person–environment relationships change, as well as interprofessional research interests (e.g., interlinks between geographical and educational research, with particular interest in aging research) have appeared on the scene (Butler & Hamnett, 2007). An emerging area also related to geography is research on climate warming and how it may affect older adults’ health and behaviors (Wanka et al., 2014).

*Geriatric medicine* as well as related disciplines such as *academic occupational therapy* frequently predominantly use the concept of environment in relation to home hazards and gait and falls relevant to physical contexts. This understanding of the environment tends to be very concrete, for example, including the consideration/assessment of barriers at different loci in the house and light and floor conditions (Iwarsson, 2004). Geriatric medicine, geropsychology, and social gerontology also have invested interest in the role of long-term care institutions and special housing for older adults. Moreover, in the *health sciences* at large, evidence is increasing that active out-of-home behavior and healthy lifestyle (e.g., physical activity) may also depend on the nature of out-of-home environments that may foster or hinder such behavior (Tudor-Locke, Craig, Thyfault, & Spence, 2013).

With particular emphasis put on older adults with severe care needs, new understandings of the role and importance of environments have also been established recently; these understandings underscore the need to consider links among the individual, neighborhood, community, and society. The meaning of environment is enriched in these approaches by concepts such as mutual responsibility, concern, respect, belonging, trust, identity, and community participation, in order to create and maintain an independent and dignified living in the community until the end of life. In Germany, for example, the concept of “caring communities” has been established in this context (Klie, 2014).

The list of exemplary disciplines illustrates the diverse nature of using the term “environment” in gerontology. Building on the views of these overlapping disciplines, one can preliminarily conclude that the use of the concept of the environment in gerontology is a multilayered enterprise. For instance, environment is used very specifically (e.g., home hazards) or very abstractly (e.g., environment in person–gene interactions); in a social way (e.g., family as environmental context) or a physical–spatial way (e.g., navigating through the community); and as an entity not separable from the person (e.g., socioeconomic status) and as a separable entity (e.g., housing quality). Moving forward, we answer how environment is used in environmental gerontology, that is, in the subarea of gerontology that explicitly considers the aging person in his or her environment.

## ■ PRINCIPLES AND EXPLANATORY AMBITION OF ENVIRONMENTAL GERONTOLOGY

### Principles of Environmental Gerontology

As we see it, environmental gerontology rests on three main principles—two more related to the concept level and one more related to research strategy: (a) importance of P–E transaction and developmental co-construction; (b) importance of explicitly considering the environment, with a focus on the physical–spatial dimension; and (c) importance of optimizing ecological validity in research.

First, the classic formula—dating back to German psychologist Kurt Lewin, which states that behavior is a function of the person’s characteristics, as well as those of the environment ( $B = f(P, E)$ )—remains to be a “conceptual given” in the social and behavioral sciences, and aging is no exception. Environmental gerontology theorizing may be characterized as the subdiscipline within gerontology which—in principal terms—has put equal emphasis on the consideration of P and E or may put more emphasis on E, presuming that other subdisciplines contributing to gerontology (e.g., geropsychology) are treating mostly the aging individual (P).

Environmental gerontology also had from the beginning close affinity with *environmental psychology*, in which the concept of “person–environment transaction” has gained much prominence (Altman & Rogoff, 1987; Wahl & Oswald, 2010). A key assumption inherent in this concept is that it is difficult to separate P from E and that the understanding of an ongoing complex and mutual shaping of P and E throughout the life span is adequate. Furthermore, it may be that this intimate intertwining of P and E increases across the life span and may indeed reach its climax in old age and very old age (often categorized as 65 and older or even 80 to 85 and older).

According to Bronfenbrenner’s (1999) bio-ecological model of lifelong coping with environmental conditions, different layers of P–E interchange must be considered, that is, the microsystem (the interpersonal interactions within the immediate environment), the mesosystem (two or more microsystems directly impacting the developing individual), the exosystem (linkages among subsystems that indirectly influence the individual), and the macrosystem (values, norms, and legislation of a given society).

Furthermore, life-span development is seen as a never-ending sequence of ecological transitions, in which new P–E territories are continuously conquered, while other P–E territories are left behind. Prototypical examples include the transitions from school to the labor sphere, from the labor world to retirement, and from community-dwelling living to nursing home, assisted-living, or retirement community life. This reasoning closely coincides with developmental science’s fundamental idea of developmental *co-construction*—that is, the assumption that developing individuals are constantly shaped by contexts and vice versa (Valsiner, 1994; Wahl & Lang, 2004).

Second, in his early landmark contributions to environmental gerontology, Powell M. Lawton (1977) has used a broad understanding of environment that included social others and social groups, as well as all its physical components (including both the natural or manmade ones). However, environmental gerontology “in action” has never treated both the physical and social components of the environment in similar intensity. Instead, the overall understanding of the environment in environmental gerontology as a subarea of gerontology has been the major emphasis on the physical and spatial environment (Wahl, 2001; Wahl et al., 2004, 2012).

It remains, however, quite clear that such emphasis does not ignore the social and cultural parts of environments of aging. Wahl and Gitlin (2007) have suggested the term “*physical–social environment*” to address this issue, that is, the physical component of the environment cannot be separated from its social component, and vice versa. For example, infrastructural characteristics in a nursing home may provoke or hinder social communication and objective spaces are not the least becoming meaningful places due to the social partners and processes being connected with them (e.g., family celebrations and rituals).

Third, environmental gerontology always argues for the importance of optimizing ecological validity in aging research (e.g., Wahl, 2001). Focusing on issues such as defining under which conditions older adults are “feeling at home” (Oswald & Wahl, 2005) or offering a detailed description of the role of environmental barriers in the home or

immediate surrounding directly brings research to the daily ecology of old age. Older adults always operate in physical–social environments; therefore, making the environment the research target implies that reconstructing daily (or weekly) ecologies must have a high priority as a meta-idea of doing aging research (Kaspar, Oswald, Wahl, Voss, & Wettstein, 2015).

That said, it is an interesting development in gerontology (particularly in geropsychology) that ecological validity seems to have become more important over the past couple of decades. Major indicators include the emphasis now given to event-sampling in situ research strategies in geropsychology (Ram & Diehl, 2015) and the rapidly increasing trend to use ambulatory assessment as a way to assess aging individuals as closely as possible in their everyday world contexts (Hoppmann & Riediger, 2009; we refer to this point again in the following text).

## Mission of Environmental Gerontology and Its Explanatory Ambition

In light of the principles described in the previous section, environmental gerontology strives for an in-depth understanding of the interrelations between aging persons and their physical–social environments and how these relationships shape aging outcomes (Wahl et al., 2012; Wahl & Gitlin, 2007; Wahl & Oswald, 2010). The overarching aim of environmental gerontology is thus to describe, explain, and modify/optimize the relationship between the aging person and his or her physical–social environment.

With regard to *description*, environmental gerontology puts, as already argued, strong emphasis on day-to-day contexts of aging individuals, reinforcing the notion that daily ecology settings deserve strong attention in gerontological research. First, older people—particularly those in advanced old age—spend most of their time (i.e., about three quarters of their daytime) at home and immediate home environment (Baltes, Maas, Wilms, Borchelt, & Little, 1999; Wahl & Oswald, 2010). As a consequence, housing characteristics as the predominant setting in which aging unfolds have been a major focus of research in environmental gerontology (Oswald & Wahl, 2004; Oswald & Wahl, 2013).

Second, older individuals tend to live in the same place for a long time; for example, in the German Aging Survey, nearly one third of those aged 65 years and older had already lived for more than 40 years in the same home (Motel, Künemund, & Bode, 2000). Such long-term living and aging at the same location seems to evoke rich cognitive and affective ties to the place one lives, coined in everyday language with the internationally known German term *Heimat* (homeland)—or, put in scholarly language, addressed as place identity and place attachment to the very specific idea of “my place.” Other naturally occurring environmental changes over the course of the year—for example, lighting, temperature, weather conditions, smells, and noises—also contribute considerably to the environmental experience of the normal rhythm of life; the assumption is that such changes are of particular importance for older people, as they reflect the aging process and provide orientation in space and time.

Regarding *explanation*, the phenomena to be explained in environmental gerontology are, for one, classic outcomes in aging research and gero-epidemiology, such as well-being (Oswald, Jopp, Rott, & Wahl, 2011) and autonomy and identity (Oswald & Wahl, 2005; Wahl, Fänge, Oswald, Gitlin, & Iwarsson, 2009). In addition, the term “healthy aging” has been used in environmental gerontology work and includes outcomes, such

as functional ability, falls, infections, cardiovascular disease, morbidity at large, and excess mortality (Oswald et al., 2007; Oswald & Wahl, 2004). The latter endpoints have been particularly linked with environmental conditions, such as heat waves, or risky living circumstances, such as moldiness in the house or noisy surroundings. Specific P–E constellations have also been linked with motor-behavior characteristics (e.g., extension of space in which one is acting) and activity patterns (e.g., frequency and quality of out-of-home activities, physical activity; Wettstein et al., 2015).

The focus on *optimization* reflects the ambition of environmental gerontology to provide a substantial and direct contribution to the improvement of quality of life in old age (Golant, 2015; Wahl et al., 2012) through means of intervention. The involvement of environmental gerontology in advancing evidence-driven home modifications is prototypical, adding to the development of new housing solutions for the diversity of aging individuals, or designing public spaces and “age-friendly” environments at large (e.g., Buffel et al., 2014).

## ■ EARLY THEORY BUILDING IN ENVIRONMENTAL GERONTOLOGY: OBJECTIVE AND EXPERIENTIAL P–E TRANSACTION SIDE BY SIDE

By “early theory building” in environmental gerontology, we mean predominantly classic work such as Lawton and Nahemow (1973) and Rowles (1978), which remains prominent in research and practice contexts (e.g., new housing solutions; community planning). As we see it, a major distinction can be made between those theories that focused on the “objective” environment “out there” versus those that emphasized the more experiential part of P–E relations for aging individuals.

### Theoretical Focus on Objective Environments Supporting or Constraining Aging

A classic view that was influential until present is the Ecological Theory of Aging (ETA; Lawton, 1982; Lawton & Nahemow, 1973; Scheidt & Norris-Baker, 2004). The basic assumption of this theory has been that the capacity to adapt behaviorally to existing physical–social environmental pressure profoundly decreases as people age, due to an increasing number of functional limitations. According to the ETA, older individuals need to react to environmental pressure in order to remain independent and feel well (Lawton & Nahemow, 1973).

The original model describes behavior and well-being primarily as a function of the level of personal competence and environmental pressure (Lawton, 1982; Lawton & Nahemow, 1973). As has been argued by a number of scholars (e.g., Scheidt & Norris-Baker, 2004; Wahl & Gitlin, 2007), the ETA’s assumptions and predictions still are of great heuristic value theoretically, as well as in applied perspective. First, the assumption that variability in autonomous behavior and well-being can increasingly be explained by physical environments (and not only by personal factors such as needs, personality traits, cognitive function, and goals) is an important addition to the understanding of development in old age.

Indeed, older adults may become “prisoners of space” (Rowles, 1978), with long-time life experiences dominated by the no-longer-fitting home environment and an unknown territory of new environments (e.g., a nursing home), which may be needed to enter in



a not-too-far personal future. Thus, physical environments such as the home may play either the role of resource or risk to life satisfaction, depending on individual living circumstances and age (Oswald et al., 2011). A second interesting feature of the theory still worth considering is that environments slightly exceeding an older person's competence may indeed reveal latent reserves and new learning. It is somewhat disappointing however—in terms of the reception of the theory—that this optimization component of P–E relations in the ETA has found less attention as compared to the compensatory aspect, that is, environments that compensate for no-longer-available competencies.

Overall, considerable empirical support for the ETA and its variants is available in areas such as independence in activities of daily living, well-being, and depression (for review, see Iwarsson, 2004; Wahl & Oswald, 2010), although it remains difficult to make an estimation of the effect size of the role of the physical–social environment as compared to personal characteristics and the social environment.

## Theoretical Focus on Perceived Environments Supporting or Constraining Aging

Major concepts in this area include place attachment, place identity, and the meaning of “home.” Theories on place attachment and place identity—which have been long discussed (Altman & Low, 1992) and still inform environmental gerontology's conceptual and empirical platform (Rowles & Watkins, 2003; Wahl & Oswald, 2010)—point to a gamut of processes, operating when people form affective, cognitive, behavioral, and social bonds to the environment, thereby transforming “space” into “place.” Often, these aspects of physical, social, and personal bonding are assessed by global attachment evaluations (e.g., on indoor versus outdoor place attachment; Oswald, Hieber, Wahl, & Mollenkopf, 2005), but there are also efforts to use qualitative methodology to approach place attachment and identity empirically (Peace, 2005).

Concepts on the meaning of “home” are directly related to place attachment, as they deal with the most frequent manifestation of attachment processes. For instance, since older adults often live in the same residence for long periods of time, cognitive and emotional aspects of the meaning of home are strongly linked to biography (“My home”; “My neighborhood”). Such social, cognitive, and emotional links may become manifest through processes of reflecting on the past, symbolically represented in certain places and cherished objects within the home. Meaning-of-home has been empirically targeted in earlier research via qualitative methodology (Rowles, 1983; Rubinstein, 1989), but recently there have also been successful efforts to quantify meaning-of-home aspects (Oswald et al. 2007; Oswald & Kaspar, 2012; Oswald et al., 2006).

Overall, this set of environmental gerontology theories has a strong descriptive notion, in that it provides conceptual dimensions to understand “place-making” processes as people age. In a sense, processes and outcomes are intertwined in these theories. For example, the goal is to describe and understand how an older person makes meaning out of his or her environment and feelings/evaluations, echoed in statements such as: “My home is the most important place in my life.” There is also an empirical support for the assumption that meaning-of-home may depend on the older individual's health status; for example, functionally impaired older adults seem to value feelings of familiarization with their physical–social environment more strongly than unimpaired older adults (Oswald & Wahl, 2005, 2013).

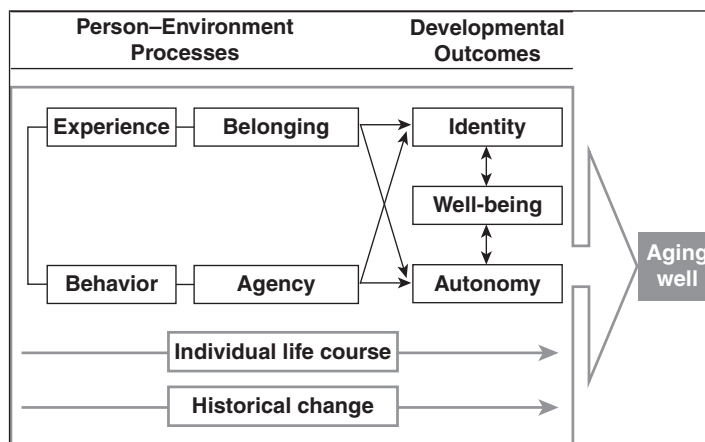
## ■ RECENT THEORY BUILDING: SEARCHING FOR INTEGRATION OF OBJECTIVE AND SUBJECTIVE P–E TRANSACTIONAL ELEMENTS

### The Model of Oswald and Wahl

Driven by the idea to integrate and extend both environmental concepts that focus on the objective and subjective physical–social environment, Wahl et al. (2012) suggest the framework depicted in Figure 31.1. At the core of this framework is the assumption that two fundamental processes, experience-driven P–E belonging and behavior-driven P–E agency, help increase the understanding and integration of existing P–E interchanges as people age. P–E belonging reflects a sense of mainly positive connection with the physical–social environment (e.g., Bakan, 1966; Baumeister & Leary, 1995), while P–E 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, 1991, 2006).

Going further, processes associated with P–E belonging account for the full range of subjective evaluations and interpretations of place and guide cognitive and emotional representations of P–E constellations related to places (Oswald & Wahl, 2005, 2013; Rowles & Watkins, 2003). Thus, belonging incorporates all non–goal-oriented cognitive and emotional aspects that make a space a place.

In contrast, processes of P–E agency include the full range of goal-directed behaviors related to making use of the objective physical–social environment, such as environment-related cognition and perceived control over the environment. They include 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. The model also assumes that both P–E belonging *and* P–E



**FIGURE 31.1** Model of Oswald and Wahl. The interplay between two fundamental processes, P–E belonging and P–E agency, is seen as a major driving force for identity, autonomy, and well-being in old age. This full P–E dynamic is embedded in individual life courses, as well as historical change.

Adapted from Wahl et al. (2012).

agency must be considered in any qualification of P–E relations in later life. Emerging empirical evidence for the model came from the “Enabling Autonomy, Participation and Well-Being in Old Age: The Home Environment as a Determinant for Healthy Ageing” (ENABLE-AGE) project, in which—for the first time—a maximum number of indicators regarding P–E belonging as well as P–E agency were assessed in parallel in advanced old age individuals in a range of European countries (Oswald et al., 2007).

As has been found to be empirically driven by this model, P–E fit processes and housing-related control processes that speak to objective constellations of remaining competence and respective objective physical–social home environments—as well as P–E belonging processes—contributed to the prediction of end points such as autonomy, well-being, and depression (Oswald et al., 2007). Furthermore, the model contributes to a better understanding of interactions among more person-based processes and environmentally based processes. For example, Wahl, Oswald, Schilling, and Iwarsson (2009) found that the link between lowered accessibility of the home environment and depression is higher in older adults aged older than 80 years, when they perceive their home situation overall as no longer under their control.

## Other Recent Models

For one, Golant’s model of Residential Normalcy has found much resonance in environmental gerontology and beyond, emphasizing residential decision-making processes in later life from an individual’s 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, 2015a, 2015b).

According to Golant’s model, if older people feel comfortable and in control of their environment at home, they have already achieved residential normalcy and may no longer feel the need to change anything. However, if there is a perceived incongruence on the behavioral or experiential level, they perceive themselves as being out of their mastery and/or comfort zone. Consequently, they will try to achieve residential normalcy again by ways of assimilative or accommodative coping strategies (Brandtstädter & Greve, 1994) with respect to the immediate home environment. The model has also been adapted into real-life settings of relocation decision making—for instance, based on data from the European ENABLE-AGE study (Granbom et al., 2014).

Another intellectually and empirically promising approach is the yet unpublished model of “At-Oneness,” which introduces a socio-spatial phenomenon in which the home evolves as both an individual and communal construct (Walsh, Rowles, & Scharf, 2014). The model of At-Oneness is based on qualitative narratives from rural Ireland; it is considered to be a multidimensional, interconnected construct, involving an evolving integration of the aging self and home across the life course. The model interweaves six dimensions of home in time and space as part of an evolving identity, that is, place of origin, inherited meaning, rhythm and routine, relational harmony, aesthetic functional landscape, and invested effort.

## “New” Environments in Need of Consideration: Future Importance of Technology Environments

Technology developments that were not available to the cohorts of older adults considered in environmental gerontology’s early theoretical work are now being developed, addressing an important new facet of the environment of older adults. Once again,

Lawton had taken strong action (see his keynote at the 1996 founding conference of the International Society for Gerontechnology in Helsinki) to support the critical role of technology for the quality of life in old age (Lawton, 1998).

The Internet, the “automation” of everyday technology (e.g., teller machines, ticket machines, computerized voice menus, car technology) and sensor- or GPS-based assistance are dramatically changing the way people organize and experience their everyday lives. Although the effect of technology was traditionally limited to a younger population, it is increasingly true for older adults as well (Schulz et al., 2014; Stokols, 1999). Robots accompany frail older adults while they stroll around the house or use the bathroom; personal computers provide cognitive or physical training programs; smart home environments support people with sensory, mobile, or cognitive decline; and robotic animals play a significant role in the social and emotional life of older people with dementia, although there is a lot of research to be done to provide better empirical evidence in this area (Kolling et al., 2013).

Future cohorts of older adults will benefit from a full range of technology products designed to support them as they “stay connected” and age well, despite accumulated loss experiences (Schulz et al., 2014). It is also possible that in the future, older adults (including those in advanced old age) will not only use robot care and other technological tools to support and compensate for lost competencies as an agency-relevant device (P–E agency), but may also feel emotionally attached to their robotic animal or enjoy virtual reality, which may become new means of experiencing environmental stimulation in the context of pronounced disability (P–E belonging).

Although this rapidly increasing role of technology as a means of P–E agency, as well as for P–E belonging purposes, is a challenge for theory building in gerontology at large (see Schulz et al., 2014), environmental gerontology is most directly affected by this challenge, with its direct emphasis on physical–social environments. For example, it may be heuristically fruitful to combine man-machine models in human factors research with ETA-inherent concepts such as environmental pressure and proactivity (Fozard & Wahl, 2012). It may also become an intellectually inspiring task to target linkages between P–E belonging and identity-building processes as highlighted in the Oswald–Wahl model (see again Figure 31.1) in relation to technology use by older adults. Will, for instance—as we currently see it in adolescents and even in older children—Internet use also serve important identity formation and social presentation purposes for aging individuals in the near future?

## ■ IMPLICATIONS OF ENVIRONMENTAL GERONTOLOGY THEORIZING FOR GERONTOLOGY’S THEORY BUILDING AT LARGE

Three major implications will be addressed in what follows: (a) implications for theories of life-span development and aging; (b) implications for the understanding of the cohort issue in aging research; and (c) implications for the understanding of the diversity and aging issue.

### Environmental Gerontology Theorizing and Theories of Life-span Development and Aging

Despite the increasingly important role of the physical–social–technical environment for old and very old individuals, its role in the broader context of aging and life-span development is not well developed. For example, research connected with *social–emotional*

*selectivity theory* (Carstensen, 2006) has confirmed that, with increasing age, people become increasingly selective, investing greater resources in goals and activities that maximize positive emotional experiences and minimize emotional risks.

Proactive use of environments, including use of technology, may indeed facilitate selection of desired people and contexts that support positive emotional interactions and help promote entertaining and engaging experiences. One may even argue that processes of socio-emotional selectivity can be seen not only at the level of social partners, but also in relation to the physical environment, expressed in increasingly stronger feelings of bonding to the home environment and familiar areas (e.g., location of one's vacation in old age; Wahl & Lang, 2004).

The *selective optimization with compensation model* (SOC; Baltes et al., 2006) focuses on how individuals allocate resources to promote growth and maintenance of functioning in the face of age-related declines/losses. According to the SOC model, successful aging involves selection of appropriate functional domains, optimizing developmental potential, and compensating for losses. It may be helpful to spell out in more detail how physical–social environments help or hinder SOC processes by using environmental gerontology theory. Regarding technology environments, Lindenberger et al. (2008) have used this general framework to discuss how intelligent assistive technology that continuously adjusts the balance between environmental support and individual capabilities can maximize the potential of an individual by “combining support with challenge, thereby enhancing motivation, social participation and a sense of autonomy” (p. 63).

The *motivational theory of lifespan development* (Heckhausen, Wrosch, & Schulz, 2010) proposes that the key criterion for adaptive development is the extent to which the individual realizes control of his or her environment (i.e., exerts primary control) across different domains of life. Striving for primary control is a constant and universal motivational drive throughout the life course. However, as individuals' capacity for primary control decreases in old age and some goals become unattainable, individuals need to have strategies that facilitate disengagement from unattainable goals in favor of pursuing other, more attainable ones.

A wide variety of cognitive strategies can be used to navigate these transitions, including adjusting expectations, values, and attributions so that losses in primary control do not undermine the individual's motivational resources for primary control striving in general. Environmental features, including technology, can compensate for declining primary control abilities through assistive and support devices; enhance control striving through task performance feedback that optimizes motivational engagement; and facilitate disengagement from unattainable goals by identifying appropriate alternative goals for a given level of functioning. Although such a role of the physical–social environment is frequently mentioned in the theory, the environmental part, as compared to the person part, is underaddressed and may profit from environmental gerontology theorizing.

## Environmental Gerontology Theorizing and the Cohort Issue in Gerontology

Environmental gerontology's theory building and research may also be helpful when it comes to the understanding of cohort flow dynamics in gerontology. For example, new housing solutions for older adults—such as assisted living, retirement communities, or intergenerational arrangements, and new housing options for persons

with dementia—have enhanced the fit between living preferences and needs (Wahl & Gitlin, 2003).

It is likely that future built environment solutions for older adults may not only, to take the model of Oswald and Wahl, better support P–E agency-related processes (e.g., enhancing daily autonomy even among older adults with disabilities), but also nurture or even “provoke” new forms of P–E belonging, including new relationships with the younger generation, friendships with persons with dementia, or even emotional attachment to robots. Similarly, new P–E interchange patterns are evident in out-of-home mobility and, at the more macro level, in the migration patterns of current and future cohorts of older people. Never before has there been an aging cohort with so much “world experience” and openness to new travel modes as there is today.

In the future, this lifestyle trend may become a more commonplace or take new directions, such as increasing “use” of virtual environmental realities. Migration or extensive traveling may become a major expression of older adults’ agency-related behaviors, while also modifying the traditional view of “aging in place.” Going further, it is also obvious that the technology environment issue as described earlier has considerable potential to deepen the discussion on ethical options and limits in aging, as well as to increase understanding of the needs, preferences, and “action modes” of future cohorts of older adults (Fozard & Wahl, 2012; Schulz et al., 2014).

## Environmental Gerontology Theorizing and the Diversity of Aging

The understanding of age diversity remains a major conceptual issue in gerontology (Settersten & Trauten, 2009). Seen through the lenses of environmental gerontology, a major argument is that diversity may also mean diversity in terms of P–E constellations. However, the aging and diversity issue so far is treated mostly as interindividual differences at the person level. Such a context-free view of diversity has its limitations, because it ignores all the diversity on the side of the physical–social environment.

Aging people live in a range of housing characteristics, neighborhoods (again with a range of characteristics such as support potential, crime rate, cultural aspects, distances to public transport), green areas, and educational and cultural infrastructure. Some of these features are represented in classic SES notions, but definitely not all (see also the following discussion: issue of urbanization). It may thus be important to consider diversity in environments and thus in P–E constellations as people age because of two primary reasons.

First, diversity in key person variables, such as cognitive performance, may need to be qualified, depending on the environment. Indeed, strong differences in cognitive performance may level out at least to some extent because of compensatory and supportive environmental characteristics. An older person low in cognitive function may live in an ecology that is easy to handle at the home and out-of-home levels and his or her neighborhood may reveal all kinds of supporting activities, resulting in no significant differences in autonomy and independence (as compared to an older individual with high cognitive functioning).

Second, focusing P–E constellations as the unit of analysis may lead to a new understanding of diversity in aging at large. One implication of such a view could be that even quite homogeneous older individuals may be seen as quite diverse, when the environment is also taken into consideration.

## ■ SYNERGIES AMONG RECENT ADVANCEMENTS IN GERONTOLOGY AND ENVIRONMENTAL GERONTOLOGY THEORY BUILDING AND RESEARCH

In this final part of the chapter, we shortly highlight three key trends in gerontology at large in recent time, for which we see synergies with environmental gerontology perspectives: (a) event-sampling research designs and the trend toward ambulatory assessment; (b) bio-gerontology developments; and (c) aging and urbanization.

### Environmental Gerontology and New Research Paradigms: The Case of Daily Experience-Sampling Methodology

We argue that the current trend toward intensive measurement designs in the daily ecology and the related increasing use of ambulatory assessment, taking into account short-term, interindividual variability in areas such as cognitive and emotional functioning, and daily stress experiences (Hoppmann & Riediger, 2009; Ram & Diehl, 2015), may benefit from environmental gerontology perspectives. This is so at a fundamental level, because it seems that measurement-burst designs reflect a more general trend—so far, mostly in the behavioral and medical sciences of aging—to consider the natural ecology of older adults as much as possible in their assessments (i.e., to increase what has been labeled “ecology validity”).

As described earlier, such ecological validity is one of the basic premises of environmental gerontology; all the gathered research experience on the issue in this area may also become of profit for event-sampling research designs. At the same time, gathering data as closely as possible in naturally occurring ecologies means automatically that the data-assessment process happens in naturally occurring P–E constellations (Kaspar et al., 2015; Wettstein et al., 2015). Therefore, it may be also good in event-sampling designs to describe (“assess”) the physical–social environment systematically; herein lies another layer where environmental gerontology research and assessment efforts may become important.

### Environmental Gerontology and Bio-Gerontology: The Case of Neuro-Aging

The intersection of environmental gerontology and bio-gerontology and the neurosciences also demands more research attention. For example, a stronger liaison would enable better understanding of possible interactions between environmental input and cognitive and affective functioning at various levels, including brain processes as we age. Although research on the relationship between cognitive functioning and enriched environments indicates the importance of environments for normal aging and Alzheimer’s disease (Arendash et al., 2004; Lores-Arnaiz et al., 2006), scant research regarding P–E transactions exists (Hertzog et al., 2008).

In particular, we are not aware of any rigorous research that brings together the physical–social environment (e.g., various housing solutions in the assisted-living sector) and its impact on frontal lobe processes or brain areas that play a role in affective functioning (e.g., amygdala). A particularly interesting topic would be the better understanding of *novelty* in environments, as much novelty may influence brain development in later life. It seems that the fundamental argument of the neurosciences—that brain

functions unfold in close correspondence with the environment—is mostly unexplored territory in human-aging research, which is in stark contrast to respective animal models designed to understand the aging process.

## Environmental Gerontology and Globalization: The Case of Urbanization

Gerontology that includes environmental gerontology research has been predominantly urban research, though the implications are seldom made explicit (Phillipson, 2004). Urban environments as major living settings of aging people all over the world increasingly reveal similarities—particularly in terms of increasing ambivalences—which seem to become even sharper in the future.

One such ambivalence manifests in the trend toward “hypermobility” on the one hand (particularly for the young, well-educated, elite population) and the search for feelings of *Heimat* on the other hand (possibly more for those in advanced old age). Furthermore, there is reason to assume that urban settings, under the influence of globalization, economic pressure, and mega-diversity of their populations, launch social exclusion and inequalities in day-to-day quality of life, which may ultimately affect senior citizens. Environmental gerontology approaches may be helpful to understand better why older adults have a high likelihood of becoming the targets of such social exclusion processes (Scharf, Philipson, & Smith, 2007).

Similarly, current P–E-fit approaches predominantly applied to the housing domain (Iwarsson, 2004) deserve extension to livable communities or even countries; they may add to the better understanding of the role of ambiguities of aging in the city and to combine political requirements (e.g., age friendliness) with the need for conceptual strength and empirical evidence (Buffel et al., 2014). In other words, environmental gerontology theorizing and the theoretical approaches of a “re-vitalized” (Phillipson, 2004, p. 963) urban sociology and political science concerned with aging should merge their conceptual strengths.

## ■ CONCLUSION

As we argued throughout this chapter, environmental gerontology is an “old” and established area within gerontology theorizing and practice. Still—and this has much to do with changing environments due to scientific and societal developments, as well as demographical trends, the urbanization movement, globalization, climate change, and the discourse on social inequality—environmental gerontology needs fresh input and is currently undergoing major conceptual and empirical challenges in a changing world.

We also made a number of arguments to support the view that developmental science, life-span theorizing, and gerontology theory building at large may profit from environmental gerontology thinking and evidence and that there is an underused potential for cross-fertilization.

Going further, we strongly believe that new alliances among disciplines and scientific programs will further infuse environmental gerontology theory as well as respective empirical research, for example, liaisons with the neurosciences, the health sciences, and the technology and aging area. Consequently, it would be promising for future research if the importance of explicitly considering aging in the environment and the environment in aging—particularly in ongoing longitudinal studies of aging—would



find better resonance; this would avoid the decontextualization of the aging individual, which is tempting, especially for geropsychology. On the other hand—from a methodological perspective—the trend toward event-sampling research designs and ambulatory assessment may bring unexpected new environmental gerontology infusing for geropsychology as well.

## REFERENCES

- Altman, I., & Low, S. M. (Eds.). (1992). *Human behavior and environment (Vol. 12): Place attachment*. New York, NY: Plenum.
- Altman, I., & Rogoff, B. (1987). World views in psychology: Trait, interactionist, organismic, and transactional perspectives. In D. Stokels & I. Altman (Eds.), *Handbook of environmental psychology (Vol. 1, pp. 1–40)*. New York, NY: Wiley.
- Antonucci, T. C., Birditt, K. S., & Akiyama, H. (2009). Convoys of social relations: An interdisciplinary approach. In V. Bengtson, D. Gans, N. M. Putney, & M. Silverstein (Eds.), *Handbook of theories of aging (pp. 247–260)*. New York, NY: Springer Publishing Company.
- Arendash, G. W., Garcia, M. F., Costa, D. A., Cracchiolo, J. R., Wefes, I. M., & Potter, H. (2004). Environmental enrichment improves cognition in aged Alzheimer's transgenic mice despite stable beta-amyloid deposition. *Neuroreport, 15*(11), 1751–1754.
- Austad, S. N. (2009). Making sense of biology theories of aging. In V. Bengtson, D. Gans, N. M. Putney, & M. Silverstein (Eds.), *Handbook of theories of aging (pp. 147–162)*. New York, NY: Springer Publishing Company.
- Baars, J. (2012). *Aging and the art of living*. Baltimore, MD: Johns Hopkins Press.
- Bakan, D. (1966). *The duality of human existence*. Chicago, IL: Rand McNally.
- Baltes, M. M., Maas, I., Wilms, H. U., Borchelt, M. F., & Little, T. (1999). Everyday competence in old and very old age: Theoretical considerations and empirical findings. In P. B. Baltes & K. U. Mayer (Eds.), *The Berlin aging study (pp. 384–402)*. Cambridge, UK: Cambridge University Press.
- Baltes, P. B., Lindenberger, U., & Staudinger, U. M. (2006). Life-span theory in developmental psychology. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology (6th ed., Vol. 1: Theoretical models of human development, pp. 569–664)*. New York, NY: Wiley.
- Bandura, A. (1991). Human agency: The rhetoric and the reality. *The American Psychologist, 46*, 157–162.
- Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on Psychological Science, 1*, 164–180. doi:10.1111/j.1745-6916.2006.00011.x
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497–529.
- Brandtstädter, J., & Greve, W. (1994). The aging self: Stabilizing and protective processes. *Developmental Review, 14*, 42–80.
- Bronfenbrenner, U. (1999). Environments in developmental perspective: Theoretical and operational models. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring*

- environment across the life span* (pp. 3–28). Washington, DC: American Psychological Association.
- Buffel, T., McGarry, P., Phillipson, C., De Donder, L., Dury, S., De Witte, ... Verté, D. (2014). Developing age-friendly cities: Case studies from Brussels and Manchester and implications for policy and practice. *Journal of Aging and Social Policy*, 26(1–2), 52–72.
- Butler, T., & Hamnett, C. (2007). The geography of education: Introduction. *Urban Studies*, 4, 1161–1174.
- Campisi, J. (2005). Senescent cells, tumor suppression, and organismal aging: Good citizens, bad neighbors. *Cell*, 120(4), 513–522.
- Carstensen, L. L. (2006). The influence of a sense of time on human development. *Science*, 312(5782), 1913–1915.
- Colcombe, S., & Kramer, A. F. (2003). Fitness effects on the cognitive function of older adults: A meta-analytic study. *Psychological Science*, 14(2), 125–130.
- Diehl, M., Hay, E. L., & Chui, H. (2012). Personal risk and resilience factors in the context of daily stress. *Annual Review of Gerontology and Geriatrics*, 32(1), 251–274.
- Fozard, J. L., & Wahl, H. W. (2012). Age and cohort effects in gerontechnology: A reconsideration. *Gerontechnology*, 11, 10–21.
- Golant, S. M. (2011). The quest for residential normalcy by older adults: Relocation but one pathway. *Journal of Aging Studies*, 25, 193–205.
- Golant, S. M. (2015a). Residential normalcy and the enriched coping repertoires of successfully aging older adults. *The Gerontologist*, 55(1), 70–82.
- Golant, S. M. (2015b) *Aging in the right place*. Baltimore, MD: Health Professions Press.
- Granbom, M., Himmelsbach, I., Haak, M., Löfqvist, C., Oswald, F., & Iwarsson, S. (2014). Residential normalcy and environmental experiences of very old people: Changes in residential reasoning over time. *Journal of Aging Studies*, 29, 9–19.
- Heckhausen, J. H., Wrosch, C., & Schulz, R. (2010). A motivational theory of lifespan development. *Psychological Review*, 117, 32–60.
- Hertzog, C., Kramer, A. F., Wilson, R. S., & Lindenberger, U. (2008). Enrichment effects on adult cognitive development: Can the functional capacity of older adults be preserved and enhanced? *Psychological Science in the Public Interest: A Journal of the American Psychological Society*, 9(1), 1–65.
- Hoppmann, C., & Gerstorff, D. (2009). Spousal interrelations in old age: A mini-review. *Gerontology*, 55(4), 449–459.
- Hoppmann, C., & Riediger, M. (2009). Ambulatory assessment in lifespan psychology: An overview of current status and new trends. *European Psychologist*, 14, 98–108.
- Iwarsson, S. (2004). Assessing the fit between older people and their home environments: An occupational therapy research perspective. In H. W. Wahl, R. Scheidt, & P. Windley (Eds.), *Annual Review of Gerontology and Geriatrics*, 23 (pp. 85–109). New York, NY: Springer Publishing Company.
- Kaspar, R., Oswald, F., Wahl, H. W., Voss, E., & Wettstein, M. (2015). Daily mood and out-of-home mobility in older adults: Does cognitive impairment matter? *Journal of*

- Applied Gerontology: The Official Journal of the Southern Gerontological Society*, 34(1), 26–47.
- Klie, T. (2014). *Wen kümmern die Alten? Auf dem Weg in eine sorgende Gesellschaft. [Who cares about the aged? On the way to a concerning society.]* Munich, Germany: Pattloch.
- Kolling, T., Haberstroh, J., Kaspar, R., Pantel, J., Oswald, F., & Knopf, M. (2013). Methodological considerations for research in social and emotional robots: Input, outcome, and evaluation. *GeroPsych—The Journal of Gerontopsychology and Geriatric Psychiatry*, 26, 83–88.
- Lawton, M. P. (1977). The impact of the environment on aging and behavior. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (pp. 276–301). New York, NY: Van Nostrand Reinhold.
- Lawton, M. P. (1982). Competence, environmental press, and the adaptation of older people. In M. P. Lawton, P. G. Windley, & T. O. Byerts (Eds.), *Aging and the environment* (pp. 33–59). New York, NY: Springer Publishing Company.
- Lawton, M. P. (1998). Future society and aging. In J. A. M. Graafmans, V. Taipale, & N. Charness (Eds.), *Gerontechnology: A sustainable investment in the future* (pp. 12–22). Amsterdam, The Netherlands: IOS Press.
- Lawton, M. P., & Nahemow, L. (1973). Ecology and the aging process. In C. Eisdorfer & M. P. Lawton, (Eds.), *Psychology of adult development and aging* (pp. 619–674). Washington, DC: American Psychological Association.
- Lindenberger, U., Lövdén, M., Schellenbach, M., Li, S. C., & Krüger, A. (2008). Psychological principles of successful aging technologies: A mini-review. *Gerontology*, 54(1), 59–68.
- Lindenberger, U., Marsiske, M., & Baltes, P. B. (2000). Memorizing while walking: Increase in dual-task costs from young adulthood to old age. *Psychology and Aging*, 15(3), 417–436.
- Lores-Arnaiz, S., Bustamante, J., Arismendi, M., Vilas, S., Paglia, N., Basso, N., ... Arnaiz, M. R. (2006). Extensive enriched environments protect old rats from the aging dependent impairment of spatial cognition, synaptic plasticity and nitric oxide production. *Behavioural Brain Research*, 169(2), 294–302.
- Motel, A., Künemund, H., & Bode, C. (2000). Wohnen und Wohnumfeld älterer Menschen [Housing and neighborhood of older adults]. In M. Kohli & H. Künemund (Eds.), *Die zweite Lebenshälfte - Gesellschaftliche Lage und Partizipation im Spiegel des Alters-Survey* [The second part of life - Societal situation and participation in the mirror of the Aging-Survey data.] (pp. 124–175). Opladen: Leske & Budrich.
- Nyqvist, F., & Forsman, A. K. (Eds.). (2015). *Social capital and health resource in later life: The relevance of context* (Vol. 11). New York, NY: Springer Publishing Company.
- Oswald, F., Hieber, A., Wahl, H. W., & Mollenkopf, H. (2005). Ageing and person-environment fit in different urban neighbourhoods. *European Journal of Ageing*, 2, 88–97.
- Oswald, F., Jopp, D., Rott, C., & Wahl, H. W. (2011). Is aging in place a resource for or risk to life satisfaction? *The Gerontologist*, 51(2), 238–250.

- Oswald, F., & Kaspar, R. (2012). On the quantitative assessment of perceived housing in later life. *Journal of Housing for the Elderly, 26*, 72–93.
- Oswald, F., Schilling, O., Wahl, H. W., Fänge, A., Sixsmith, J. & Iwarsson, S. (2006). Homeward bound: Introducing a four domain model of perceived housing in very old age. *Journal of Environmental Psychology, 26*, 187–201.
- Oswald, F., & Wahl, H. W. (2004). Housing and health in later life. *Reviews on Environmental Health, 19*(3–4), 223–252.
- Oswald, F., & Wahl, H. W. (2005). Dimensions of the meaning of home in later life. In G. D. Rowles & H. Chaudhury (Eds.), *Home and identity in later life. International perspectives* (pp. 21–46). New York, NY: Springer Publishing Company.
- Oswald, F., & Wahl, H.-W. (2013). Creating and sustaining homelike places in own home environments. In G. D. Rowles & M. Bernard (Eds.), *Environmental Gerontology* (pp. 53–77). New York, NY: Springer Publishing Company.
- Oswald, F., Wahl, H. W., Schilling, O., Nygren, C., Fänge, A., Sixsmith, A., . . . Iwarsson, S. (2007). Relationships between housing and healthy aging in very old age. *The Gerontologist, 47*(1), 96–107.
- Peace, S. M. (2005). *Environment and identity in later life*. Berkshire, UK: Open University Press.
- Peace, S., Holland, C., & Kellaher, L. (2006). *Environment and identity in later life*. Maidenhead, UK: Open University Press.
- Phillipson, C. (2004). Urbanisation and ageing: Towards a new environmental gerontology. *Ageing and Society, 24*, 963–972.
- Phillipson, C. (2007). The “elected” and the “excluded”: Sociological perspectives on the experience of place and community in old age. *Ageing and Society, 27*, 321–342.
- Ram, N., & Diehl, M. (2015). Multiple-time-scale design and analysis: Pushing towards real-time modeling of complex developmental processes. In M. Diehl, K. Hooker, & M. J. Sliwinski (Eds.), *Handbook of intraindividual variability across the life span* (pp. 308–323). New York, NY: Routledge/Taylor & Francis.
- Richards, M., & Sacker, A. (2003). Lifetime antecedents of cognitive reserve. *Journal of Clinical and Experimental Neuropsychology, 25*(5), 614–624.
- Rowles, G. D. (1978). *Prisoners of space? Exploring the geographical experience of older people*. Boulder, CO: Westview Press.
- Rowles, G. D. (1983). Geographical dimensions of social support in rural Appalachia. In G. D. Rowles & R. J. Ohta (Eds.), *Aging and milieu: Environmental perspectives on growing old* (pp. 111–130). New York, NY: Academic Press.
- Rowles, G. D., & Bernard, M. (2013). *Environmental gerontology*. New York, NY: Springer Publishing Company.
- Rowles, G. D., & Watkins, J. F. (2003). History, habit, heart and hearth: On making spaces into places. In K. W. Schaie, H. W. Wahl, H. Mollenkopf, & F. Oswald (Eds.), *Aging independently: Living arrangements and mobility* (pp. 77–96). New York, NY: Springer Publishing Company.
- Rowles, G. D., & Watkins, J. F. (2010). The geography of aging and the aged. In B. F. Warf (Ed.), *Encyclopedia of geography* (Vol. 2, pp. 877–878). Thousand Oaks, CA: Sage.

- Rubinstein, R. L. (1989). The home environments of older people: A description of the psychosocial processes linking person to place. *Journal of Gerontology*, *44*(2), S45–S53.
- Ryff, C. R., & Singer, B. (2009). Understanding healthy aging: Key components and their integration. In V. Bengtson, D. Gans, N. M. Putney, & M. Silverstein (Eds.), *Handbook of theories of aging* (pp. 117–144). New York, NY: Springer Publishing Company.
- Scharf, T., Philippson, C., & Smith, A. (2007). Aging in a difficult place: Assessing the impact of urban deprivation on older people. In H. W. Wahl, C. Tesch-Römer & A. Hoff (Eds.), *New dynamics in old age: Individual, environmental and societal perspectives* (pp. 153–174). Amityville, NY: Baywood Publishing.
- Scharf, T., Phillipson, C., & Smith, A. E. (2005). Social exclusion of older people in deprived urban communities of England. *European Journal of Ageing*, *2*, 76–87.
- Scheidt, R. J., & Norris-Baker, C. (2004). The general ecological model revisited: Evolution, current status, and continuing challenges. In H. W. Wahl, R. J. Scheidt, & P. G. Windley (Eds.), *Annual review of gerontology and geriatrics*, *23* (pp. 35–48). New York, NY: Springer Publishing Company.
- Scheidt, R. J., & Windley, P. G. (2006). Environmental gerontology: Progress in the post-Lawton era. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (6th ed., pp. 105–125). Amsterdam: Elsevier.
- Schulz, R., Wahl, H. W., Matthews, J. T., De Vito Dabbs, A., Beach, S. R., & Czaja, S. J. (2015). Advancing the aging and technology agenda in gerontology. *The Gerontologist*, *55*(5), 724–734.
- Settersten, R. A. (2003). Propositions and controversies in life-course scholarship. In R. A. Settersten (Ed.), *Invitation to the life course: Toward new understandings of later life* (pp. 15–45). Amityville, NY: Baywood.
- Settersten, R. A., & Trauten, M. E. (2009). The new terrain of old age: Hallmarks, freedoms, and risks. In V. Bengtson, D. Gans, N. M. Putney, & M. Silverstein (Eds.), *Handbook of theories of aging* (pp. 455–470). New York, NY: Springer Publishing Company.
- Stokols, D. (1999). Human development in the age of the internet: Conceptual and methodological horizons. In S. L. Friedman, & T. D. Wachs (Eds.), *Measuring environment across the life span* (pp. 327–356). Washington, DC: American Psychological Association.
- Tudor-Locke, C., Craig, C. L., Thyfault, J. P., & Spence, J. C. (2013). A step-defined sedentary lifestyle index: <5000 steps/day. *Applied Physiology, Nutrition, and Metabolism = Physiologie appliquée, nutrition et métabolisme*, *38*(2), 100–114.
- Valsiner, J. (1994). Irreversibility of time and the construction of historical developmental psychology. *Mind, Culture, and Activity*, *1*, 25–42.
- Wahl, H. W. (2001). Environmental influences on aging and behavior. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (5th ed., pp. 215–237). San Diego, CA: Academic Press.
- Wahl, H. W., Fänge, A., Oswald, F., Gitlin, L. N., & Iwarsson, S. (2009). The home environment and disability-related outcomes in aging individuals: What is the empirical evidence? *The Gerontologist*, *49*(3), 355–367.

- Wahl, H. W., & Gitlin, L. (2003). Future developments in living environments for older people in the United States and Germany. In K. W. Schaie, H. W. Wahl, H. Mollenkopf, & F. Oswald (Eds.), *Aging independently: Living arrangements and mobility* (pp. 281–301). New York, NY: Springer Publishing Company.
- Wahl, H. W., & Gitlin, L. N. (2007). Environmental gerontology. In J. E. Birren (Ed.), *Encyclopedia of gerontology* (2nd ed., pp. 494–502). Oxford, UK: Elsevier.
- Wahl, H. W., Iwarsson, S., & Oswald, F. (2012). Aging well and the environment: Toward an integrative model and research agenda for the future. *The Gerontologist*, 52(3), 306–316.
- Wahl, H. W., & Lang, F. (2004). Aging in context across the adult life course: Integrating physical and social environmental research perspectives. In H. W. Wahl, R. Scheidt, & P. Windley (Eds.), *Annual review of gerontology and geriatrics* (Vol. 23, pp. 1–33). New York, NY: Springer Publishing Company.
- Wahl, H. W., & Oswald, F. (2010). Environmental perspectives on aging. In D. Dannefer & C. Phillipson (Eds.), *The SAGE handbook of social gerontology* (pp. 111–124). London, UK: Sage.
- Wahl, H. W., Oswald, F., Schilling, O., & Iwarsson, S. (2009). The home environment and quality of life related outcomes in advanced old age: Findings of the ENABLE-AGE project. *European Journal of Ageing*, 6(2), 101–111.
- Wahl, H. W., Scheidt, R., & Windley, P. (Eds.). (2004). *Annual review of gerontology and geriatrics* (Vol. 23). New York, NY: Springer Publishing Company.
- Walsh, K., Rowles, G. D., & Scharf, T. (2014, November). *Constructing home over the life course: Toward a model of at-oneness*. Paper presented in the symposium “International perspectives on home, belonging and aging in the community” at the 67th Annual Scientific Meeting of the Gerontological Society of America, Washington, DC.
- Wanka, A., Arnberger, A., Alex, B., Eder, R., Hutter, H. P., & Wallner, P. (2014). The challenges posed by climate change to successful ageing. *Zeitschrift für Gerontologie und Geriatrie*, 47(6), 468–474.
- Wettstein, M., Wahl, H. W., Shoval, N., Oswald, F., Voss, E., Seidl, U., . . . Landau, R. (2015). Out-of-home behavior and cognitive impairment in older adults: Findings of the SenTra Project. *Journal of Applied Gerontology: The Official Journal of the Southern Gerontological Society*, 34(1), 3–25.