Social-structural lag revisited

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A.Peine, L.Neven. Social-structural lag revisited. Gerontechnology 2011; 10(3):129-139; doi:10.4017/gt.2011.10.3.002.00 This paper revisits Lawton's classic distinction between individual and social-structural lag. We discuss Lawton's original work in the light of two precursors on which he strongly relied: Riley's notion of structural lag, and Lawton's own environmental docility vs. proactivity argument. We then unravel two related implications of a social-structural lag perspective: (i) Older persons should be seen as proactive users of technology. (ii) Technology, in turn, should be explored in terms of the role opportunities it does or does not provide. A brief review of research in gerontechnology reveals that these implications have thus far not received adequate treatment. To rectify this, we make use of insights from the sociological and economic study of innovation, in particular the notions of script and domestication. We conclude with three propositions to augment the gerontechnology agenda on social-structural lag. In sum, research on and design for social-structural lag has to avoid an excessive concern with user needs; rather, it should focus on the inputs of users to evolving technology.

Keywords: social-structural lag, age script, domestication, enrichment, satisfaction

In this paper, we revisit a classic contribution in the field of gerontechnology: the distinction between individual and social-structural lag. This distinction, transferred to gerontechnology by Lawton[1] who relied on Riley's work in social gerontology[2-4], alludes to a twofold objective - that technology for older persons should address shortcomings and vulnerability as much as comfort, enhancement, and joy. While Lawton's claim to address these objectives on equal terms has been reflected in the core conceptual contributions to gerontechnology, we demonstrate that a social-structural lag perspective has more fundamental implications - that older persons should be seen as proactive users of technology, and that technology incorporates role opportunities that strengthen certain behavioral patterns while constraining others. We derive these implications from a discussion of the precursors of social-structural lag, most notably Lawton's own environmental docility vs. proactivity argument[5,6], and Riley's structural lag concept[2-4]. We then develop a set of propositions for future research on and design for social-structural lag. Most importantly, these propositions strive to balance an overly excessive concern with user needs, which permeates much of the literature on technology and aging. Insights from the sociology of technology and innovation, in particular the notions of *script* and *domestication*, inform our propositions.

Individual and social-structural lag

Lawton reloaded

Lawton's 1998 article 'Future Society and Technology'[1] is widely regarded as a milestone publication in gerontechnology[7-9]. Lawton explored two sorts of problems that characterize the relationship between older persons and their technological environments. First, technological change may outpace the capacities of older persons, thus leading to over-demand. An example for this is menu prompting that characterizes contemporary electronic devices, and that does not fit well the technological expertise of

those used to electro-mechanical interfaces[10]. Lawton refers to this gap that opens between rapidly developing technological functionalities and the competences of older persons as 'individual lag'. Secondly, Lawton identified another, possibly subtler gap that opens up between the needs of older persons to grow and engage with new experience, and the opportunities a technological environment offers in this regard. An example for this is the frequent need of today's older persons to maintain family links over great geographical distance, and the lack of opportunities certain technological environments, for instance in institutional housing, offer in this regard. Such environments are not well adapted to changing practices of aging. Lawton referred to this as 'social-structural lag'.

Both lags mark ideal typical challenges in the relation between older persons and their technological environments: Individual lag departs from the demands of a technological environment and indicates the degree to which a person's capacities lag behind this demand; social-structural lag, contrariwise, departs from the demands of a person to actively develop his or her well-being, autonomy, and life-style, and indicates in how far a technical environment fails to provide resources for this. Lawton argued for more attention to social-structural lag problems, which he saw underrepresented in existing research. Unfortunately, he did not elaborate in greater detail the conceptual specifications to meet this request. However, a closer look at two important precursors to his distinction provide additional insights.

Environmental gerontology

Lawton's own seminal contribution to 'environmental gerontology', the press-competence model[11], has provided a framework to analyze how environmental design can curtail comfort and performance of older persons, and how alterations of environmental design can reduce environmental press for older persons. However, as Lawton himself acknowledged, the press-competence model has significant shortcomings, most notably because it assumes older persons to be passive respondents to their environment. This environmental docility hypothesis neglects the role of the environment as a resource, and Lawton later proposed to balance it with an environmental proactivity hypothesis – the understanding that older persons also proactively seek to modify their environment and screen it for resources that meet their needs[5,6,12,13]. In a nutshell, the environmental proactivity hypothesis acknowledges that older persons, in particular those with high levels of competence, are able to actively manage environmental press, and that such coping is a resource for maintaining and enriching competence. While Lawton did not refer to his own earlier work in 1998, the resemblance between individual lag and environmental docility, on the one hand, and social-structural lag and environmental proactivity, on the other, is striking.

Social gerontology

Lawton's concept of social-structural lag explicitly builds on Matilda Riley's work in 'social gerontology' on structural lag[2-4,14,15]. For Riley and her collaborators, role opportunities in the social structure are a pivotal influence for the ways people age. While these role opportunities are constantly redefined, in modern societies they typically lag behind the evolving behavioral patterns of aging. An example of such structural lag is that most European societies still maintain rigid retirement ages, thus constraining productive roles beyond that age[16]. Hence, social definitions of aging, as far as they are institutionalized in norms, rules, and organizations, assume authority over actual patterns of aging, while they are, at the same time, reshaped by these patterns. At the heart of structural lag theory is thus a person-role distinction, where individual behaviours and attitudes and societal role opportunities mutually shape each other[17]. Structural lag refers to the fact that role opportunities normally change slower than the changing behavioral patterns among sequential cohorts of older persons.

Two key messages

Two key messages become apparent from this discussion. First, Lawton's own earlier

work on environmental proactivity points to an important shortcoming of the individual lag perspective: Individual lag presupposes environmental docility, i.e. it positions older technology users as passive vis-à-vis evolving technological environments, and thus downplays their capacity to select, modify and create such environments. It, therefore, assumes a particular division of labor between older technology users and designers: the former are passive recipients of technology, whereas the latter are active creators of it. Secondly, by alluding to Riley's interpretation of aging as a social construct (i.e. governed by social norms and institutions), Lawton reminds us that technological environments embody role opportunities that enable or constraint certain behavioral patterns. In other words, technological environments are not neutral but reflect, give credibility to, and corroborate certain social definitions of aging.

Empirical research

Lawton's claim to equally analyze individual and social-structural lag has been reflected in a series of conceptual contributions to gerontechnology[7,18-25]. Indeed, of the four goals in the gerontechnology impact matrix, a well-established conceptual scheme[24], one goal - 'enrichment and satisfaction' - reflects Lawton's point that technology for older persons must offer opportunities for growth, development, and fun. However, Fozard et al.[21p193] have recently pointed out "[t]hat the conceptual basis for the role of technology in improving the quality of life by 'enrichment & satisfaction' in adult aging is less well articulated than that of its role in prevention, compensation, and care". We contend that this imbalance has its origins in a simplified reception of Lawton's work. We shall substantiate this diagnosis by analyzing empirical research in gerontechnology, and explore how the more fundamental implications of Lawton's framework discussed above are operationalized.

We relied on studies published in the journal Gerontechnology since its inception in 2001, and were interested in modes of conceptualizing older technology users in relation to the design of new technological environments. In a first screening, we identified a set of 36 studies that fit this criterion. We then used a qualitative-inductive approach in the tradition of grounded theory[26-28] to analyze these studies in greater depth. This procedure resulted in three prevailing modes of conceptualizing older technology users. In line with the principles of qualitative inquiry, these modes represent ideal types[29]. That is, probably none of the included studies neatly resembles any of the three modes in a pure way, but all studies incorporate elements of these modes. Consequently, we were interested in these three modes in terms of their content rather than their relative prevalence.

(i) Biomedical approaches and human enhancement: This mode is straightforward - fairly generic biomedical knowledge informs the design process. Certain physical and cognitive functions are likely to decrease with age, and technical interventions are studied in terms of their mitigating effects on this decline. This approach is clearly devised at individual lag problems, i.e. at improving an individual's capacity to cope with the demands of his or her environment.

(ii) Ergonomics in a broad sense: This mode explores the capacities of aging users in relation to particular technological environments. As such, it most closely resembles an orientation towards individual lag and environmental docility: The relationship between technology users and their technological environments is typically modeled as a set of demands posed by the system on the one hand, and a set of capabilities available to the user on the other[30]. If there is a misfit, i.e. a user's capacities do not allow him or her to live up to the demands of an environment, this is recorded as a usability problem marking a potential design improvement. Studies following this approach have been extraordinarily helpful to improve understanding of and mitigate individual lag. They proceed on the assumption that users have to use the technology in question[31] and thus have to live up to its demands. As such, they downplay a user's potential desire and ability to selectively and innovatively engage with technological environments.

(iii) Ethnography inspired inquiries into the everyday life of aging users: Studies incorporating this mode take knowledge about the everyday lives of older people as a starting point to think about technological design[32]. In contrast to the other categories, they do not investigate users and technology in artificial settings, but delve squarely into the context in which technology use takes place. Typically, this involves qualitative, often ethnography inspired methods to unravel not only specific problems older persons may face, but the full set of ambitions, needs, and problems that characterize their daily lives. A pivotal feature of these studies is that they take neither technology nor designers' imaginations of technology as a linchpin from which to evaluate the effectiveness of different types of use. Rather, they elicit a fine-grained understanding of the patterns of everyday life of which new technology ultimately will become part.

Modes (i) and (ii) squarely corroborate Lawton's finding that social-structural lag problems have not received adequate attention in gerontechnology. Indeed, they incorporate two decisive features of an individual lag perspective: First, aging users are represented and defined - often in quite subtle and probably unintentional ways - in terms of shortcomings not characterizing their younger counterparts. Aging users are thus seen as being distinct from other, 'normal' users due to a lower level of competence. Secondly, the characteristics of a technology are the yardstick to evaluate how effectively a user can cope with the technology. Both features resemble environmental docility, as older users are supposed to comply with what designers have envisioned them to do. Mode (iii) also incorporates environmental docility, although in a subtler, less direct way: It uses an in-depth understanding of everyday life to infer a set of needs that can then be satisfied by design. This mode goes a long way in illuminating the importance of user needs, but it leaves the designer's authority over how to meet these needs intact.

All three modes can be and have been related to any of the objectives in the gerontechnology impact matrix, including 'enrichment & satisfaction'. Conceptually, however, none of them reflects the deeper conceptual issues of Lawton's social-structural lag perspective. To the contrary, the studies we have investigated barely go beyond the scope of the environmental docility hypothesis, let alone that they have paid attention to the normative weight embedded in technological design. To the extent that a social-structural lag perspective seems to capture 'enrichment & satisfaction' more adequately, our analysis thus supports Fozard et al.'s[21] finding that the conceptual basis for this objective is still deficient.

Social-structural lag revisited

In this section, we shall demonstrate that the insufficient coverage of a social-structural lag perspective as discussed above reflects more generic misconceptions about the respective roles of users and designers in innovation processes. We then explore the two concepts 'script' and 'domestication' from the sociological and economic study of technological change and innovation - a field usually referred to as 'Science, Technology and Innovation Studies'[33-35] - that will be the basis for an augmented gerontechnology perspective on social-structural lag.

Co-evolution of needs and design

It is common that designers and engineers talk and write about the 'needs' of users. In such reasoning, it seems that needs already exist in the world prior to the conception of the technology. However, empirical studies of technological change and innovation have long questioned the view that 'needs' are something 'out there', ready to be elicited. Rather, technological innovation has been demonstrated to be a process of 'embedding technology in society', where the characteristics and meaning of new technology become articulated while it finds its way into society[36-39]. Technology design, then, is not so much a one-off occurrence, but rather a gradual process to which a broad range of societal actors contribute over time[40]. The car is a classical example[41,42]: It was originally introduced as a 'horseless carriage'. Only after early user experience, the modern idea

of an 'automobile' with a relevance structure organized around issues like speed, mobility, style, endurance, and, lately, sustainability could emerge. Contemporary ideas of the 'sport coupe', the 'family station wagon' or the 'convertible', as well as the needs and wants these designs satisfy, the aspirations they represent, and the lifestyles and status they display, illustrate that the 'horseless carriage' has come a long way in shaping new mobility needs and wants in contemporary societies. This process would not have been possible without the aggregated input of users that, during use, have articulated what the car could and should be.

At the more specific level of product design, this puts into context the idea of user needs as design input. When in technological change needs emerge together with design characteristics, then an excessive concern with user needs might be as much a pitfall as the traditional neglect for user needs. Stewart and Williams[43] have recently referred to this dilemma as the 'design fallacy'. The family resemblance with the environmental docility vs. environmental proactivity tension is apparent: Only under the assumption of environmental docility, user needs have to be known beforehand in order to design for optimal person-environment interactions. Assuming environmental proactivity, on the contrary, would focus on a user's capacity to shape the form and meaning of new technological environments in accordance with his or her evolving needs. The concept of 'script' and the notion of 'domestication' capture this subtler side of user-technology interactions.

Script

To capture the interplay between the uses imagined by designers and the use to which designs are put in the everyday life of users, the metaphor of a script is frequently employed[44-47]: Just like in a film script, designers 'write' into an object certain scenarios for its future use. These scenarios make it easier or more obvious to use the technology in a certain way, while other forms of use – often deemed less desirable – are discouraged by the design of the technology.

The notion of 'genderscripts' is an illustrative example[48-50]: feminist researchers have shown how (male) designers script ideas about gender identities into technology. These scripts then reinforce the status of these identities as 'normal'. For instance, shavers for men are usually screwed together, are black and metal colored and have displays. In contrast, shavers for women are often clicked together, have no displays and are presented as a beauty set[49]. As a result, men have far more opportunities to control and gain access to and knowledge about their shavers, whereas shavers for women make it very hard for women to gain knowledge about or control over them. Through their particular design, male and female shavers reinforce existing social definitions of men as technologically competent, and women as technologically incompetent. Through scripts, therefore, (implicit) ideas about users are materialized in designs, influence the behavior of real users, and become part of normality, of 'the way things simply are'.

Of course, users are not bound to follow scripts, but can interpret, reinvent or simply ignore them. And, indeed, evidence is abundant that users find creative ways to use technologies in ways not intended by designers[51]. Resistance to scripts, therefore, is an important source of reflective learning in innovation processes; through adapting scripts to suit the specificities of their everyday life, users claim their authority in the innovation process. An important implication of research on scripts, therefore, is that the practices and values of designers and users mutually shape each other, with scripts as an important connection. The degree to which the respective authorities of designers and users play out in a specific innovation process thus depends both on designers' scripts and the competence of users.

Domestication

To analyze the reinterpretation of scripts as a source of innovation, the metaphor of 'domestication' is widely used. Domestication research has explored in detail how newly acquired technical objects gradually be-

come part of everyday routines, practices and identities[52-55]. Through domestication, originally alienating technical objects, once entering a household, are turned into something familiar so that domestication "quite literally involves a taming of the wild and a cultivation of the tame"[51]. Domestication is a complex process where users create a physical space and temporal routines for a new technology and establish its particular meaning and relevance, which becomes the background against which the usefulness of a technology is evaluated.

An example that illustrates the stages of domestication can be taken from the research of one of these authors (L.N.) on a test with a human-interaction robot for older persons[56]. With this robot, for the purpose of this article called iRo, older persons could play cognitively challenging games. iRo could mimic facial expressions, and comment in plain Dutch on the events in the game at hand, thus turning it into a game companion.

The developing company did two tests with a group of older persons, one in its laboratories and a subsequent field test in the homes of the test persons. Although the older participants liked playing with iRo during the laboratory tests and thought it worked very well, their initial response to the question whether they would like to have a robot like iRo was very typical. One older man, for instance, said: "If you were, say, old and growing demented, then I could imagine this being a good thing, but for me? (…) You'd have to be a lonely old person, chained to your home with few contacts. I still go to my checkers club". To the participants in the tests, iRo was a signifier of old age and frailty. Partly this was due to the way iRo and robots like it had been in the media prior to the tests and partly it could have been due to the fact that the older persons knew that they were selected on the basis of their age and the fact that they lived alone. They thus assumed that iRo was a robot for older persons that were not very active and needed company, and they did not associate themselves with such a person.

Interestingly, when asked after the laboratory tests whether they would like to participate in the field test, nearly all the test persons in the group agreed. They did this because they thought participating in testing and research was fun and interesting, and – importantly – because they thought they were helping other people, older and frailer than they were. Thus, via the back door of being a helpful participant, the robot did find its way into the homes of older persons. Once there, something interesting happened: despite their initial reservations about iRo not being a robot for them, nearly all the participants in the field test fully domesticated iRo. It got a physical place in their homes and it was taken up in their daily routines. After the field test was done and the researchers came to collect iRo, the participants readily admitted that they had grown attached to iRo and that they were going to miss it. iRo was fully taken up in their lives, up to the point that they were not afraid of showing themselves to others as users of iRo. The important point is that the older persons managed to turn iRo into a fun object to which they became attached. It is unlikely, however, that they would have done this without referring to the alternate identify of a helpful and altruistic test user. As mere end-users, these older persons would have simply rejected iRo.

This case illustrates two essential points. First, technical objects are not just adopted by their users, but users actively adapt technical objects to fit their specific circumstances. Domestication, therefore, involves a complex and creative process through which technology is brought into use in specific contexts. This is an important impetus for innovation, as it elicits the needs a technology satisfies and thus the range of functions it, eventually, offers. Secondly, how, and if at all, technical objects become domesticated depends on the images designers have of prospective users. The case study illustrates that (implicitly) scripting images of frail and lonesome older persons into a technology can effectively keep older persons from engaging with a technology.

In summary, studies of technological change and innovation have revealed that users can be innovative in many ways. Their role is not constricted to that of passive recipients of new technology. To the contrary, users explore what certain designs can do in different contexts, and, in this way, contribute to the collective definition of the functionality, relevance and meaning of a technology. In addition to such 'immaterial' contributions, users have frequently been found to modify designs in order to fit local circumstances[38]. The point is that as more complex technologies - particularly ICTs as discussed under headings as home automation, smart homes or ambient intelligence - advance into today's private households, users are more likely to become co-designers of technology to fit complex technical arrangements into their lives[57]. These insights nicely connect with a social-structural lag perspective as defined by Lawton - as we shall demonstrate in the following, concluding section.

Conclusions

We have demonstrated that individual and social-structural lag as defined by Lawton mark two distinct perspectives on the relation between older persons and technological environments. Delving into the origins of Lawton's distinction has revealed two pivotal features of the social-structural lag perspective: older persons should not be seen as passively responding to their environments. Furthermore, technological environments are not neutral but rather incorporate and strengthen certain ideas about aging. The prevailing modes in gerontechnology research of conceptualizing older persons in relation to new technological environments have not reflected these aspects. Rather, they resemble, more or less directly, the environmental docility hypothesis and thus an individual lag perspective. Our findings thus support and specify Fozard et al.'s[21] contention that social-structural lag still awaits proper conceptualization and empirical treatment. In our view, the notions of domestication and script, which stem from economic and sociological studies of innovation, provide an excellent basis to rectify this and augment research on and design for social-structural lag. In what follows, we elaborate upon this conclusion along three key dimensions - two for gerontechnology research, and one for gerontechnology design.

Researching domestication

In a social-structural lag perspective, design for older persons should not be overly obsessed with user needs 'as an input'. Much of the underconceptualization of social-structural lag and the related gerontechnology category of 'enrichment & satisfaction', we believe, can be accounted for by this belief that new design should fit a set of previously defined needs. Indeed, there is a strong affinity with the environmental docility hypothesis that underlies an individual lag perspective: under the assumption that the needs of older persons can be identified before they use a design in their everyday context, their capability to proactively alter or create environments is likely to be neglected. A social-structural lag perspective, therefore, asks for a considerably more complex treatment of users needs, namely as something inherently entangled with the real world use of technology, than an individual lag perspective.

The notion of domestication provides a possible way out of this quandary. That is, a social-structural lag perspective might considerably benefit from the insight that designs are propositions to users who can and will respond in unforeseen but meaningful ways. In this regard, the tradition of domestication research is a valuable source of inspiration: mostly using ethnographical methods, it has explored the often intricate ways in which users put new technologies to use, thus inventing unforeseen forms of use and sometimes also altering the technology itself. Unfortunately, only a few recent and sometimes preliminary studies have focused on such processes specifically for older persons[56,58-61]. Building on this emerging strand of domestication research in the everyday worlds of older persons, we conclude, will substantially augment the conceptual and empirical basis for understanding social-structural lag. A central tenet is to

scrutinize closely the everyday practices of older persons 'in interaction' with new technology. The example of the iRo discussed above indicates more concrete directions and possible benefits of such an approach.

Researching age scripts

On a more general level, a social-structural lag perspective implies to acknowledge that technology lends normative power to certain ideas about aging. This aspect has not yet received noteworthy coverage in gerontechnology. The notion of script and associated research has potential to rectify this. Like certain ideas of gender are 'written' into technologies, ideas about ageing can be – and often are – written into technologies as well. When simplified or stereotypical ideas or images of older persons are the basis for design, these ideas may not only inadequately reflect needs, but they may actually constrain the behavior of older persons accordingly. One of these authors (L.N.) has proposed to use the notion of 'age scripts', in this regard, and showed how passivity is often inscribed in the design of telecare environments[62]: If older people are imagined as having problems in handling new technologies, as having trouble learning, as forgetting instructions, or as using technology in 'inappropriate' ways, technological environments are likely so designed as to require very few new actions by older users. An individual lag perspective, just in the sense described by Riley[3p2] , may thus turn into a self-fulfilling prophecy when environmental proactivity is deliberately constrained by design.

Technological environments, therefore, are powerful mediators between stereotypes of older persons and the actual behavioral patterns of aging. For gerontechnology research, we thus propose a greater sensitivity to the role opportunities implicit to technological environments. In other words, research has to acknowledge the importance of 'age scripts' - that technological design not neutrally meets (or fails to meet) certain needs, but that it makes certain behavioral patterns more likely than others. This also means to be sensitive how certain research settings about older technology users, for instance in detached laboratories, might reinforce assumptions about vulnerable and overstrained older technology users. We conclude, therefore, that a social-structural lag perspective has to incorporate an understanding of the construction and working of age scripts in design. For designers, focusing on active rather than passive scripts might thus become a key task in designing for social-structural lag - as we will see in the following section.

Designing for domesticability

Given the importance of domestication and scripts, we finally conclude that 'domesticability' is likely to be a more important and encompassing aspect in designing for social-structural lag than traditional ideas of usability or user-centered design. By domesticability we mean that new technology should allow older users to engage with it in a proactive and playful way, i.e. it should encourage them to domesticate it as active users. A focus on domesticability relaxes the assumption often found in usability approaches - at least in the way they are normally operationalized[63] - that a technology is usable when users appropriate it in more or less exactly the way intended by designers. Domesticable technology, in contrast, is open to uses not foreseen by its designers.

In a nutshell, domesticability marks a middle ground between design and user centered approaches: designer's conceptions of technology should not be taken as a yardstick to measure a user's 'performance'. But neither should design be based on meticulous research into existing user needs. Apple's recent strategy, particularly in relation to the iPad, is an excellent example: they create well-conceived design proposals to users not based on extensive research on user needs, but open to modification and redefinition by users[64,65]. In other words, Apple pursues a relatively design-driven approach, but deliberately focuses on active scripts in their designs. In such an approach, it is crucial to give users the opportunity to work with designs and monitor closely the evolving practices that emerge from the us-

ers' engagement with a particular design. Also designing for older persons might greatly benefit from such a playful involvement of users, not as an end in itself but as a way to facilitate the input of older technology users to innovation.

Our conclusions are meant to enrich a social-structural lag perspective on technology and aging. Of course, this does not imply that we deem an individual lag perspective unimportant. To the contrary, we share Lawton's claim that gerontechnology should address both individual and social-structural lag. We hope that our discussion of some hitherto neglected implications of a social-structural perspective helps to strengthen such a balanced approach in gerontechnology. As a side effect, our considerations might also help in addressing older persons as technology users in the full sense of the word - not as mere recipients of new technology, but as active co-creators of innovation.

Finally, it will also be interesting to investigate how the individual vs. social-structural lag dynamics play out across different cultural contexts. We speculate that a social-structural lag perspective is most relevant in Western industrialized economies, with the baby boomer generation and its particular consumer lifestyles soon reaching retirement[66]. It is far from self-evident, however, that this also applies to other cultures, in particular to Asian cultures, where older technology users might be accustomed to express their lifestyles through the consumption and use of new technology in quite different ways.

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