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Age stereotypes in agile software development – an empirical study of performance expectations

Uta Schloegel
Department of Social Psychology, Goethe University Frankfurt, Frankfurt, Germany
Sebastian Stegmann
Department of Psychology, Goethe University Frankfurt, Frankfurt, Germany
Alexander Maedche
Chair of Information Systems, University of Mannheim, Mannheim, Germany, and
Rolf van Dick
Department of Psychology, Goethe University Frankfurt, Frankfurt, Germany

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Abstract

Purpose – Research on agile software development (ASD) has so far primarily focused on processes and tools. Recently, researchers have started to investigate the social dimensions of ASD. The authors contribute to this and examine the largely invisible psychological factor of age stereotypes as one important social dimension of ASD. Driven by demographic change, employees of different age groups will need to work closely together in ASD in the future. However, age stereotypes can hinder many aspects of communication, cooperation and coordination in these self-managed teams. The purpose of this paper is to identify and differentiate age stereotypes in ASD.

Design/methodology/approach – A quantitative survey at the individual level was conducted with 464 employees in two software development companies. The authors developed an age stereotype model for ASD and developed two scales to measure performance expectations (PEs) in ASD.

Findings – Employees in ASD show a bias in general PEs, favoring middle-aged employees over both younger and older employees. The perceived PE of a developer decreases over working life. Furthermore, the data show a complex interplay of age and job role in both the research participants and the group evaluated. Younger developers hold the strongest negative age stereotypes and older developers suffer most from stereotypes.

Practical implications – Management should enact formal or informal measures against stereotypes when an older or younger employee joins a team of members of other age groups, or when a new team is formed. In addition, the authors propose human resources to create permeable career paths.

Originality/value – The study extends the stereotype content model by adding additional age groups and including job role as a moderating variable. It identifies obstacles in daily employee interactions in agile development, and proposes ways of incorporating invisible psychological aspects in ASD-specific theories.

Keywords Perceptions, Information systems development (ISD), Agile computing, Agile software development, Knowledge worker performance, Job role, Age stereotype, Performance expectation, Stereotype content model

Paper type Research paper

1. Introduction

In 2012, the *Economic Times* (Sujit and Phadnis, 2012) quoted alarming statements by the managing director of an Indian subsidiary of a leading international software company: "The shelf life of a software engineer today is no more than that of a cricketer – about 15 years […] The 20-year-old guys provide me more value than the 35-year-olds do."

The European Commission stated in 2009 that workers experience age discrimination more often than other forms of discrimination and 58 percent of European citizens believe that age stereotypes are a widespread problem in their country, despite legislation against it (Krings *et al.*, 2011). In an extensive review, Posthuma and Campion (2009) found that most age stereotypes are negative and that they are especially strong in jobs entailing

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technology-related tasks. Furthermore, owing to the worldwide aging of the workforce (Avery *et al.*, 2007), the proportion of older employees will rise steeply by 2030, to the point where soon they will no longer be a minority (Fullerton, 1999; Posthuma and Campion, 2009). Demographic change is an important challenge for the innovation and competitiveness of the IT industry with its formerly young and highly educated employees, who are now also starting to age (Kleefeld, 2008; Posthuma and Campion, 2009). However, there is a dearth of research on the topic within the software industry.

Information systems researchers have focused to a great extent on processes and tools in software development (SD: Adolph *et al.*, 2012). Recently, some researchers have called for more research on the social dimensions (Fernández-Sanz and Misra, 2011), because social factors are significant cost drivers in SD and explain variation in the productivity of SD teams (Adolph *et al.*, 2012). Practitioners, also, tend to focus more on social aspects than processes and tools; they emphasize collaboration, communication, commitment, care, sharing, and self-organization (Fontana *et al.*, 2014). Thus, understanding the barriers and success factors of social behavior would greatly benefit the software industry. However, very few studies have focused on the social dimension of SD (Adolph *et al.*, 2012).

Research needs to be more sensitive to subtle human factors and team dynamics (Conboy, 2009). This is particularly important concerning agile software development (ASD), because agile practices shall value people and interactions over processes or tools (Chow and Cao, 2008; Moe *et al.*, 2010), and they rely even more on communication and knowledge exchange than conventional SD practices (Lee *et al.*, 2014; Maximini, 2013a). In this line, some researchers have started to examine trust and care in SD (Fontana *et al.*, 2014; Moe *et al.*, 2010) and aspects of diversity, such as gender-based stereotypes (Ruiz Ben, 2007). In addition, ethnicity-based stereotypes have been studied in relation to distributed development (Mishra and Mishra, 2014). However, diversity in terms of age has been found to have a stronger negative effect on team-level performance across industries than diversity in gender or race/ethnicity, as shown in a recent meta-analysis (Joshi and Roh, 2009). Therefore, it is surprising that research on the diversity aspect of age is lacking in SD.

Age stereotypes are socially shared beliefs concerning the attributes, characteristics, and behaviors that members of a specific age group have in common (Levy, 2009). They can be positive or negative. Age stereotypes can strongly shape social behavior (Posthuma and Campion, 2009), and thus influence interaction in SD. Negative stereotypes are dangerous for interactive work in SD, because they can manifest themselves in social discrimination, and the denial or disadvantaging of persons purely because they belong to a specific group (Stangor, 2009). In particular, they can harm respect, trust, care, communication, cooperation, and team identification (Posthuma and Campion, 2009; Wegge *et al.*, 2012), which all are aspects shown to be important in agile development in general and for the self-organization of teams in particular (Drury *et al.*, 2012; Hoda *et al.*, 2013). We outline these relationships in more detail below.

In addition, research on stereotypes of younger employees has been largely neglected. Observing only stereotypes of older employees bears the risk of disregarding the effect of stereotypes that employees have suffered at an earlier stage, and these could shape attitudes, behavior, or stereotypes in later career stages. In addition, the proportion of employees above 50 years of age in the IT industry grew by 78 percent from 1999 to 2004 (DiWa, 2010), and it will become difficult to find enough younger employees in the decades ahead (Wegge *et al.*, 2012). Consequently, the preservation of sustainable performance is becoming more important than ever for both older (> 50 years) and younger employees (< 35 years). In the long run, younger employees might become a minority. With this in mind, it is interesting to see that negative stereotypes of younger employees are already forming today: younger employees are viewed as being too young for specific jobs or positions (Snape and Redman, 2003) or for promotion (O'Higgins, 2001).

Given the current demographic trends, we will see more generations working together in age-diverse teams. Such age-diverse teams, especially those engaged in complex tasks (as in SD), need to have a high appreciation of age diversity to be effective (Wegge *et al.*, 2012); thus, negative age stereotypes can greatly hinder team performance in SD.

The goal of this paper is to identify and differentiate performance-related age stereotypes in ASD. In addition, we seek to explore which employees suffer from particularly negative stereotyping (considering their age and job role), and which employees hold particularly negative age stereotypes (considering their age and job role). To address these research questions, we develop an age-stereotype model in ASD.

This study contributes to research in the field in three ways. First, our study extends the stereotype content model (SCM) by adding age groups (younger and middle-aged employees), as well as the new moderator of job role. Second, we have developed and successfully validated two scales for job role-specific performance expectations (PEs) that can be used in further studies. Third, our study uncovers conditions under which team processes might be endangered and for which proactive measures should be taken. For example, it gives first indications concerning why communication and respect – as two of the five key values of ASD (Conboy, 2009) – are lacking in some areas and how they can be improved. Strode and colleagues (2012) have asked for a re-evaluation of existing theories concerning SD and project management in the context of agile development. Given the high demands for well-functioning social interactions in ASD and the negative effect of stereotypes on team performance (Joshi and Roh, 2009), our study is a call for researchers to extend ASD-specific theories by incorporating implicit social factors, such as age stereotypes (i.e. factors that are latent and cannot be observed directly). For this purpose, we will develop ideas for future research regarding the components of existing ASD-specific theories that can be integrated with age stereotypes. Finally, the study contributes to practice as it shows barriers to effective work processes in self-managed teams and proposes proactive measures.

We first introduce existing psychological research on age stereotypes in general and then explain how social factors in SD are influenced by age stereotypes in Section 2. Thus, we integrate existing SD and psychological perspectives to lay the foundations for developing our hypotheses in Section 3. After that, we set out our research method to test our hypotheses in Section 4 and present the results of our quantitative study in Section 5. We conclude with a discussion of our findings, the study's theoretical and practical contributions, and directions for future research in Section 6.

2. Theoretical foundations

2.1 Age stereotypes

Stereotypes have been described using the SCM (Fiske *et al.*, 2002), which has repeatedly been reconfirmed (Cuddy *et al.*, 2011). The model describes stereotypes for specific groups (such as disabled and homeless people, professionals, and older, rich, and middle-class people) using the dimensions of warmth and competence. These two stereotype dimensions of warmth and competence (or performance in the context of work as Krings *et al.* (2011) suggested) are important to people because they answer the question of whether another person might be helpful or harmful, and whether that person wants to help or harm. In particular, the model has been used to describe age stereotypes, and the low-competence stereotype has been confirmed for older people in general (Fiske *et al.*, 2002), and the low-performance stereotype has been confirmed for older employees in the workplace specifically (Cuddy *et al.*, 2011; Krings *et al.*, 2011).

Stereotypes are often learned through socialization, and might be activated even in people who deem themselves tolerant and free of discriminating tendencies (Devine, 1989). Indeed, stereotypes can be held and affect behavior even at a pre-conscious level (Jost *et al.*, 2009).

Research has found many negative age stereotypes toward older employees. They are frequently viewed as less productive, less creative, more resistant to change, less able to learn, less receptive to new technologies, and less willing to attend training sessions or take risks (Posthuma and Campion, 2009; Van Dalen *et al.*, 2010). All of these aspects are seen as important barriers to high performance in the SD process. Some positive age stereotypes of older employees have been reported, such as better self-regulation, reliability, loyalty toward the employer, know-how, customer orientation, communication, and conflict resolution capabilities (Krings *et al.*, 2011; Posthuma and Campion, 2009). It is not clear, however, if these stereotypes are based on biological age or more on the older employees' greater work experience.

Many of these stereotypes do not fit reality. For example, older employees' performance is not generally lower than that of younger employees, but rather is often even higher (Posthuma and Campion, 2009). Inter-individual differences are high among older people (Posthuma and Campion, 2009), i.e., performance differences are higher within the age group of older employees than between the age groups of older and younger employees. Furthermore, differences within age groups are higher than between age groups, and differences between employees result more from abilities, experience, health, and compensation strategies than due to age (Posthuma and Campion, 2009).

Negative stereotypes toward younger employees also exist. For example, younger employees are viewed as being disloyal to their employer and to prefer not to work with older employees (Snape and Redman, 2003), which can be considerably harmful for the interaction between employees of different age groups. Interestingly, there is a positive correlation between ageism toward both younger and older people (Barel *et al.*, 2013). A person who tends to hold negative age stereotypes with regard to either older or younger people typically also holds negative age stereotypes toward the other age group.

The consequences of age stereotypes are numerous, exerting an influence at the individual, team, and organizational levels: the expectation that performance declines can act as a self-fulfilling prophecy, and shape the attitudes and behavior of older employees (Leidig, 2007). Consequently, by the age of 40, developers fear that soon they may no longer satisfy the requirements of their profession (Comeau and Kemp, 2007). In addition, age stereotypes can diminish the chances of younger and older workers being given interesting and profitable tasks (Cuddy *et al.*, 2011). They can influence leadership and cause discrimination in the workplace by managers, favoring older employees less for selection or promotion (Leidig, 2007). They can shape corporate cultures (Leidig, 2007), and they can lead to difficulties in attracting or keeping highly qualified and productive employees (Brooke and Taylor, 2005), thus harming the whole enterprise. They can also strongly affect various team-level aspects, as we outline in the following section.

2.2 The influence of age stereotypes on social factors in SD

Software is developed in teams, and teamwork relies greatly on communication, team orientation, feedback, and coordination (Dickinson and McIntyre, 1997). Communication and the sharing of knowledge are often difficult because of differences in knowledge, perceptions, and work practices (Ponte *et al.*, 2009). Team work processes and resistance from groups or individuals are two of the main factors for human-based failures in ASD (Chow and Cao, 2008). Age stereotypes can separate employees and thus be harmful in SD. For example, cooperation within and across teams, as well as with external stakeholders, relies on listening carefully and responding constructively to different views expressed by others (Adolph *et al.*, 2012; Moe *et al.*, 2010), a process that can be greatly impaired by negative stereotypes. When negative age stereotypes are in place, the product owner might, for example, negotiate less carefully with a product owner of another team who belongs to another age group, or a developer might negotiate interfaces less carefully with a developer of another age group.

ASD refers to a group of methodologies focusing on the flexible and responsive development of software, typically realized in self-organizing teams within short iterations, allowing changes to requirements during development (Conboy, 2009; Dingsøyr *et al.*, 2012). Self-organizing agile teams are composed of individuals who manage their own workloads and shift work, based on need and best fit, and participate in team decision making (Hoda *et al.*, 2013). A fundamental requirement of ASD practices is that formal documentation is kept to a minimum (Pikkarainen *et al.*, 2008), because documented knowledge often cannot be kept up to date due to fast-changing requirements or technology, and development requirements cannot be documented without project participants misinterpreting them because too many actors view the product from different perspectives, for example, technically or business-related, or from a consumer or seller perspective (Pikkarainen *et al.*, 2008). Consequently, ASD practices increase the need for good communication, cooperation, and knowledge exchange (Lee *et al.*, 2014 Maximini, 2013a), both internally within the team (across all job roles) and externally with stakeholders. Consequently, age stereotypes might harm ASD processes even more than conventional SD processes.

Scrum is the most popular ASD methodology (Hoda *et al.*, 2013; Rubin, 2012). It involves short incremental product development cycles, a prioritized backlog (i.e. a list of necessary functionalities or capabilities), and a team with specific job roles (developer, development architect, scrum master, and product owner), deciding on its own how to develop the next product increment based on the backlog (Schwaber and Beedle, 2002). The product owner is responsible for the success of the product to be developed, analyzes requirements, engages in discussions with customers, and breaks down business requirements into development tasks. The scrum master facilitates communication among the developers within the team and moderates the review meetings wherein accomplishments are presented to the product owner and stakeholders, such as customers and management. The development architect defines the system architecture and reviews the technical concepts that developers propose. The developer translates business-related tasks into technical requirements and produces the programming code necessary to accomplish these tasks, as well as the interfaces that other developers or programs need (Rubin, 2012).

The social processes that take place within teams have been explained by Moe and colleagues (2010), who extended the Dickinson and McIntyre teamwork model for ASD by incorporating the component of trust. The team-work model has the following core components: communication, team orientation, team leadership, monitoring, feedback, backup, and coordination. Most of these components can be impaired when negative age stereotypes arise: a person holding negative age stereotypes might not reach out enough to colleagues in another age group and share knowledge, while a person suffering negative age stereotyping might not be sufficiently willing to reveal problems in the daily scrum meeting, and thus cannot be helped or monitored by team members, which in turn can reduce backup for and the learning of the individual and the team (Moe *et al.*, 2010). In addition, it becomes difficult for those holding or suffering from negative age stereotypes to give or accept negative feedback, which again hinders learning. Negative age stereotypes can also reduce team identification (Ellwart *et al.*, 2013). Moreover, negative age stereotypes impair trust between employees, which is needed in the interplay between employees in various job roles (Kuriyan *et al.*, 2010): product owners need to place great trust in team members (McHugh *et al.*, 2012); scrum masters need to place trust in order not to start to control individuals; developers need trust in each other when revealing problems or skill deficiencies or when asking for help; developers need to trust the scrum master, who guides team processes without having the authority to do so, and developers will only follow this person's advice if they believe in him or her (Maximini, 2013a).

As effective coordination is crucial in self-organizing teams, Strode and colleagues (2012) extended the theory of coordination within ASD by showing that coordination strategy

drives coordination effectiveness, which in turn drives project success. In addition to comprising an explicit component of physical elements, coordination effectiveness entails an implicit component without explicit message passing, based on knowledge. The implicit effectiveness component is in turn influenced by two components of the coordination strategy, i.e., synchronization (activities and artifacts) and structure (availability, proximity, and substitutability of team members). Both components within the strategy component can be influenced by age stereotypes as these can shape the frequency and quality of synchronization between team members and external interaction partners, as well as the substitutability of team members. Consequently, age stereotypes can shape coordination as well as project success.

Assuming that age diversity in teams will grow due to demographic change in the future, it is of the utmost importance to gain a deeper understanding of how differences in age affect members who are working together. Previous research has shown that team members' diversity in the age can have positive and negative effects (Avery *et al.*, 2007; Wegge *et al.*, 2012). One of the preconditions of an effective team that works on complex tasks (as in ASD) is a high appreciation of diversity in age (Wegge *et al.*, 2012). It is unlikely that people holding negative age stereotypes will appreciate working with people from other age groups. Hence, negative age stereotypes are likely to impair the performance of age-diverse teams. Under these conditions, team performance is likely to be diminished because negative perceptions of diversity in age (and not diversity in age itself) can foster emotional conflicts in a team, and reduce group identification and knowledge exchange (Ellwart *et al.*, 2013; Homan *et al.*, 2007).

To summarize, negative age stereotypes (i.e. implicit factors) can harm many social factors crucial for the success of SD, and even more so for ASD. In particular, stereotypes can influence several components of ASD-specific theories.

3. Research model: age stereotypes in ASD

To identify age stereotypes and their moderators in ASD, we follow the meta framework of Posthuma and Campion (2009), which explains that age stereotypes can be tested by examining the main effect of target age (i.e. the age of the group evaluated) on PEs. The meta-framework suggests examining curvilinear relationships and moderators. To find curvilinear relationships, we use more than two age categories (i.e. younger, middle-aged, and older). In this way, we can compare PEs of younger, middle-aged, and older employees. As potential moderators, we assess participant age, participant job role, and target job role. Our research model is depicted in Figure 1 and outlined in the following sections.

3.1 Stereotypes of younger and older employees in ASD

Is the relation between age and PEs linear or curvilinear? To the best of our knowledge, research to date has not addressed this specific question. Based on the SCM, research has discovered that older employees are negatively stereotyped, as explained above. This has

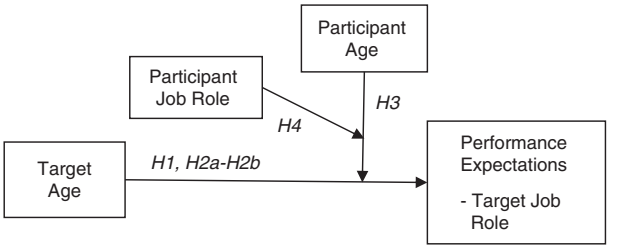

Figure 1.
Conceptual model: age stereotypes in ASD model

been shown for several industries, and thus, we propose that the performance of older employees is also perceived to be lower in ASD. How is the performance of younger and middle-aged employees perceived? During their working life, employees accumulate experience, and meta-analyses have found that the experience gain is very important for performance in the first years of a complex job (Sturman, 2003). Similar results have been found in SD because expertise in programming greatly improves development project efficiency (Faraj and Sproull, 2000). However, these results concern performance and not PE. Nevertheless, Marshall (2011) found in a qualitative study that IT employees view experience as an important factor for performance. Thus, we propose that middle-aged employees are considered better performers than younger employees:

H1. Employees in ASD are biased regarding the performance of younger, middle-aged, and older employees.

H1a. PEs of middle-aged employees are higher than those of older employees.

H1b. PEs of middle-aged employees are higher than those of younger employees.

H1c. The relation between target age and PEs is curvilinear in the form of an inverted *U*-shape.

3.2 Stereotypes of younger and older employees related to job role

Different task requirements might contribute to the differing results in the literature concerning age and PEs (Waldman and Avolio, 1986). For example, older top managers are widely accepted as being good performers (Salthouse, 2012), while older employees in technology-associated jobs tend especially to suffer negative age stereotypes (Perry and Finkelstein, 1999), which implies that job role might exert a strong influence. The results of negative stereotyping of older employees in technology-associated jobs led Posthuma and Campion (2009) to the conclusion that age stereotypes are particularly strong in IT. However, this needs to be differentiated because not all job roles in IT have the same focus on technology. For example, the product owner focuses more on business-related aspects, while development architects and developers focus more on technology-associated parts (Maximini, 2013b).

In addition, a job position that is seen as typical by the workforce for younger employees can lead to more negative age stereotyping of older employees in this position as age is more salient (Cleveland and Hollman, 1990; Perry and Finkelstein, 1999). This can be explained by the notion of normative fit in the social identity approach (SIA: Turner *et al.*, 1987). The SIA has been used extensively in age stereotype research (Posthuma and Campion, 2009). It comprises two interrelated theories – social identity theory (Tajfel and Turner, 1986) and self-categorization theory (Turner *et al.*, 1987). Probably the most basic tenet of both theories is that a large part of our identity is based on membership in social groups, and that people categorize themselves and others into such groups. To derive such categorizations, people execute social comparisons to distinguish between individuals who are similar and different. The SIA predicts the circumstances in which certain differences will lead to social categorization. One important influencing factor is normative fit (Turner *et al.*, 1987), which reflects the extent to which a categorization makes sense in relation to an individual's cognitive frame of reference, such as beliefs or expectations.

The job role of developer is associated with youth in general (Cleveland and Hollman, 1990; Marshall 2011), i.e., it is perceived by people (within and outside the software industry) as being prototypical for younger people (Cleveland and Hollman, 1990); in other words, the normative fit of developers being young is likely to be high in ASD and thus, the job role is a salient category. Such a salient categorization can in turn elicit age stereotyping of out-group members, i.e., those developers who are not younger (Turner *et al.*, 1987).

This association of youth with the role of developer probably arises for several reasons. First, younger people are digital natives; second, people believe that it is difficult for older employees to keep up with the latest, ever-changing programming languages, frameworks and system environments (Marshall, 2011). Indeed, older employees are stereotyped as being less able and willing to learn in general, and to learn new technologies in particular, than younger employees (Perry and Finkelstein, 1999; Posthuma and Campion, 2009). As the use of new technology and constant learning needs are salient for developers (Lyytinen *et al.*, 2010), negative stereotypes of older developers might be stronger than of older employees in other scrum roles.

In contrast, tasks that seem more suited to older than younger employees, may reflect more experience, decision making, and responsibility (Cleveland and Hollman, 1990). Senior designers, for example, often have implicit knowledge about project processes and whether current arrangements will lead to success; consequently, they play an important role in the evaluation of intended activities and coordination of project teams (Flanagan *et al.*, 2007; Nonaka and Von Krogh, 2009). Thus, stereotypes in relation to scrum roles, such as scrum master, development architect, and product owner – associated with coordination, social interaction, and decisions (Ahmed *et al.*, 2012; Green, 1989) – might underestimate younger employees.

We define bias in PEs of older employees as the difference between PEs of middle-aged employees and older employees. Similarly, we define bias in PEs of younger employees as the difference between PEs of middle-aged employees and younger employees. We thus propose:

H2a. Performance stereotypes of older employees in the job role of developer are stronger than performance stereotypes of older employees in ASD in job roles other than developer.

H2b. Performance stereotypes of younger employees in the job role of developer are stronger than performance stereotypes of younger employees in ASD in job roles other than developer.

3.3 The influence of participant age on stereotypes in ASD

Having hypothesized about who is negatively stereotyped, we now want to examine who holds particularly negative age stereotypes. That is, in addition to applying three age categories to the target, we also apply these three age categories to the participant. As explained above, the SIA explains that a large part of our identity is based on memberships in social groups. Importantly, the perception of such a social identity is not an outcome of a cold-blooded categorization process, but rather is linked to self-worth and self-esteem (Tajfel and Turner, 1986). In other words, people are driven by a basic motivation to feel good about their own group, and thus have a tendency to ascribe more positive attributes to members of their own group than to those of other groups (Brewer, 1999), i.e., they have a so-called in-group bias. For example, younger participants believe that younger employees have better job qualifications and more potential than older employees (Perry and Finkelstein, 1999). Thus, we expect that members of one's own age group will be perceived to perform better than members of other age groups in ASD. We propose:

H3. There is an interaction of participant age and target age on PEs.

H3a. Younger participants hold stronger performance stereotypes of older employees than of younger employees.

H3b. Older participants hold stronger performance stereotypes of younger employees than of older employees.

3.4 The influence of participant age and participant job role on stereotypes

Not only diversity in age, but also any other difference between people can lead to social categorization (Turner *et al.*, 1987). As explained before, the SIA predicts circumstances in which differences will lead to social categorization and one influencing factor is normative fit. Another factor is comparative fit, which is a function of the perceived differences within and between categories (Homan *et al.*, 2007; Turner *et al.*, 1987). The larger differences are between members of a group and the smaller differences are within a group based on such a category, the higher is the comparative fit of such a categorization, and the more likely the categorization is to be salient (Turner *et al.*, 1987).

Different job roles in ASD evoke differences in information. For example, product owners have more business-related knowledge, while developers, development architects, and scrum masters possess more technical knowledge. Scrum masters and product owners typically have more coordination experience than developers and – in part – development architects. These examples show that the comparative fit of different job roles is likely to be high in ASD and thus job roles are a salient category.

While categorization according to job roles might entail some degree of in-group bias in itself, we assume that its negative potential is greatest if categorization according to job roles is aligned with categorization according to age group. That is, people who hold not only different job roles but also come from a different age group will be perceived especially negatively. Indeed, stereotypes probably arise when two diversity dimensions converge, because in this case the comparative fit is higher (Thatcher *et al.*, 2003). In contrast, when the diversity dimensions cross-cut each other, stereotypes might not arise (Homan *et al.*, 2007). For example, an older development architect and an older product owner (two cross-cutting dimensions) can find similarities in one category, i.e., age. However, differences between an older development architect and a younger product owner (two converging dimensions) are salient, and thus stereotypes might arise. Thus:

H4. There is a three-way interaction of participant age, target age, and job role on PEs.

H4a. Younger employees hold particular strong performance stereotypes of older employees in a job role other than their own.

H4b. Older employees hold particularly strong performance stereotypes of younger employees in a job role other than their own.

4. Research method

We chose a quantitative method to test our hypotheses because this enabled us to include the attitudes of many participants (namely 464). In addition, we chose participants from two different companies to rule out context-specific results as far as possible. This approach has the advantage that results can be generalized, at least to some extent.

4.1 Procedure and sample

We first collected pilot data in 2014. The managing director of the SD organization of a large international software company sent an e-mail to 308 of his employees. The e-mail included a link to an online questionnaire. Employees answered questions about their beliefs concerning how well employees in different job roles and age groups would perform. To do so, they were asked to think about experiences during the last few months with employees who they believed were younger, middle-aged, or older. This is helpful because the perception of age is a main driving force for stereotypes as people typically base their beliefs on such perceptions instead of objective data (Stangor, 2009). In total, 124 employees answered the survey, and we were able to use 92 data sets after deleting questionnaires with missing responses. The pilot data successfully verified our two new scales.

We then collected data in 2014 and 2015 for the main study in two software companies that both develop business applications (e.g. in banking) and follow ASD methodologies to reduce the risks of obtaining company-specific results. One of the companies had already used ASD for three to five years, depending on the department, and the other company had used ASD for two years. The participants were mainly located in Europe and answered questions about PEs of younger, middle-aged, and older employees in ASD. Both companies have a program for diversity and inclusion, which does not focus on a particular diversity dimension, but includes gender, race, age, and culture. In one company, the questionnaire was sent by the managing director to 487 employees; in the other company, it was sent by three department managers to 965 employees. As the participants were assured of strict anonymity, the fact that the manager requested questionnaire completion should not have influenced the answers. Overall, 563 employees participated. In the first company, 391 employees participated (response rate: 40 percent); in the second company, 172 employees participated (response rate: 35 percent). We deleted the data of 99 employees who canceled the survey before responding to all questions concerning PEs. Thus, we used 464 responses to test our hypotheses.

The average age of the 464 participants was 38 years (ranging from 23 to 63 years, SD = 10.1). This corresponds to information provided by both companies' HR on the overall age distribution of their 10,000 employees in SD. In addition, it also corresponds to the typical average in SD in Europe and the USA (see DiWa, 2010; Kleefeld, 2008; Marshall, 2011). In all, 218 younger, 168 middle-aged, and 78 older employees participated. The participants had an average of 7.4 years of tenure (ranging from a few months to 33 years, SD = 7.4), and 41 percent of the participants were developers, 83 percent were male, and 18 percent held managerial positions.

4.2 Measures

Developer PEs (PE-D) and general PEs (PE-g) were measured using four and three items, respectively, with two new scales per age group (younger, middle-aged, and older), resulting in 21 items overall. All items were answered on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). All items are described in the Appendix. The items were derived from a pilot study using factorial analysis, as explained below. The pilot study allowed us to distinguish between PEs in different target job roles, which was necessary to test *H2a-H2b* and helped in further differentiating PEs for all other hypotheses. Reliability was measured using Cronbach's α for PE-D and PE-g (0.75 and 0.86, respectively) in the main study.

Bias in developer PEs (BPE-D), comparing middle-aged with younger or older employees, was calculated as the difference between the PE-D of middle-aged and younger employees (BPE-D-my), or as the difference between the PE-D of middle-aged and older employees (BPE-D-mo). We applied the same procedure for bias in general PEs in ASD (BPE-g), comparing middle-aged with younger (BPE-g-my) employees, and comparing middle-aged with older employees (BPE-g-mo).

Age was measured in years. The thresholds of age groups are operationalized differently in the literature, with no common agreement on cutoffs (Dordoni and Argentero, 2015; Levy and Macdonald, 2016). We adopt the definitions used by Krings *et al.* (2011) and Chiu *et al.* (2001) of "older" as meaning 51 years or more and "younger" as 35 years or less (Kite *et al.*, 2005). Thus, "middle-aged" employees are operationalized as between 36 and 50 years old.

Job role had one item for scrum job roles (developer, development architect, scrum master, product owner, other).

As control variables, we assessed gender, organizational tenure, working hours, organization, and managerial position, because they probably correlate with dependent and independent variables (Becker, 2005). In both companies, the vast majority of employees in

SD had a university degree (more than 96 percent in each company). In addition, having a university education is usual in large software companies (Eom and Lim, 2012), so we did not include questions on educational background.

5. Results

5.1 Scale creation and validation

An item pool of 42 items was created together with IT experts (one development architect, one developer, one scrum master, two product owners, and two managers), and a psychologist. Each item concerned subjective PEs in ASD, either for a given specific task (e.g. breaking down business requirements into technically related tasks) or for whole scrum job roles (developer, development architect, scrum master, product owner). Asking about PEs in different job roles was important to be able to address *H2a-H2b*. When assembling the set of tasks, we took into account O*Net items that focus on development and product management, a performance evaluation scale for the IT workforce (Green, 1989), role-dependent skill requirements in SD (Ahmed *et al.*, 2012), characteristics of good developer performance (Baddoo *et al.*, 2006), and PE items from the beliefs toward older workers questionnaire (Hassell and Perrewé, 1995). Adopting the design of Avery *et al.* (2007), the items were tripled to encompass the three age categories, which resulted in items such as "younger employees (⩽35 years) work well as scrum master" and "middle-aged employees (36-50 years) work well on translating predefined requirements into executable code." In the pilot, we tested various orders of items in the questionnaire, which revealed no significant differences. The internal consistency of the overall scale was good, with Cronbach's α of 0.94.

We used exploratory factor analysis, including principal component analysis, Varimax rotation, scree tests and the "Eigenvalues above 1" criterion to determine the number of factors (Costello and Osborne, 2005). We found a two-factor structure that could be interpreted easily for PE-D and PE-g, i.e., PEs do not differ between all scrum job roles, but can be distinguished in relation to developer PE and general PE (including the PE of scrum masters, development architects, and product owners). This was an important result because it was used as a basis to test *H2a-H2b*. In addition, it helped distinguish age stereotypes in the context of SD, as stated as one of our goals in the introduction: In this way, we could distinguish age stereotypes concerning performance in all hypotheses as we used PE-D and PE-g as dependent variables. This approach is explained in greater depth in the next section.

To reduce our item set further, commonalities were set to exceed 0.60, and factor loadings were expected to be higher than 0.50 (Costello and Osborne, 2005). This resulted in four items for PE-g and three items for PE-D per age category (see Appendix). The scales exhibited sufficient internal consistency, with Cronbach's α of 0.75 for PE-D and 0.86 for PE-g in the pilot.

5.2 Hypothesis testing

We controlled for age, gender, working hours, leadership, tenure, and company. Herein, we abbreviate the general PEs of younger, middle-aged, and older employees using the notations PE-g-y, PE-g-m, and PE-g-o. Similarly, we abbreviate the developer PEs of younger, middle-aged, and older employees, denoting them PE-D-y, PE-D-m, and PE-D-o. The hypotheses with the suffix (a) predict stereotypes of older employees, while the hypotheses with suffix (b) predict stereotypes of older employees.

H1 predicted that employees are biased regarding the performance of younger, middle, and older employees. We conducted two separate repeated measures analyses of variance (GLM), first using PE-D-y, PE-D-m, and PE-D-o, and then PE-g-y, PE-g-m, and PE-g-o as dependent variables to test whether PEs differ for younger, middle-aged, and older employees. We found a significant main effect of target age on PE ($F(2,462) = 85.61$,

$p < 0.001$, $\eta^2 = 0.16$ for PE-D and $F(2,462) = 574.40$, $p < 0.001$, $\eta^2 = 0.55$ for PE-g). Thus, *H1* was supported by the data.

H1a predicted that PEs are higher for middle-aged employees than for older employees. Simple contrasts in the GLM explained above with PE-g-m or PE-D-m as the reference category showed that PE-g-m ($M = 4.39$, SD = 0.51) were favored over PE-g-o ($M = 3.90$, SD = 0.73: $F(1,463) = 271.77$, $p < 0.001$, partial $\eta^2 = 0.37$), and PE-D-m ($M = 4.13$, SD = 0.60) were favored over PE-D-o ($M = 3.39$, SD = 0.93: $F(1,463) = 486.18$, $p < 0.001$, partial $\eta^2 = 0.51$), as *H1a*.

H1b predicted that PEs are higher for middle-aged employees than for younger employees. The simple contrasts explained above showed that PE-g-m ($M = 4.39$, SD = 0.51) were favored over PE-g-y ($M = 3.74$, SD = 0.74: $F(1,463) = 340.50$, $p < 0.001$, partial $\eta^2 = 0.42$), as *H1b*. However, interestingly, PE-D-m were significantly lower than PE-D-y ($M = 4.47$, SD = 0.62: $F(1,463) = 97.40$ $p < 0.001$, partial $\eta^2 = 0.17$), i.e., employees hold positive performance stereotypes of younger developers in ASD. Consequently, *H1b* was only partly supported by the data.

H1c predicted that the relation of target age and PE would be curvilinear in the form of an inverted *U*-shape. The polynomial contrasts showed a quadratic relationship ($p < 0.001$ for PE-D and PE-g), as *H1c*. Nevertheless, it is an inverted *U*-shape only concerning PE-g. The relation between target age and PE-D is not only quadratic, but also linear ($p < 0.001$). PE-Ds continuously decrease with target age. Figure 2 depicts the results. Thus, *H1c* was only supported for PE-g.

H2a predicted that stereotypes of older employees would be stronger for developers than other job roles in ASD, i.e., that the bias with regard to PE of older employees would be stronger for developers than for other job roles in ASD. As target age and performance type (i.e. PE-D and PE-g) were both assessed as within factors due to the data structure, we could not use target age as the main effect in the analysis without a complex data conversion. Thus, we used the bias measures to assess age stereotypes for *H2a*, and kept target job role as the within factor for testing the hypothesis. We, thus, conducted GLM with BPE-D-mo and BPE-g-mo as dependent variables. Values above 0 for BPE-D and BPE-g indicate that PEs of middle-aged employees are favored over PEs of younger (or older) employees. BPE-D-mo ($M = 0.744$, SD = 0.73) was significantly stronger than BPE-g-mo ($M = 0.49$, SD = 0.64, $F(1,463) = 76.14$, $p < 0.001$, $\eta^2 = 0.14$). Thus, the data supported *H2a*.

Similarly, *H2b* predicted that the bias in PE of younger employees would be stronger for developers than for other job roles in ASD. We conducted GLM with BPE-D-my and

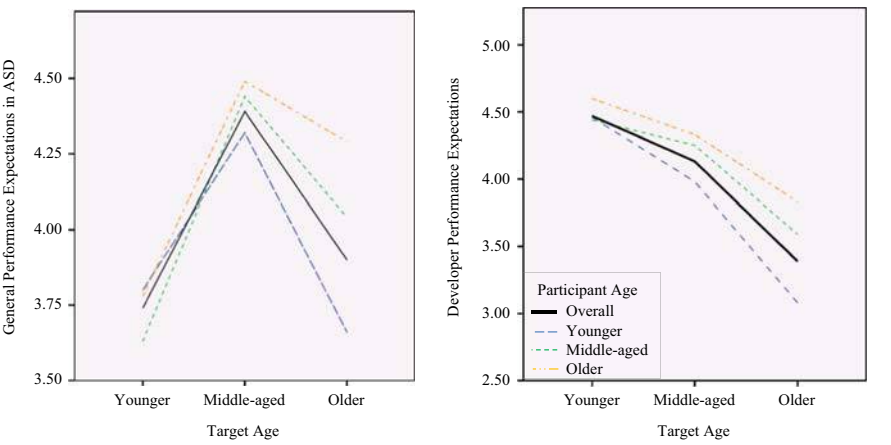

Figure 2.
H1 and *H2a-H2b*: the effect of target age and participant age on performance expectations

BPE-g-my as dependent variables. BPE-g-my ($M = 0.66$, SD = 0.76) was significantly higher than BPE-D-my ($M = -0.34$, SD = 0.74, $F(1,463) = 599.03$, $p < 0.001$, $\eta^2 = 0.56$). The high F-value of 599.03 was due to the fact, that BPE-D-my was below 0 (because PE-D-y was favored over BPE-D-m). We recalculated the analysis, testing if PE-g-m was favored over PE-g-y to a greater extent than PE-D-y was favored over PE-D-m, and the results stayed significant ($F(1,463) = 30.49$, $p < 0.001$, $\eta^2 = 0.56$). Thus, *H2b* was rejected by the data. The bias in PE-g toward younger employees is stronger than the bias in PE-D toward younger developers.

H3 predicted an interaction of participant age and target age on PEs. We conducted the same GLM as in *H1* and added participant age as a between factor. The interaction was significant ($F(4,460) = 17.53$, $p < 0.001$, partial $\eta^2 = 0.07$ for PE-g and $F(4,460) = 12.30$, $p < 0.001$, partial $\eta^2 = 0.05$ for PE-D). Thus, *H3* was supported by the data.

H3a predicted that younger participants would hold stronger performance stereotypes of older employees than older participants. We used simple contrasts with PE-g-m (PE-D-m) as a reference. Regarding general performance, younger employees favored middle-aged employees ($M = 4.32$, SD = 0.49) over older employees ($M = 3.66$, SD = 0.77) to a greater extent than older employees did (middle-aged: $M = 4.49$, SD = 0.52; older: $M = 4.29$, SD = 0.55; $F(2,462) = 19.55$, $p < 0.001$, $\eta^2 = 0.08$). Regarding developer performance, younger employees favored middle-aged developers ($M = 3.98$, SD = 0.65) over older developers ($M = 3.08$, SD = 0.97) to a greater extent than older employees did (middle-aged: $M = 4.33$, SD = 0.52 and older: $M = 3.83$, SD = 0.78, $F(2,462) = 10.91$, $p < 0.001$, $\eta^2 = 0.05$), as *H3a*. In particular, younger employees held stronger (positive) stereotypes of younger employees concerning PE-D than older employees.

H3b predicted that older participants would hold stronger performance stereotypes of younger employees than younger participants do. Older employees favored the PE-g of middle-aged participants over younger ($M = 3.78$, SD = 0.66) more than younger employees did ($M = 3.80$, SD = 0.68, $F(2,462) = 6.92$, $p = 001$, $\eta^2 = 0.03$). Thus, *H3b* was supported for PE-g. Older employees favored the PE-D of younger developers ($M = 4.60$, SD = 0.57) over middle-aged employees more than younger employees did ($M = 4.46$, SD = 0.59 for PE-D-y, $F(2,462) = 7.71$, $p = 0.001$, $\eta^2 = 0.03$). Thus, *H3b* was only supported concerning PE-g. The slopes in Figure 2 depict the results for *H3*, *H3a*, and *H3b*.

Moreover, additional analysis revealed that the interaction effects hold true when comparing middle-aged participants with younger or older participants ($p < 0.03$ for all analyses). Furthermore, Figure 2 indicates that: PEs of older employees differ most depending on participant age ($p < 0.001$ for PE-D and PE-g); PE-D-y are favored over PE-D-m and PE-D-o by all age groups ($p \leqslant 0.001$); and middle-aged employees view PEs of younger employees as less positive than PEs of employees of other age groups ($p < 0.05$ for PE-D and PE-g).

H4 predicted a three-way interaction of participant age, target age, and job role on PE. We first used the same GLM as that employed to test *H3* and added job role as an additional between factor. The three-way interaction was supported only concerning PE-D ($F(4,460) = 5.84$, $p = 001$, $\eta^2 = 0.03$). Thus, *H4* was partially supported.

H4a predicted that younger employees would hold particularly strong performance stereotypes of older employees in a job role other than their own. Contrasts showed that the interaction effect was significant when comparing middle-aged and younger developers ($F(2,462) = 10.76$, $p < 0.001$, $\eta^2 = 0.05$), i.e., younger developers favored PE-D-y ($M = 4.49$, SD = 0.62) over PE-D-m ($M = 3.87$, SD = 0.67), while middle-aged developers favored PE-D-m ($M = 4.22$, SD = 0.59) over PE-D-y ($M = 3.98$, SD = 0.90). In addition, we conducted the same GLM for PE-D with contrasts, wherein younger target age was the reference group. The analysis revealed that younger developers favored the PE-D of younger developers ($M = 4.44$) particularly strongly over the PE-D of older developers ($M = 2.97$, SD = 1.03) compared with older developers' expectations ($M = 4.57$, SD = 0.71 for PE-D-y and $M = 4.10$, SD = 0.71 for PE-D-o, $F(2,462) = 5.82$, $p = 003$, $\eta^2 = 0.03$). Thus, *H4a* was supported for PE-D.

H4b predicted that older employees would have particularly strong performance stereotypes of younger employees in a job role other than their own. The hypothesis was not supported by the data. The results for *H4* and *H4a* are depicted in Figure 3.

6. Discussion and conclusion

The goal of this paper was to identify and differentiate age-related performance stereotypes specific to ASD because they can negatively affect social interaction in ASD in many ways, and thus, be a critical obstacle to success. Our data show that there are significant amounts of age stereotypes to be found within the ASD context, and that age stereotypes depend on a complex interplay of four components: the age and job role of the employee holding the stereotype, as well as the age and the job role of the employee facing such stereotypes. Three important results to be highlighted are that: older developers suffer the strongest negative stereotypes in ASD; younger developers hold the strongest bias; and the PEs of developers decrease continuously with target age, while the general performance of middle-aged employees (product owner, scrum masters, and development architects) is favored over that of younger and older employees.

6.1 Theoretical contributions

We found a significant bias in general PEs, favoring middle-aged employees over both younger and older employees, in line with our first hypothesis. This result contributes to the literature because it enables us to view stereotypes not only for older employees, but also over a lifespan perspective, as called for in the review by Levy and Macdonald (2016). In particular, this finding further extends the SCM by adding new age groups (younger and middle-aged).

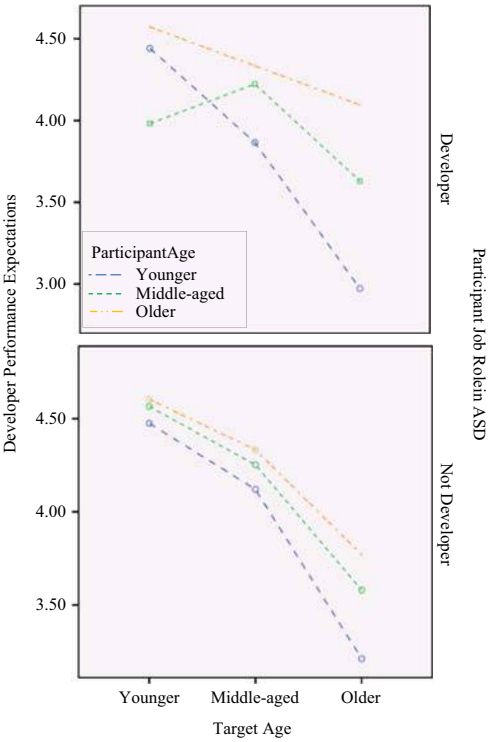

Figure 3.
H4: a three-way interaction of participant age, target age and job role on performance expectations

PEs did not differ significantly between the job roles of product owner, scrum master, or development architect, in contrast to being significantly different for developers (as found during scale creation in the pilot study). This result helps in differentiating performance stereotypes in the specific context of SD, as stated in our goals. It was used explicitly to test the second hypothesis and more implicitly in testing *H1*, *H3* and *H4* because distinctions were made between general and developer PEs when testing these latter hypotheses. Perry and Finkelstein (1999) showed that age stereotypes are particularly strong for technology-related tasks. While this might be an issue for many job roles in our study, it does not seem to be the sole cause of the augmented age stereotypes concerning developers, because developers, scrum masters, and development architects all focus on technology. This shows that it is important to examine job roles in addition to task types, especially because job roles include several task types, and these might either cross-cut each other or mutually enforce each other. For example, a scrum master has technology-related tasks and decision-making tasks. The tasks cross-cut each other because the technology-related tasks might enforce age stereotypes, while the decision-making tasks might reduce them (Cleveland and Hollman, 1990; Perry and Finkelstein, 1999). Consequently, job roles reveal additional knowledge concerning age stereotypes. In particular, adding job roles (as the target) to the SCM extends previous knowledge on the performance dimension of stereotypes.

Surprisingly, younger developers' performance was favored over both older and middle-aged developers' performance. The effect is rather strong and sheds new light on the specific context of SD. The association of youth with the developer job role, including its learning and adaptation requirements to new technologies (explained above), seems to be so strong that younger employees seem to be even more prototypical for this job role than middle-aged employees (in terms of normative fit), and this is true for employees of all age groups holding this stereotype.

Older developers suffered the strongest negative stereotypes in ASD. This result justifies further explanation. The job roles of developer, product owner, development architect, and scrum master officially have the same status (Schwaber and Beedle, 2002). In addition, many developers are not interested in traditional career-like management – they simply want to code (Marshall, 2011). Nevertheless, employees might assume that the job of developer is more a typical entry-type job in the business than are the other job roles in ASD, and that developers have less coordination expertise, less decision authority, and less responsibility, all of which are associated with the values of traditional career paths, such as those pursued in management roles. Consequently, employees might feel a difference in status. A lower status in turn elicits negative age stereotypes (Stangor, 2009). Another possibility is that developers who grow old in this job role could be perceived as lacking what it takes to climb the career ladder, with poor performance being salient among possible reasons.

Middle-aged employees view the performance of younger employees as less positive than the performance of employees in other age groups. This is a new finding in age stereotype research in general and warrants further exploration. We believe that middle-aged employees remember the mistakes that they have made in the past and implicitly compare their own current performance with their performance several years previously. Older developers might have realized that their mistakes in the past were not problematic, or perhaps they do not compare their current performance with that when they were young because there is a considerable time lag in between, and thus they do not sense such a great difference in PEs.

Younger developers hold especially negative stereotypes of older employees. The association of youth with the developer job role might be especially salient for younger developers. Younger developers might not yet strongly distinguish between the various roles in SD when thinking about performance because they probably have limited experience with employees in other job roles due to the fact that developers interact mainly

with members of the team; therein, developers comprise the large majority (Rubin, 2012). Thus, younger developers might have a particularly negative bias not only toward older developers, but also toward older employees in other job roles. In particular, we extend the SCM by including the moderators of age and job roles (concerning the participant as well as the target).

In summary, our study contributes to theory in three ways. First, we found evidence that implicit, psychological aspects are at work in ASD in the form of age stereotypes; given the great demand for well-functioning social interactions in ASD and the numerous negative effects of stereotypes on social interactions, this points to a potentially crucial pitfall of modern ASD. Knowledge of stereotypes is needed as a first step to identify measures for reducing barriers to effective processes in self-organizing teams. Thus, our study provides cues for researchers in terms of how to incorporate invisible aspects such as beliefs and attitudes in ASD-specific theories. We outline this idea in greater depth in the section on future research. Second, we have developed and successfully evaluated two new scales for job role-specific PEs that can be used in further studies. In particular, our study differentiates performance-related stereotypes in ASD into two different factors (age stereotypes concerning general and developer performance). Third, we have examined various factors that influence age stereotypes in ASD. We thereby extend the SCM by adding additional age groups (younger and middle-aged) in the workplace, and we provide evidence that both participant and target job role function as moderators.

6.2 Practical implications

Our research may be leveraged by practitioners in various ways. First, the belief in the continuous decrease in the performance of developers over their working life might become a problem in terms of retaining developers in their actual jobs or organizations over several decades. Thus, human resource departments may strengthen specific long-term developer career paths and promote their acceptance (Maximini, 2013b). Alternatively, they may create and promote permeable career paths enabling early horizontal movement, such that developers can decide to follow career paths of scrum master, development architect, or product owner, for example.

Second, when a new team is formed or a new colleague joins the team, formal or informal diversity measures should be enacted as a proactive measure. As we have seen, this is particularly important when new colleagues are younger because they hold the strongest stereotypes, or, when an older developer joins a team with several younger employees this is crucial because older employees suffer the strongest effects of stereotyping. Even when a younger employee enters a team with several middle-aged colleagues, the middle-aged employees should be made aware of their potentially negative beliefs toward the younger age group and the risk of underestimating their younger colleague.

As informal measures, supervisors can communicate their belief in the value of diversity by explaining how task performance can benefit from a diversity of information and perspectives, and discuss with team members typical problems that might arise due to age stereotypes. Supervisors can also narrate positive success stories of employees' achievements that contradict negative stereotypes toward older developers or younger employees, for example in job roles other than that of developer. In terms of more formal measures, employees can attend age stereotype interventions (Schloegel *et al.*, 2016) to gain experiences that contradict existing age stereotypes. Alternatively, young employees can be paired with older employees in pair programming (Plonka *et al.*, 2015). This increases contact, and contact has firmly been established as reducing age stereotypes (Pettigrew, 1998). Younger employees might benefit, for example, from older employees' overview of the "big picture," while older employees might learn new

techniques, and thus understand the advantages of employees in other age groups. In addition, older and younger employees can be encouraged to engage in peer-related activities, such as peer mentoring or coaching, in which they inform each other or give emotional support or feedback (Kram and Isabella, 1985).

6.3 Limitations

As this was a cross-sectional study, causal relationships cannot be established. In addition, the effects of age and generations cannot be separated. In the future, longitudinal studies should be conducted to underpin our results. We used self-report data that might increase common method variance, but at least they cannot artificially increase the interaction effects (McClelland and Judd, 1993). We cannot fully rule out alternative antecedents, but we were able to include several control variables, and the models explained high proportions of variance, which lowers the probability of important alternate explications.

6.4 Directions for future research

First, the study should be repeated in a few years' time because demographics in the software industry change substantially over time. Consequently, younger employees might become the target of negative age stereotypes more often and more strongly than today. As many middle-aged employees will then become part of the category of older employees, they might no longer be a minority and it will be interesting to see if age stereotypes against them will be reduced due to demographic change. Moreover, the new scales might be used before and after a formal intervention to evaluate it (for a successful application, see Schloegel *et al.*, 2016). Second, additional antecedents for age stereotypes could be examined at an organizational level, for example, age-specific diversity management, experience with agile methods (how long they have been in place) or national culture. Third, researchers should add implicit factors (such as attitudes and social cognitions) to ASD-specific theories explaining explicit social aspects. For example, researchers could empirically test outcomes (i.e. main effects) of age stereotypes on trust and main components of the team-work model (communication, team orientation, monitoring, feedback, back-up, coordination, and learning) that has been adapted to ASD by Moe *et al.* (2010); and coordination strategies (such as synchronization and substitutability) within the theory of coordination extended to ASD by Strode and colleagues (2012).

There are many opportunities to build on this study and to find means of theoretical and practical improvement. As the workforce is aging in ASD, such endeavors are of great importance for enterprises to adjust their practice with regard to future personnel and to guarantee long-term success.

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Appendix

Items of the Performance Expectations Scales (here, three items are combined in each statement to provide a brief overview).

Scale: General Performance Expectations in agile software development:

- Younger (⩽35 years)/middle-aged (36-50 years)/older (> 50 years) employees work well as development architects.
- Younger (⩽35 years)/middle-aged (36-50 years)/older (> 50 years) employees work well as scrum masters.
- Younger (⩽35 years)/middle-aged (36-50 years)/older (> 50 years) employees work well as developers.
- Younger (⩽35 years)/middle-aged (36-50 years)/older (> 50 years) employees work well as product owners.

Scale: Developer PEs:

- Younger (⩽35 years)/middle-aged (36-50 years)/older (> 50 years) employees work well as developers.
- Younger (⩽35 years)/middle-aged (36-50 years)/older (> 50 years) employees work well on tasks with new technologies.
- Younger (⩽35 years)/middle-aged (36-50 years)/older (> 50 years) employees work well on translating predefined requirements into executable code.

About the authors

Uta Schloegel is a PhD Candidate of Organizational Psychology at the Goethe University Frankfurt. She received a Diploma in Mathematics and Computer Science from the University of Paderborn as well as a Bachelor Degree in Psychology from the University of Hagen. Uta has been working for nearly two decades in the software industry in several roles, such as Project Manager, Development Architect, Product Manager, and Team Lead. Her research interests are diversity and team processes in software development. Uta Schloegel is the corresponding author and can be contacted at: utaprigge@yahoo.com

Sebastian Stegmann is an Assistant Professor of Social and Organizational Psychology at the Goethe University Frankfurt and also a Member of the Center for Leadership and Behavior in Organizations (CLBO). After studying Psychology and various other subjects in Germany and Australia, he received his PhD Degree in Psychology in 2011. He has been teaching university classes in social and organizational psychology for over ten years. Sebastian's research interests are the functioning of diverse groups, the development of social identities, psychological work design, and interpersonal processes in leadership. He frequently acts as a Reviewer for a broad range of scientific journals.

Alexander Maedche is a Full Professor and the Chairperson of the Chair of Information Systems & Service Design at the Karlsruhe Institute of Technology (KIT). His research focusses on the design of user-centered and intelligent digital service systems. One key research area is the development of digital services and software with a specific focus on processes, practices and teams. Alexander's work is published in leading international journals and conferences, such as *Journal of the Association of Information Systems (JAIS)*, *Information & Software Systems Technology*, *IEEE Intelligent Systems*, *SIGMOD Record*, *AI Magazine*, and the *International Conference on Information Systems (ICIS)* as well as the *European Conference on Information Systems (ECIS)*.

Rolf van Dick is a Full Professor of Social and Organizational Psychology at the Goethe University Frankfurt and a Professor at the Work Research Institute (AFI), Oslo. Prior to his current position he was a Professor at Aston Business School, Birmingham, UK. He has published and edited several books, and more than 200 book chapters and papers in academic journals. Rolf was a Visiting Professor in Shanghai and Beijing, Tuscaloosa, USA, on Rhodes, Greece and in Kathmandu. His research focusses on social identity processes and applies social identity theory to topics such as leadership, mergers and acquisitions, health and stress, or diversity.