The Dark Side of Software Development: Job Stress amongst Autistic Software Developers

Terrell Kelvin Holmes, Jr.
The Good Org
tkholmes@thegoodorg.com

Hala Annabi
The Information School, University of Washington
hpannabi@uw.edu

Abstract

The software workplace is a competitive space and presents significant stressors for software developers. Autistic software developers are more susceptible to stress, and due to the unique challenges they face in addition to those faced by the majority, neurotypical software developers. There is very little research addressing stressors for autistic people in the software workplace and how to mitigate those stressors. This paper synthesizes the existing literature relevant to software workplace stressors for autistic people, and proposes a framework to guide further research to investigate the implications of and mitigate stressors in the software industry for autistic software developers.

1. Introduction

According to the Centers for Disease Control, approximately 1 in 59 American children is diagnosed with Autism [11]. Autism is a lifelong neurological condition characterized by impairments in social communication and the presence of restricted and repetitive behavior, interests, or activities [3]. The latter may manifest as an intense focus on a topic area or object. This intense focus may impact social interactions and lead to difficulty in establishing diverse relationships [25]. Sensory processing challenges often co-occur with core autism symptoms and include hypo- and hypersensitivity to sensory stimuli such as sounds and lights [3][32]. Autism is characterized by significant heterogeneity in terms of abilities, with some individuals demonstrating particular strengths in areas including cognitive skills [35], visual and perceptual processing [36][46] and technical aptitude [14]. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [3], which is used for clinical diagnosis, suggests that autistic individuals without intellectual disabilities (who

comprise 50% of autistic individuals) score in the above-average range on intelligence tests and are the fastest growing subgroup of the autism population [39].

Scholars from various fields recognize the propensity of autistic individuals (who are without intellectual disabilities) to pursue technology-oriented careers [34]. A recent national longitudinal study revealed that autistic individuals are more likely to pursue and persist in STEM fields in postsecondary education than non-STEM fields [65]. Baron-Cohen and colleagues [14][15] suggest that the systemizing tendencies of autistic individuals make them more likely to succeed in and therefore pursue technology and other STEM-related fields. This, along with initial success from companies such as SAP and Microsoft at hiring autistic individuals in technology roles, emphasized the potential business benefits of hiring autistic individuals in IT related roles to meet the rising demand for technology workers. Furthermore, technology companies benefit from the unique talents of some autistic employees, such as attention to detail, systematic thinking, high level of focus, comfort with doing repetitive behaviors, and ability to visualize problems [6][9][11].

Despite autism hiring programs' potential, early studies of these programs reveal that autistic technology workers experience challenges in the workplace [20][27][35]. These experiences often are attributed to: 1) limited understanding of the diversity of talents of autistic IT employees [6]; 2) suboptimal environmental and task design accommodations [42]; and 3) the social and behavioral disconnect between autistic employees and their neurotypical managers and co-workers [9][35][41]. These challenges are stress inducing for autistic individuals. In fact, in a recent study Hedley et al. [27] identified that autistic persons face challenges managing work-related stress [27]. At the 2018 and 2019 Autism @ Work Summits (an industry conference focused on autism hiring programs), autism hiring program leaders and autistic

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employees emphasized that mental health concerns (such as stress and anxiety) were amongst the most significant and most concerning challenges they face.

There is little research that addresses the experiences of autistic individuals (especially those without intellectual disability) in the workforce [43][50], particularly in the IT industry [6][35]. We know little about the stressors autistic IT employees face and how best to address these stressors in order to maintain employment and productivity, and therefore a positive quality of life. The purpose of this paper is to advance our understanding of the stressors inherent in the IT work environment and their effect on autistic people working in IT. We propose a framework that synthesizes the stressors faced by software developers in particular and the potential unique effects of these stressors on autistic software developers. We focus on software developers due to: 1) the rise in autism-specific employment programs in IT especially for software developers; 2) the leanings of autistic individuals to pursue software development, and 3) the stressful nature of software development environment. These three factors suggest that software developers provide a unique opportunity to develop our understanding of stressors affecting autistic people employed in IT.

2. The experience of stress and anxiety for autistic people

The American Psychological Association defines stress as "any uncomfortable emotional experience accompanied by predictable biochemical, physiological and behavioral changes" [16]. More specifically, Beehr and Newman [17], define occupational stress as "any work-related factor which produced a maladaptive response." Although occupational stress is specific to the workplace, its manifestation can be the same as general stress. Anxiety is amongst the most notable biochemical effects of stress relevant to autistic people. Anxiety is a reaction of non-specific dread to the anticipated stress of a future event. It is caused by past events that have caused stress [47]. Due to the trauma of past events, a person may anticipate a traumatic outcome of similar events in the future. Anxiety is a common condition; however, Hare, Wood, Wastel, & Skirrow [26] suggest that autistic individuals tend to experience greater anxiety than neurotypical people. Some attribute this higher rate of anxiety in autistic people to a lack of coping mechanisms to deal with stressful experiences [22].

Autistic individuals experience various social challenges that induce stress and anxiety. They often misunderstand or do not pick-up on social nuances and subtle clues. They may experience some difficulty empathizing with colleagues and peers [6][14]. Additionally, autistic people's restricted interests may sometimes distract them during social interactions [6]. Simon Baron-Cohen contends that autistic people prefer predictable experiences [14]. Therefore, autistic people may encounter challenges when dealing with inconsistencies in daily routines, and unplanned occurrences [31]. The combination of social misunderstanding, challenges with empathy, restricted interests, and unpredictability of social interaction may make it especially difficult for autistic people to build and maintain social relationships [29]. The stress that autistic people feel while dealing with these challenges can arouse anxiety [24].

In their model, Ollendick and White [38] suggest that anxiety processes common to both autistic and non-autistic youths include negatively biased information processing, compulsive thoughts, and "physiological hyperarousal." Additionally, Ollendick and White [38] suggest that autistic youth experience unique anxiety processes including misunderstanding of social situations and social apprehension thereof, difficulty identifying and understanding emotions in self and others, sensory defensiveness, social disability (and concomitant negative, sometimes hostile, interpersonal exchanges), aversive and distressing milieu (e.g., rejecting peers), and cognitive factors (e.g., rigidity, difficulty with change).

Although Gillott et al. [22] and Ollendick and White [38] studies focused on anxiety in autistic youth, their work is relevant to our study of adult autistic software developers for two reasons. First, Gillott et al. [22] suggest that the basis of anxiety in autistic adults is a remnant of the anxieties the adults experienced as youths, therefore drawing on the experiences of autistic youth provide a valid representation of the experiences in autistic adults. Furthermore, there is very limited research that addresses anxiety in autistic adults more specifically.

There are various stressful experiences that may provoke anxiety for autistic people. Gillott et al. [22] indicate that social situations and inconsistent routines, in general, may create stressful experiences. Wood and Gadow [50] elaborate on stressful experiences identified in work by Bellini [18][19], Gillot & Standen [22], Corbett et al. [21] and Goodwin et al. [23] and provide a theoretical model of stressors, resulting anxieties, and manifested behaviors (right side of Figure 1). In their model, they present four categories of autism-related stressors organized into one of two clinical

diagnoses: social anxiety and negative affectivity. The clinical diagnoses are then associated with four categories of manifestations of anxiety which include 1) confusing social demands, and unpredictable and inconsistent daily occurrences; 2) rejection due to non-conforming social behaviors; 3) "prevention or punishment" of undesirable behaviors by authoritative figures; and 4) frequent overstimulating sensory experiences [10].

Confusing social demands and social rejection may lead to a clinical diagnosis of social anxiety; and prevention or punishment, and overstimulating sensory experiences may lead to a clinical diagnosis of negative affect, other anxieties, depression, or some combination thereof. The model suggests that social rejection may also lead to either type of clinical diagnoses - social anxiety, or negative affect/other anxieties/depression/a combination of diagnoses [50]. Lastly, Wood and Gadow [50] present a list of behavioral manifestations of the two types of anxieties. The sole behavioral manifestation of social anxiety without co-occurring conditions from the second diagnosis group is increased social avoidance. Negative affect/ other anxieties/ depression/ combination – may manifest in increased autism symptoms, such as self-stimulatory behavior; tantrums; and personal distress [50]. Wood and Gadow's autism-related manifestations ("Effects") correspond closely to Ollendick and White's anxiety processes (left side of Figure 1) and include: *"social confusion and consequent fear/apprehension, deficits in perceiving emotions in self and others (including feelings of paranoia), sensory defensiveness, social disability (and concomitant negative, sometimes hostile, interpersonal exchanges), aversive and distressing milieu (e.g., rejecting peers), and cognitive factors (e.g., rigidity, difficulty with change)"* [38].

3. Stressors and anxiety experienced by software developers

Like any workplace, there are occupational stressors that affect all employees, both autistic and non-autistic individuals. Studies suggest that IT often demands long work hours, unpredictable travel schedules, constant availability, and an intensified need to stay current with rapidly changing technology when in technical roles [2][28][44]. Furthermore, the software development environment is characterized as having strict timelines, deep client-focus, and required deep domain and technical knowledge [37]. The nature of software development characterized

above introduces unique challenges to those who work in this domain.

In their study of software developers, Rajeswari and Anantharaman [40] identified ten common stressors (i.e., causes of stress) including fear of obsolescence, individual team interactions, client interactions, work-family interface, role overload, work culture, technical constraints, family support towards career, workload, and technical risk propensity. In their analysis, Rajeswari and Anantharaman [40] concluded that fear of obsolescence, team factors, and client interaction are amongst the most significant stressors experienced by software developers. Items comprising each of the constructs above are similar to the stressors proposed by Ollendick and White [38] and Wood and Gadow [50] which affect autistic people and may induce their anxiety. Comprising the construct Fear of Obsolescence, the items with the highest factor loadings include "constant need to increase my preparedness to meet future demands" and "need to adapt myself to frequent technological changes" [40]. These top two items describe anxiety around change, which is consistent with Ollendick and White's "rigidity, difficulty with change" anxiety process for autistic people. In the second construct, Team factors, the top three items are "Lack of trust among team members," "Lack of support from team members in experimenting and learning," and "… low interest in listening to and trying to deal with official problems that confront other team members." These items hearken back to both Ollendick and White's Sensory Defensiveness anxiety process, as well as Wood and Gadow's autism-related stressors (see Figure 1).

In addition to the stressors of software developers identified by Rajeswari and Anantharaman [40], other workplace factors may contribute to the decrease or increase of the effect of stressors on software developers. Singh, Suar, and Leiter's [45] work suggests that for Indian software developers the risk factors of role ambiguity, role conflict, schedule pressure, irregular shifts, group non-cooperation, psychological contract violation, and work-family conflict contribute to job burnout. Singh, Suar, and Leiter [45] presented several antecedents to job burnout among Indian software developers, many of which correspond to the stressors put forth by Rajeswari and Anantharaman [40] including: role ambiguity and role conflict (role overload, technical risk propensity), schedule pressure (workload), pressure from client interactions (client interactions), group noncooperation and interpersonal relationships (individual team interactions), and work-family conflict (work-family interface, family support towards career).

Rashidi and Jalbani's 2009 study [41] tested Rajeswari and Anantharaman's [40] stressors on a group of Pakistani software developers and revealed that developers 21 to 28 years old feel the most stress. The primary stressors for that age group were pursuing further education, learning new technology, and managing frequent contact. As mentioned in their article, although job stress is a common problem in all work environments, it is more common in workplaces which are driven by deadlines [7], such as the software development workplace.

Based on the few available studies listed above, the most significant stressors among software developers are frequent and inconsistent client interactions where client requirements change, workload and aggressive project deadlines, learning new technologies, and role overload. Most of the literature, including the four studies cited above, recruited subjects from within "software houses" which are located outside the United States and primarily work with external clients. There are aspects of the client-contractor relationship which increase the difficulty of client relationship management and time delays as compared to teams that work within a software development group which services internal clients. Nonetheless, the research presented in these "software house" papers is relevant to our work until more research finds distinctions between the dimensions of internal or external clientele, project lead skill and experience, and geographic location.

4. Stressors and anxiety in software development careers specific to autistic people

A significant number of software development jobs require communication, collaboration, and management skills [6]. Acuña et al. [1] found that when making hiring decisions, managers not only considered technical knowledge and job leveling, but human capabilities that included independence, stress tolerance, environmental orientation, empathy, and teamwork and cooperation [1]. Although the soft skills – human capabilities [1] – are not directly related to software development knowledge, they are crucial to participating in productive teamwork, the lack of which is a "… main contributing factor[s] in the high failure rate of [information and communications technology] projects [29]." Teamwork was also mentioned as an important soft skill when Matturro, Raschetti, & Fontán [33] asked software team leaders and team members to determine the top five soft skills for the respective roles.

The traits described above are squarely situated in the sphere of social skills, which are related to several anxiety processes and autism-related stressors identified by Ollendick and White [38] and Wood and Gadow [50], represented in Figure 1. Autistic people face the same pressures and stressors as neurotypical people in the software workplace. However, the challenges presented by desired social skills add a layer of complexity to an already challenging work environment for autistic software developers.

We know little about how occupational stress factors, such as those identified by Rajeswari and Anantharaman [40], affect autistic software developers. In their study exploring challenges faced by software developers, Morris et al. [35] compared the responses of ten-subjects who self-identified as neurodiverse (neurological diversity including but not exclusive to autism) software employees to the remaining 846 software developers and testers who responded to their survey. They concluded that although there was little consensus regarding role-specific challenges, half of the self-identified "neurodiverse" interviewees described themselves as having poor interpersonal communication skills and felt that their lack of interpersonal savvy made their jobs more challenging. The challenges mentioned in the paper include "difficulty interpreting nuance in the meaning of coworkers' statements, difficulty interpreting coworkers' emotions, difficulty dealing with office politics, and difficulty handling conflicts with co-workers" [35]. In another study, Rebholz [36] interviewed autistic knowledge workers, many of whom were engaged in technical work such as software development. The study suggests that challenges among autistic people include understanding nuanced communication, visual or aural sensory issues, and unique information processing [42].

Comparing studies of general stressors of autistic people by Groden et al. [22], Hurlbutt and Chalmers [30], and Wood and Gadow [50] with studies of stressors of software workers by Rajeswari and Anantharaman [40] and Rashidi and Jalbani [41], an intersectional model of stressors for autistic people in the software workplace begins to emerge.

5. A theoretical model to explore stressors for autistic people in the software workplace

Employment of autistic individuals is a newer phenomenon and little is known about stress autistic people experience in the workplace. No single established suitable theory exists to guide our study of stress autistic software developers experience or their employment. [5]. Therefore, we propose a theoretical framework to present our understanding of stress autistic people may experience in software development. This theoretical framework is directly informed by the work of Annabi & Locke [5], Morris et al. [35], and Rebholz [42] and is presented as a guiding framework to be tested empirically and further developed into theory. The framework provides a synthesis of current literature reviewed in the previous sections and presents stressors unique to the autistic software worker (illustrated in Figure 2) that are at the intersection of stressors of autistic people and stressors of software workers.

Although autistic people may have an advantage in the software work environment and enjoy the actual work, as discussed by Baron-Cohen [12][14][15][13], there are stressors in software work environments that may trigger underlying anxieties for autistic people. The combined effects of stressors inherent in the software workplace [40][41] and the stress inducing challenges autistic people experience at work [5][35][42] results in a significantly less positive workplace experience for autistic software developers.

Open workspaces, which do not block noise or may even amplify it, may trigger overstimulation. Nuanced and complex communication styles, which require "reading between the lines" may result in misunderstandings about colleague relationships, manager direction, role expectations. Organizational changes and fluid (dynamic) job requirements, which are sometimes expected in the technology industry may also lend to misunderstandings and confusion. These stressors trigger previous negative experiences for autistic people and contribute to anxieties that surface as a lack of psychological safety, degraded trust, feelings of rejection, and difficult work relationships. Without mechanisms to identify and work through these anxieties, autistic software workers are at great risk for negative work experiences that may lead to stagnation of professional progress or even termination of employment.

The comparison between stressors in the software workplace and the stressors autistic software developers experience (presented in Figure 2) provides a basis on which to evaluate the prevalence of stress triggers (stressors) for autistic people in the software workplace. It may also serve a starting point for building corporate education, accommodation, and self-advocacy programs for autistic people, their peers, and their managers.

6. Implications for practice

Recent studies of autism hiring programs [5][4][35][27] suggest key practices and accommodations to facilitate equitable inclusion of autistic employees in autism hiring programs. These practices emerged to address challenges autistic employees identified. In Table 1 we identified practices that have the potential to mitigate stressors inherent in software development and identified by autistic people. Key practices include manager and co-worker training specific to communication and interaction differences and needs, environmental accommodations such as noise canceling headphones, job coaching, explicit job design, regular check-ins regarding changing requirements, telecommuting, and flexible work scheduling.

7. Implications for research

To advance our understanding of stress and its impact of autistic software developers there is an opportunity to develop research instruments that will measure the stress of autistic workers from their perspective, similar to the work by Rajeswari and Anantharaman [40]. Findings from such studies have the potential to provide comparisons of how autistic software developers may experience stressors differently than neurotypical developers. Even if the measurement is subjective and significant to one person, the tool would provide the autistic person – and potentially their manager or coach – with data relative to the employee's baseline and empower the autistic person to act when necessary. Once a reliable research instrument and measures of stress are established, research may focus on assessing best practices and intervention design to relieve stressors for autistic people.

8. Conclusion

Our review of the literature revealed little empirical and theoretical research addressing stressors affecting autistic employees particularly in software development workplace. Identifying stressors affecting autistic developers in the workplace is an important area for research with significant implications to research, practice of autism hiring programs, and most importantly to the quality of life for autistic software developers. Our proposed framework and suggestions for best

practices to mitigate stress serve as a conceptual foundation to empirically the extent to which these stressors affect individual productivity, job satisfaction, and feelings of inclusivity, as well as the effectiveness of organizational practices and intervention efforts.

9. References

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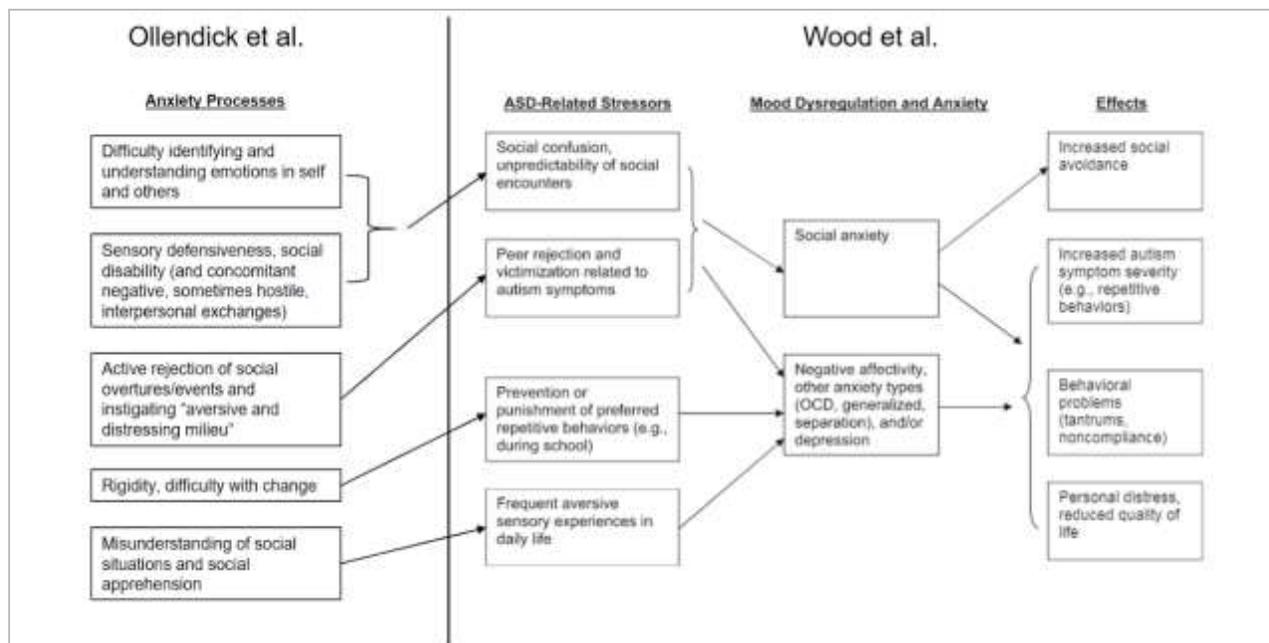
Figure 1. Comparison of Autism Anxiety Processes and Autism-Related Stressors[38][50]
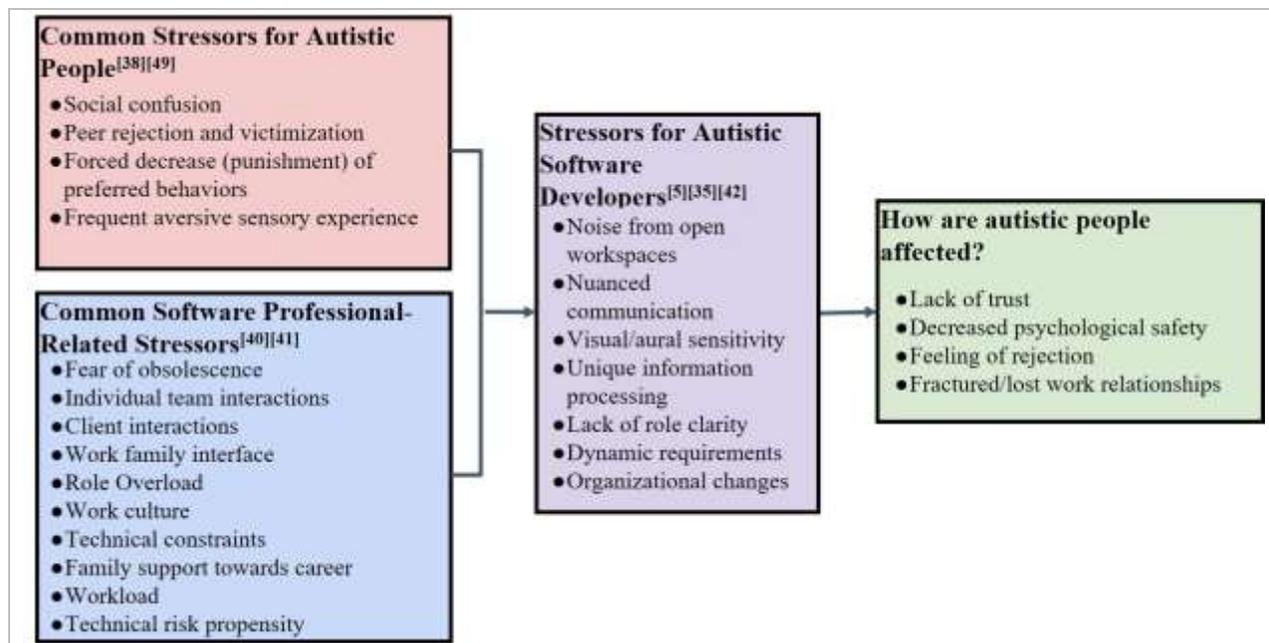
Figure 2. A Combined Model of Stressors for Autistic Software Developers

Stressors Affecting Autistic Software Developers (Fig. 3)	Employers' Efforts to Address Stressors[4]
Noise from open workspaces	• Manager/team training • Noise canceling headphones • Private office space when needed • Telecommuting
Nuanced communication	• Manager/team training for written and explicit communication • Coaching • Team buddy and community mentor
Visual/aural sensitivity	• Manager/team training • Specific accommodations to meet needs (e.g., lighting)
Unique information processing	• Manager/team training • Use of explicit communication with sufficient time given for processing • Development of templates and checklists
Lack of role clarity	• Job Coaching • Manager training • Explicit job design • Team buddy and community mentor • Skill development training • Shadowing
Dynamic requirements	• Regular check-ins with manager and team members • Regular check in with job coach • Explicit written communication regarding change with reasons for change
Organizational changes	• Regular check-ins with manager and team members • Regular check in with job coach • Explicit written communication regarding change with reasons for change

Table 1. Employer practices