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Examining the longitudinal relationship between visibility and persistence on stress and technology-assisted supplemental work

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Abstract

This study examines the longitudinal relationship between two affordances of organizational information and communication technologies (ICTs)—that is, visibility and persistence—and individuals' subjective stress and technology-assisted supplemental work (TASW). We propose that visibility and persistence associated with organizational ICTs are often more aptly construed as *probabilities* for action, rather than merely *possibilities* for action. The hypotheses are tested using latent change structural equation modeling drawing on two-wave survey data from 437 employees of a global industrial logistics company headquartered in a Nordic country. The findings highlight that visibility is associated with increases in TASW, but not in subjective stress, while persistence is associated with decreases in TASW and subjective stress. We suggest that visibility may pressure workers into extending their workdays, while persistence may operate as an important resource for employees reducing subjective TASW and stress as well as intra-individual changes in TASW and stress over time.

Keywords: affordances, visibility, persistence, stress, technology-assisted supplemental work, organizational ICTs

The increasing reliance on digital technologies in contemporary work settings calls into question many of our understandings regarding how workers interact and organize. In particular, the growth of social media and collaboration technologies, which offer workers greater insight into the work of others and flexibility regarding when to complete work, present new and distinct ways for employees to communicate and collaborate (Leonardi & Vaast, 2017). In recent years, scholars have increasingly adopted an affordance perspective to study the intersection between technologies and users; the ways that people do things with technology and the ways technologies offer people possibilities to do things (Fox & McEwan, 2017; Nagy & Neff, 2015; Rice et al., 2017; Treem & Leonardi, 2013).

An affordance perspective suggests that materiality permits, facilitates, or makes possible certain actions and limits, constrains, or prevents other actions (Treem & Leonardi, 2013). This view treats the materiality of objects as shaping, but not determining, possible actions (Nagy & Neff, 2015) and notes that an "'affordance' reflects the potential for action that (new) technologies provide users" (Leonardi & Vaast, 2017, p. 152). However, we argue that current conceptualizations of affordances are limited in their focus on the dyadic relationship between technologies and users, without explicitly considering how individual interpretations of material features of technologies are socially constructed, nor how these *possibilities for action* could have consequences beyond the specific uses of technologies.

Mazmanian (2013) indicates that affordances are the result of social expectations as much as a person's own experience. Hence, we argue that affordances are not just the result of

individual actors' isolated interpretations of a technology's material features, but also align with social structures, norms, policies, and formal rules articulated in the organizational context in which they are embedded. Though affordances are always relational in the sense that they are enacted through the ways in which an actor perceives materiality, those perceptions are always contextually situated (Sun et al., 2019) and may turn out to be relatively consistent within user groups (Song & Xu, 2019). Given contextual influences, affordances may in practice *direct*, rather than *afford*, certain actions. Or as Withagen et al. (2012) have put it "we argue that affordances are not mere action possibilities but that they can also invite behavior" (p. 250). Thus, affordances may operate as a pressure allowing us to predict a *probable* outcome rather than a *possible* outcome that individuals "freely" choose to pursue. Hence, our central argument is to suggest that affordances may not just represent *possibilities for action* regarding the use of technologies but are often more aptly constructed as *probabilities for action* with consequences beyond technology use.

In this study, we seek to examine the psychological (i.e., stress) and behavioral responses (i.e., technology-assisted supplemental work [TASW]) that may be related to organizational information and communication technology (ICT) affordances (here specifically, visibility and persistence). TASW is defined as a form of distributed work where employees perform role-prescribed tasks at home after regular work hours using advanced organizational ICTs (Fenner & Renn, 2010). A focus on subjective stress and TASW is important because it expands our understanding of affordances as eliciting and heightening expectations for action. Beyond the

different uses that technological features may afford, the socio-psychological and behavioral responses to these possibilities for action are often ignored. We demonstrate the contradictory impact of various technological affordances (i.e., visibility and persistence) on psychological responses and employees' work practices.

Furthermore, this study expands our methodological repertoire for studying affordances by adopting a longitudinal latent change approach. Research on organizational ICTs and their affordances often imply a temporal change as technology use, or affordances, may lead to an increase in perceived overload (Barley et al., 2011). More generally, we often assume that when *X* changes, *Y* changes (Ployhart & Vandenberg, 2010), yet most inquiries into organizational ICTs, their affordances, and potential outcomes rely on static rather than temporal change measurements. This study seeks to add to our understanding of the role of organizational ICT affordances by temporally modeling the association of intra-individual change between variables (see Matusik et al., 2021 for a detailed overview of the methodology). In this dynamic perspective, modeling intra-individual change better accounts for alternative influences on this change than has been presented in more static perspectives.

Theoretical framework

Scholars adopting an affordance approach have demonstrated the value of understanding the ways in which material properties of digital technologies can be used to theorize communicative properties of computer-mediated communication and related consequences without isolating a particular tool (Carr, 2020). Although affordances are considered to enable or constrain certain actions, the analytical focus commonly concentrates on whether affordances are perceived by technology users or if users take particular actions among various possibilities (e.g., Norman, 1999). For instance, the visibility afforded by social media technologies in organizational settings allowed users to make information and communication more *and* less visible to others (Gibbs et al., 2013) or allowed employees to share *and* hide knowledge (Chen et al., 2020). Mao and DeAndrea (2019) suggest that perceived affordances of anonymity and visibility in organizations affected subsequent prohibitive voicing intentions. Furthermore, several studies suggested that ICT affordances may be (cognitively) demanding (Freytag et al., 2021) and present drawbacks (Fox & Moreland, 2015), regardless of whether they are actualized through individual technology usage behaviors.

Notably, these investigations adopt an affordance lens but attribute control or agency largely to the individual user in deciding how to engage with the material features of a technology, overlooking how individual users interact with material features within a broader social and material context. Such a perspective adopts a narrow focus on individual activity-oriented benefits and intended outcomes of user-technology interactions and promotes individuals' free choice to shape these interactions.

Specifically, research has identified a broad range of different affordances associated with organizational ICTs. Fox and McEwan (2017) identified 10 affordances associated with various communication channels, such as accessibility, persistence, editability, conversation control, and anonymity. Rice et al. (2017) identified pervasiveness, editability, self-presentation, searchability, visibility, and awareness as key organizational ICT affordances. Specifically, related to enterprise social media Treem and Leonardi (2013) discussed four major affordances: visibility, editability, association, and persistence. As these lists exhibit there is quite a lot of inconsistency in the use and application of affordances in communication research (see for a review of key issues; Evans et al., 2017). The multiple efforts to identify and characterize technological affordances reflect widespread acceptance that contemporary ICTs make it possible for individuals to make communication accessible and visible in new ways and across time.

To capture the fundamental ways that possibilities for communication have evolved along with technology, Flyverbom et al. suggested that visibility should be seen as "a root affordance of the digital age" (2016, p. 101). Specifically, ICTs facilitate visibility in organizations by increasing the accessibility of various behaviors, knowledge, preferences, and communication that were previously invisible or difficult to view (Treem & Leonardi, 2013). Indeed, research describing the affordances of contemporary organizational ICTs predominantly focuses on the ways in which communication is made more or less visible (Evans et al., 2017; Rice et al., 2017). Notably, visibility serves to both grow and amplify, and limit and restrict, the presentation of communication and behavior (Treem et al., 2020).

However, as an affordance visibility is commonly viewed in terms of the accessibility of communication at a particular time. Pairing visibility with persistence captures how digital communication makes communication visible over time and available to confront and consume (Treem et al., 2020). Persistence refers to the permanence and ephemerality of communication afforded by organizational ICTs (Fox & McEwan, 2017). The idea is that many contemporary organizational ICTs have some capability of capturing, saving, replicating, and recirculating information long after its initial communication (Fox & McEwan, 2017). Importantly, this means that users can interact with information and others in any place at any time (Rice et al., 2017). Hence, persistence may have unique implications compared to visibility in terms of consequences beyond moments of technology use.

Our intention is not to argue that visibility and persistence are the only relevant affordances to consider, but that many other affordances are likely to be subsumed in an examination of visibility and persistence. For example, Fox and McEwan's (2017) operationalizations of privacy and bandwidth use language aligned with conceptions of visibility. Any attempt to specify multiple affordances in a context is likely to be both incomplete and contain murky distinctions among categories. The choice of visibility and persistence allows us to capture the two most important types of affordances in the most parsimonious way: visibility captures possibilities individuals have to make communication accessible to others, and persistence captures the temporal aspect of that accessibility.

In delineating the scope of our investigation to these two affordances, our goal is to demonstrate the potentially distinct impact of affordances beyond the imminent interactions between users and the material features of a technology. Though persistence may be relevant to the extent that communication is visible over time (Treem et al., 2020), we portend that persistence and visibility afforded by organizational ICTs may create very different individual realities. In what follows, we develop hypotheses concerning the psychological

and behavioral implications of the visibility and persistence affordances.

Hypotheses
Visibility

Visibility is often seen as an important precondition to individual and organizational functioning, especially in the context of learning and knowledge sharing (Leonardi, 2014). Yet, what we learn about others' knowledge or work behavior may not always be beneficial. For instance, visibility may convey a certain pressure as we make judgments and learn about normative expectations based on the communication and actions we see of others. In the context of personal relationships, visibility provided by public social media (e.g., Facebook) is perceived as stressful as it enables others to monitor content without one's awareness and increases social comparison (Fox & Moreland, 2015). Similarly in an organizational context, seeing the achievements of others may create a stressful pressure to increase one's own performance, and learning about co-workers' TASW practices may lead other employees to do the same.

Interestingly, third parties may affect individual uses of technologies for instance, "onlookers"—that is, actors who are not directly involved in technology use—may directly or indirectly influence user behavior (Sergeeva et al., 2017). In contrast, the focus of this study is on how visibility afforded by organizational ICTs presents people with ways to learn about normative expectations by observing others. The vicarious learning afforded by communication visibility enables others to see available communication about work (Leonardi, 2014), which may escalate one's own psychological and/or behavioral engagement to work. Similarly, Chen and Wei (2019) demonstrate that communication visibility provides employees with access to overly complex and diverse information, thereby creating barriers to collaboration, rather than enabling it. They conclude that "communication visibility may backfire by generating unproductive organizational behavior" (p. 33).

Along these lines, Stephens et al. (2017) explain the availability–expectation–pressure pattern to describe how the quantity of information available to users leads to an expectation, and pressure, to act upon the availability of information. Conversely, we know that the availability of communication technologies that afford anywhere, anytime connectedness often leads employees to connect everywhere all the time (Mazmanian et al., 2013). Constant cognitive preoccupation with online content and communication has been found to induce stress (Freytag et al., 2021). More broadly, visibility has been found to be problematic in social support. For instance, research on support provisions concluded that invisible support may be more beneficial than visible support provision. The reason for this is that visible support provision is believed to exert emotional costs, making support receivers feel obligated to return something to restore perceived inequity in the relationship (Priem & Solomon, 2015).

Hence, we suggest that visibility afforded by organizational ICTs may be associated with increased stress and TASW for several reasons. First, the ability to make behavior and communication visible to others may create expectations to perform work behaviors beyond those formally required. Second, presenting work behaviors and knowledge in a sociomaterial space may be so complex that it requires additional efforts from employees inducing stress and leading to TASW. Finally, visibility afforded by organizational ICTs also allows employees to see the behaviors of others. The accumulation of visible behavior and communication by colleagues may require employees to expend more resources on processing this information potentially leading to stress and TASW. Hence, based on the reasoning above, we argue that visibility is not only positively related to stress and TASW, but contributes to intra-individual increases in stress and TASW. Thus:

> H1a: Visibility at baseline (T1) relates positively to subjective stress at T2.
>
> H1b: Visibility at baseline (T1) relates positively to changes (Δ_{T1-T2}) in subjective stress.
>
> H2a: Visibility at baseline (T1) relates positively to TASW practices at T2.
>
> H2b: Visibility at baseline (T1) relates positively to changes (Δ_{T1-T2}) in TASW.

Persistence

Though persistence represents the extent to which communication remains visible and available over time, the implications of persistence are not necessarily similar to those of visibility. For instance, the ability to engage with information long after its initial communication may provide individual users opportunities to exercise more agency in terms of when, where, and how to engage with information. The persistence of information may also increase the possibility that workers will be held accountable for their communication long after its initial publication, creating a form of accountability (Treem, 2015). Studies on public social media (e.g., Facebook) have found that users may associate persistence with stress as negative information can be accessible online for a long period of time and is difficult to remove permanently (Fox & Moreland, 2015).

However, in the context of organizations, research has found that persistence of information can also yield positive effects. A study by van Zoonen et al. (2021a) found that it was the persistence of communication that moderated the positive relationship between communication technology use and TASW in global work. This suggests that the persistence of communication also affords the opportunity to engage with information at times that fit better to the personal preferences of employees, reducing the need for TASW. Hence, persistence can be construed as a personal resource reducing the urgency to immediately act upon behaviors and communication that are made visible through organizational ICTs. As such we argue that persistence could reduce intra-individual changes in levels of stress and TASW. Thus, the persistence of communication afforded by organizational ICTs may reduce the change in stress and TASW over time.

> H3a: Persistence at baseline (T1) relates negatively to subjective stress at T2.
>
> H3b: Persistence at baseline (T1) relates negatively to changes (i.e., stabilize; Δ_{T1-T2}) in subjective stress.

H4a: Persistence at baseline (T1) relates negatively to TASW at T2.

H4b: Persistence at baseline (T1) relates negatively to changes (i.e., stabilize; Δ_{T1-T2}) in TASW.

Methods

Procedure and sample

Data were collected from employees in a global industrial logistics company headquartered in Northern Europe.[1] The organizational ICTs used in the company included Google Workspace and offered email, cloud storage, as well as video and audio-conferencing tools. These ICTs were accompanied by a content management system (i.e., intranet) and an enterprise social media platform (mimicking the functionalities typically found in Yammer or Facebook Workplace). This study focused on understanding the affordances that were derived from these ICTs, and this focus was clarified to participants in the questionnaire. All office employees ($N = 8,554$) were invited to participate in the study at T1 (September 2019), in total 1,295 completed questionnaires were returned. Nine months later (June 2020) we invited the same participants to complete the questionnaire again which resulted in a final sample of 437 respondents that completed both questionnaires. The initial response rate in T1 was 15.1%; the final sample after T2 has a response rate of 5.1%. The dropout between T1 and T2 was 66.3%. The longitudinal set-up with two measurement points allowed us to examine the extent to which changes in stress and TASW can be attributed to affordances associated with organizational ICTs. In addition, such a design allows us to account for autocorrelation and provide empirical evidence for the theoretical argument that affordances share a dynamic relationship with stress and TASW (Matusik et al., 2021). Looking at these relationships at multiple time points allows us to draw stronger conclusions about the relationship between affordances, stress, and TASW than would be possible based on cross-sectional designs.

There is no consensus on determining the ideal time lag for investigating the longitudinal effects of affordances. However, it should be noted that time misspecifications may be more problematic when the time interval is too short (e.g., may lead to non-findings) rather than too long (e.g., may lead to underestimation of the true causal impact; Zapf et al., 1996). We decided on a 9-month time interval for multiple reasons. First, existing organizational communication efforts and the COVID-19 global pandemic influenced data collection. Specifically, the surveys were scheduled so as not to compete with other employee demands and the intention was to minimize the burden on workers. Relatedly, over the course of our engagement with the organization, we regularly discussed any changes in work conditions related to the COVID-19 global pandemic. Informed by these discussions, we moved forward with our second measurement in June 2020, with the goal of capturing similar circumstances as our initial measure in 2019. Second, longitudinal research on occupational well-being and worker behavior commonly relies on time lags of up to 1 year (e.g., Zapf et al., 1996). Longitudinal studies reported that well-being (e.g., exhaustion or stress) may develop slowly—that is, more likely within a year than within a week (Houkes, et al., 2003). Hence, we concluded a 9-month

period is long enough to measure possible changes in individual scores, but not so long as to lead too many non-responses.

The average organizational tenure of the respondents ($N = 437$) is 8.4 years ($SD = 8.53$), and they reported working 40 hours ($SD = 16.96$) on average per week. The majority (72.5%) of the respondents reported being male (27.5% reported being female). Comparing the demographics of our sample to the employment records of all office employees suggests that employees in our sample were slightly older compared to the population $n = 8,117$: $M_{population} = 41.71$, $SD = 10.73$; $M_{respondent} = 44.57$ $SD = 10.15$; $t = 5.71$, $p < .001$. There were no differences in organizational tenure $n = 8,117$: $M_{population} = 8.13$, $SD = 8.44$; $M_{respondent} = 8.43$ $SD = 8.53$; $t = 0.705$, $p = .481$) or working hours ($n = 8,117$: $M_{population} = 39.41$, $SD = 8.33$; $M_{respondent} = 40.00$ $SD = 16.96$; $t = 0.718$, $p = .473$). Finally, the gender distribution was similar though there are slightly more male employees in the population compared to the sample (Male$_{population}$ = 77%; Female$_{population}$ = 22.9%; Male$_{sample}$ = 72.5%; Female$_{sample}$ = 27.5%; $\chi^2 = 4.96$, $p = .026$).

Measures

Table 1 reports all the measurement items related to our central constructs with corresponding factor loadings and standard errors.

Affordances

Visibility was measured using three items derived from van Zoonen and Sivunen (2020). Respondents were prompted to indicate their agreement based on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). *Persistence* was measured using four items derived from Fox and McEwan (2017) and van Zoonen et al. (2021b). Again, respondents were asked to indicate their agreement with the statements on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Psychological response

Stress was measured using four items tapping subjective stress developed by Motowidlo et al. (1986). Subjective stress refers to the experienced psychological or physiological responses to the work environment. Responses were on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Behavioral response

TASW was measured by adopting four items from Fenner and Renn (2010). TASW refers to the extent to which employees utilize available technologies to engage in supplemental work outside of regular work hours during the evening, at night, or on weekends. The statements refer to utilizing smartphones and laptops to conduct supplemental work. We refer to these broader technologies (a) because these were in the original measure, and (b) to reflect the notion that supplemental work is not necessarily limited to the use of collaborative tools. But the visibility and persistence afforded by collaborative tools may trigger a variety of supplemental work behaviors that may rely on technology use more broadly. Participants were asked to indicate the frequency, ranging from 1 (never) to 5 (always [every day]), with which they engaged in TASW.

Table 1. Measurement items

Item	Time 1				Time 2			
	R^2	St. Factor loading	Unst. Factor loading	Se	R^2	St. Factor loading	Unst. Factor loading	Se
Persistence								
The collaboration tools we use at [company name] keep a record of communication that I can go back and look at.	.70	.837	1.000		.73	.893	1.000	
I can retrieve past messages that have been sent through collaboration tools	.79	.884	1.128	.05	.92	.924	1.031	.04
Collaboration tools used at [company name] keep a record of communication that can last long after the initial communication	.94	.959	1.246	.04	.78	.812	1.150	.04
Communication through collaboration tools exists long after the initial interaction is finished	.87	.928	1.176	.04	.86	.870	1.095	.04
Visibility								
I can see content that is shared among my colleagues even though I am not the designated recipient	.26	.510	1.000		.36	.601	1.000	
I can see the expertise of other people through the content that they share among each other	.65	.804	1.486	.15	.66	.809	1.325	.15
I can see what others are working on based on the information they exchange	.74	.859	1.629	.16	.49	.699	1.160	.16
Stress								
My job is extremely stressful	.75	.867	1.000		.79	.887	1.000	
Very few stressful things happen to me at work	.28	.524	0.643	.06	.40	.633	0.737	.05
I feel a great deal of stress because of my job	.70	.834	1.011	.05	.73	.856	1.060	.05
I almost never feel stressed because of my work	.57	.758	0.929	.05	.55	.739	0.846	.05
TASW								
When I fall behind in my work during the day, I work hard at home at night or on weekends to catch up by using my smartphone or computer	.76	.874	1.000		.80	.893	1.000	
I perform job-related tasks at home at night or on weekends using my smartphone or computer	.84	.914	1.126	.04	.85	.924	1.091	.04
I feel my smartphone or computer is helpful in enabling me to work at home at nights or on weekends	.71	.843	1.145	.05	.66	.812	1.085	.05
When there is an urgent issue or deadline at work, I tend to perform work-related tasks at home during the night or on weekends using my smartphone or computer	.79	.888	1.126	.04	.76	.870	1.063	.04

Analytical approach

Our investigation into the relationships between organizational ICT affordances of visibility and persistence and psychological and behavioral outcomes relies on a Latent Change Score (LCS) approach (Matusik et al., 2021). The LCS approach enables us to examine the dynamic (i.e., time-lagged) relationship related to individual differences in change. There are different forms of change including mean-level change (i.e., group-level changes over time), rank-order change (i.e., test–retest correlations), and individual differences in change (i.e., individual changes in absolute levels of stress and TASW; Li et al., 2014). Individual differences in change fit the purpose of this study, that is, to examine whether the affordances of ICTs shape individual differences in changes of stress and TASW. LCS explicitly accounts for the dynamic difference in individual changes across two measurement times (Ferrer & McArdle, 2003). In this study, such a dynamic change relationship refers to whether affordances at baseline (T1) are related to individual changes in stress and TASW from T1 to T2.

To test our hypotheses, we developed a four-variable LCS in which changes in stress (ΔY_a) and TASW (ΔY_b) between T1 and T2 are predicted by persistence (X_a) and visibility (X_b). The change score is defined as the part of the score of Y_{a2} that is not identical to Y_{a1}. To model the "true" score

corrected for measurement error several model constraints were imposed. The T1 and T2 measures of the same construct were constrained to be equal by fixing the autoregressive path to 1 and setting the variance of the latent variable at T2 to zero. In addition, the latent score factor was modeled to account for all the residual variance in the T2 measure by constraining the regression path from the latent change factor to the variable at T2 to 1. Latent factors within measurement occasions were allowed to covary as were the covariations between error terms for the same observed indicators at T1 and T2.

Furthermore, a set of alternative models were tested and contrasted against the baseline model representing imposed constraints above. First, the hypothesized causal model was estimated, which added the regression paths between X_1 and ΔY_2. Second, the reversed causal model was tested which added the regression paths between Y_1 and ΔX_2. Third, a reciprocal model was tested including paths in both directions between X_1 and ΔY_2 and between Y_1 and ΔX_2. Figure 1 visualizes the approach to capture "true" latent change in our model over time.

Models were estimated using a maximum likelihood estimator. Bias-corrected parameter estimates were obtained by extracting 5,000 bootstrap samples. To gauge model fit several fit indices were examined: the model χ^2 (where a value of

χ^2/df = < 3 indicates good fit), the Root Mean Square of Approximation (RMSEA; < .05) and Standardized Root Mean Squared Residual (SRMR; < .09) were tested. Furthermore, the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) were examined (> .95; Kline, 2015).

Drop-out from the study was explored in various ways. First, Little's test for missing completely at random (MCAR) was conducted demonstrating that missings were MCAR ($\chi2 = 198.19$, $df = 209$ $p = .693$). Employees who dropped out did not score significantly different on visibility, stress, or TASW. We did find that those who dropped out reported lower scores in persistence compared to panel survivors ($M_{drop\text{-}out} = 3.67$, $SD = 0.90$; $M_{panel} = 3.85$, $SD = 0.92$; $t = -3.590$, $p < .001$). In addition, those who dropped out of the sample were slightly younger compared to panel survivors ($M_{drop\text{-}out} = 43.37$, $SD = 19.89$; $M_{panel} = 443.64$, $SD = 10.14$; $t = -2.208$, $p = .038$). Finally, there were no differences between survivors and drop-outs in terms of tenure, work hours, or gender.
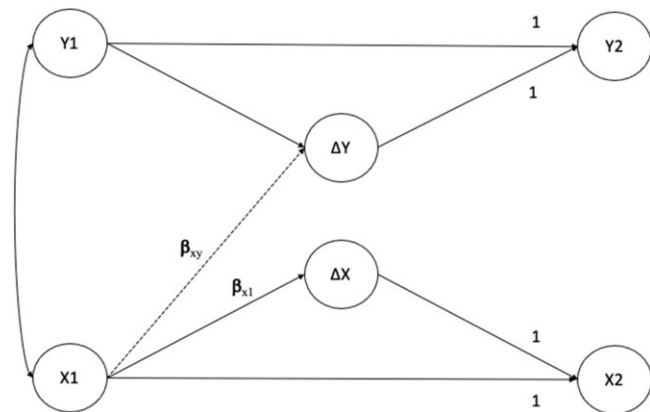
Figure 1. Simplified visualization of latent change modeling approach.

Note. Visualization of approach to capture the LCS of a variable *X* and *Y*. The "1" represent the imposed constraints to specific parameters. Variances in the outcome at T2 were constrained to equal 0. The *β* represents freely estimated parameters, where β_x represents the proportional change from the measured variable at T1. The β_{xy} path represents the proportional change from *X* at T1 on the latent change in outcome (*Y*). The "ΔX" and "ΔY" represent the LCS of variables *X* and *Y*, respectively.

Measurement model

The measurement model included eight constructs, representing four different factors measured twice (i.e., persistence, visibility, stress, and TASW). The measurement model demonstrated good model fit: $\chi^2_{(df\ =\ 377)} = 832.80$; TLI = .95; CFI = .96; RMSEA = .053 [CI95% .048, .057]; SRMR = .03. Model parameters indicate no reliability or validity concerns (see Table 2). The average variance extracted (AVE) for all constructs is above .50. Furthermore, the maximum shared variance (MSV) is lower than the square root of the AVE. Overall, this indicates adequate convergent and discriminant validity. Also, the standardized factor loadings ranged from .51 to .97 at T1 and from .60 and .96 at T2. Factor loadings for measurement items at T1 and T2 are reported in Table 1. Finally, the measures exhibited high reliability, with maximum reliability (H) ranging between .77 and .96 and composite reliabilities ranging between .75 and .95.

Since both measurements still rely on self-reported data common method variance was assessed through a common latent factor technique and Harmon's Single factor technique. The common latent factor technique indicated that the average shared variance among observed variables that can be attributed to the common factor is 3.6%. Additionally, Harmon's Single Factor technique suggested that the explained variance for a single factor is 23.4%, overall indicating common method variance is not a major concern in this data (Podsakoff et al., 2003). Configural invariance— that is, testing the Null hypothesis that the same construct underlies the same measure at each measurement occasion— and metric invariance—that is, testing the equality of factor loadings of like items across time—were examined (Ployhart & Vandenberg, 2010). Both the configural model and the metric model demonstrate good model fit, imposing equality constraints do not significantly deteriorate model fit ($\Delta\chi^2_{(\Delta df}$ 77) = 41.42, $p = .999$). Having confirmed measurement invariance, we proceeded to test our hypotheses.

Results
Hypotheses testing

In the analysis, we controlled for age, gender, tenure, and work hours. The results indicated that none of the control

Table 2. Validity statistics measurement model

Variable	M (SD)	CR	AVE	MSV	MaxR (H)	1	2	3	4	5	6	7	8	9	10	11	12
Time 1																	
1 Persistence	3.85 (0.92)	.95	.82	.20	.96	**.91**											
2 Visibility	2.93 (0.95)	.78	.55	.23	.83	.28	**.74**										
3 Stress	4.53 (1.28)	.84	.57	.56	.88	.00	−.09	**.76**									
4 TASW	2.61 (1.15)	.93	.78	.61	.94	.08	.15	.27	**.88**								
Time 2																	
5 Persistence	3.86 (0.94)	.95	.82	.20	.96	*.45*	.30	−.09	.09	**.91**							
6 Visibility	2.70 (0.94)	.75	.50	.23	.77	.22	*.48*	−.03	.13	.29	**.71**						
7 Stress	4.52 (1.34)	.86	.62	.56	.89	−.07	−.03	*.75*	.32	−.12	−.14	**.79**					
8 TASW	2.76 (1.17)	.93	.77	.61	.94	−.02	.21	.29	*.78*	.06	.13	.38	**.88**				
9 Gender	1.27 (0.45)	–	–	–	–	.07	.01	−.11	−.09	.08	−.03	−.08	−.01	–			
10 Age	44.57 (10.15)	–	–	–	–	−.09	−.09	.14	.08	−.05	−.10	.09	.05	−.19	–		
11 Tenure	8.43 (8.53)	–	–	–	–	.01	−.05	.14	.06	−.02	−.07	.07	.03	−.21	.50	–	
12 Work hours	40.00 (16.96)	–	–	–	–	.01	−.06	−.00	−.04	−.04	.01	.02	−.05	.07	−.11	−.02	–

Note. CR, composite reliability; AVE, average variance extracted; MSV, maximum shared variance; Ma-xR(H), maximum reliability. Square root of the AVE is reported on the bolded diagonal. Italicized values indicate correlations between the same constructs across measurement points. Gender was coded 1 = Male, 2 = Female. Correlations of .10 are significant at $p < .05$; correlations above .13 are significant at $p < .01$; and all correlations above .18 are significant at $p < .001$.

variables were significantly related to the LCSs. The inclusion of age, gender, tenure, and work hours did not affect the relationships in the model. Since there is no theoretical basis for the further inclusion of these variables (Spector & Brannick, 2011) and following the parsimony principle, the simpler model is preferred (Kline, 2015). Hence, the results below are drawn from the more parsimonious model without these variables. The retained model represents four latent variables that were created to represent the intra-individual change scores in visibility, persistence, stress, and TASW. To capture the "true" change score we corrected for measurement error and imposed several constraints. In addition, we allowed LCSs to covary. This represented our baseline model and demonstrated good model fit: $\chi^2_{(df = 380)} = 743.37$; TLI = .96; CFI = .96; RMSEA = .047 [CI95% .042, .052]; SRMR = .06. To test our "b" hypotheses (i.e., h1b – h4b), we added cross-lagged paths from the baseline scores on visibility and persistence (T1), to measure changes in subjective stress and changes in TASW (Figure 1). This model demonstrates significant improvement ($\Delta\chi^2_{(\Delta df\ 4)} = 15.4$, $p = .004$) and good model fit: $\chi^2_{(df = 376)} = 727.97$; TLI = .96; CFI = .96; RMSEA = .046 [CI95% .041, .051]; SRMR = .06.

Hypothesis 1 focuses on the relationship between visibility and subjective stress. The absence of a significant correlation between visibility at T1 and subjective stress at T2 (beta = .054, [CI95% −.003, .146], $p = .116$) does not support our assumption that visibility at T1 and stress at T2 are positively correlated. Hence, hypothesis 1a is not supported. Hypothesis 1b reflects the assumption that visibility is positively related to individual differences in changes in stress. The results indicate that baseline scores in visibility demonstrate a non-significant standardized effect on changes in subjective stress (beta = .245, [CI95% −.188, .703], $p = .267$). These results do not support H1b. Hypothesis 2 reflects the assumption that visibility will increase TASW. The results demonstrate a positive correlation between visibility at T1 and TASW at T2 (beta = .124, [CI95% .073, .194], $p = .006$). These findings support H2a. Furthermore, H2b posits that visibility at T1 is positively related to individual differences in changes in TASW. The findings indicate a positive standardized effect between baseline scores on visibility and changes in TASW (beta = .506, [CI95% .230, .769], $p = .001$). Hence, hypothesis 2b is supported. These findings indicate that visibility afforded by organizational ICTs results in higher, and more individual change in, TASW over time.

Hypotheses 3 and 4 relate to the relationships between persistence, stress, and TASW. The findings demonstrate a negative correlation between persistence at T1 and stress at T2 (beta = −.088, [CI95% −.139, −.015], $p = .022$). This supports hypothesis 3a. The results further indicate that a strong negative relationship between persistence at baseline and intra-individual changes in subjective stress (beta = −.422, [CI95% −.843, −.088], $p = .014$). This result suggests that, after controlling for other sources of change (e.g., previous levels of stress), persistence reduces the intra-individual change in subjective stress, supporting H3b. The findings suggest persistence afforded by organizational ICTs results in lower and more stable levels of subjective stress over time. Finally, Hypothesis 4 reflects the assumed relationship between persistence and TASW. Again, the findings demonstrate a non-significant correlation between persistence at T1 and TASW at T2 (beta = −.122, [CI95% −.178, −.019], $p = .044$), thus, supporting Hypothesis 4a. In addition, the results indicate a significant and strong negative relationship between

baseline scores on persistence and intra-individual change in TASW (beta = −.495, [CI95% −.767, −.212], $p. = .001$). This result supports Hypothesis 4b. Overall, these findings suggest that persistence afforded by organizational ICTs results in lower and more stable levels of TASW over time.

Discussion

Utilizing a latent change modeling technique, we demonstrated that two affordances of organizational ICTs related differently to the change in subsequent levels of subjective stress and TASW. Furthermore, we add a dynamic perspective demonstrating that visibility and persistence predict intra-individual change in stress and TASW. Specifically, visibility is not significantly associated with stress but is associated with higher levels of TASW and greater individual fluctuations in TASW over time. In contrast, persistence is associated with lower and more stable levels of stress and TASW over time. Overall, our results contribute to knowledge about the implications of affordances of organizational ICTs for individual psychological and behavioral outcomes.

Theoretical implications

The current study contributes to research by adopting an affordance perspective to theorizing about, and studying, the implications of organizational ICTs in the context of work processes (e.g., Chen & Wei, 2019; Chen et al., 2020; Treem & Leonardi, 2013; van Zoonen & Sivunen, 2020, van Zoonen et al., 2021b). Most of these efforts have directed attention to core organizational communication processes such as knowledge sharing and socialization (Treem & Leonardi, 2013; Sun et al., 2019) and often specifically focused on performance outcomes such as in-role or creative performance (Chen et al., 2020). In addition, previous research has often considered affordances of single technologies (e.g., enterprise social media; Pee, 2018) or focused on a specific affordance (e.g., [persistence] van Zoonen et al., 2021a; [visibility] Zhu et al., 2021). By simultaneously considering visibility and persistence and demonstrating the divergent impact of both affordances we present novel insights into the impact of affordances on individuals' psychological states and work behaviors, beyond specific technology uses. This work represents an effort to better connect workers' engagement with digital technologies to individual outcomes, and future work should explore similar relationships among different affordances and various individual outcomes.

In contrast to earlier findings that visibility and persistence have univocally positive implications for organizational network relationships (Chen et al., 2020), we find that visibility might in some cases be more aptly construed as a constraint or pressure. The finding that visibility is associated with increases in TASW over time suggests that greater visibility of communication may trigger an expectation and subsequent pressure to act upon the available information. In analyzing this result, we acknowledge that TASW during the night or on weekends is not by definition bad. However, arguably the visibility of others' communication and knowledge through organizational ICT supports the availability–expectation–pressure hypothesis (Stephens et al., 2017). This hypothesis implies that employees may feel pressure to engage with, or respond, to the available information because of a felt social expectation or pressure. In addition, the results indicate that visibility is associated with higher, and more individual

changes in, TASW over time. If TASW is triggered in response to the visible communication and work behaviors of others, employees may feel pressured to work longer hours and weeks. Although we did not study the long-term implications of TASW we did find positive correlations between TASW and stress in our study. Ultimately, engaging in TASW at night or on weekends for a prolonged time could eventually result in detrimental consequences for individual well-being (Freytag et al., 2021). Overall, the finding that visibility is associated with higher levels of TASW and greater fluctuations in TASW over time provides tentative evidence for the argument that some affordances present possibilities for action that may become more normative than others. This may result in certain outcomes (e.g., TASW) feeling more inevitable or expected.

In contrast to visibility, the persistence afforded by organizational ICTs is associated with lower and more stable levels of stress and TASW. Persistence at the baseline was negatively related to stress and TASW and individual changes in these constructs over time. This suggests that persistence is a source of stability, rather than change. These findings support the idea that persistence afforded by organizational ICTs operates as a resource allowing employees to engage with information and communication at their discretion, and therefore reduces the need to engage in TASW. The persistence of communication has already been found to mitigate the positive relationship between collaboration technology use and TASW (van Zoonen et al., 2021a). We add that persistence might more directly impact decisions to engage in TASW. In addition, our findings suggest that persistence is associated with lower and more stable levels of subjective stress. This provides further evidence that the persistence of communication may serve as an important informational resource. In contrast to visibility, persistence ensures that information outlasts a person's work hours or weeks (Siegert & Löwstedt, 2019) and this may alleviate some of the stress or pressure individuals feel to respond to or engage with the content immediately. Furthermore, an affordance lens is often heralded for its ability to help explain why people use the same technologies in diverse ways and with diverse outcomes. Our findings demonstrate that affordances perceived by employees using the same organizational ICTs vary across individuals and within individuals over time. These results prompt questions of whether affordances of technologies perceived by users in a specific social context would converge or diverge over time and with what implications for more distal outcomes of technology use.

Taken together, this study also informs emerging theorizing about communication visibility (Leonardi, 2014; Treem et al., 2020). First, beyond the positive implications of visibility for knowledge management in organizations (Leonardi, 2014; van Zoonen & Sivunen, 2020), we confirm that visibility may have detrimental implications (Chen & Wei, 2019) as has the potential to trigger TASW. This study also adds to recent theorizing on communication visibility as a multidimensional concept that involves actors, audiences, and a socio-material space (Treem et al., 2020). Central to this theorizing is that (a) communication visibility is a root affordance of computer-mediated communication, (b) computer-mediated communication makes communication visible across time and location, and (c) individuals can manage the visibility of communication in a socio-material context. Our findings explicitly considered the temporality that is enclosed in these principles of communication visibility theory. We demonstrate that the ephemerality or enduring nature of communication visibility, here reflected in the persistence of communication, is critical to evaluating and understanding the implications of technological affordances. The notion that communication may remain accessible over time may present users of technologies with distinct advantages—that is, reducing stress and TASW.

Additionally, this work contributes to scholarship highlighting competing tensions and pressures associated with the flexibility of contemporary communication technologies. Early work examining the affordances of *new media technologies* like social media contrasted the increased breadth and magnitude of possibilities for action relative to other technologies in a largely binary way—that is, social media affords greater visibility, or greater persistence. Yet as communication technologies continued to proliferate and evolve forms of use have also diversified. As a result, scholars recognized problems associated with efforts to match technologies with singular or binary outcomes or consequences associated with affordances (Evans et al., 2017). Indeed, empirical work has noted that individuals vary significantly in the affordances they perceive as offered by various organizational media—those both novel and more traditional (Rice et al., 2017).

Though increasing the affordances of technologies is often positioned as a positive for organizations in terms of enabling new or more action, the results of this study align with research showing that affordances can be a mixed blessing for individual workers. Research has demonstrated various tensions that workers may face in navigating the affordances of technology such as protecting autonomy versus responding to group expectations (Mazmanian et al., 2013), individual promotion versus team recognition (Erhardt & Gibbs, 2014), increased relational closeness versus entrapment (Hall & Baym, 2011), and usefulness versus overload (Califf et al., 2020). As the relationships in this study between visibility, persistence, stress, and TASW indicate, there is a need to understand that possibilities for action can be both enabling and burdensome. When possibilities for action expand or are altered workers are confronted with choices and tensions, often difficult ones, that are likely to be influenced by various aspects of individual and organizational contexts. Future work is needed to further explore the individual, group, and organizational conditions that can inform how individuals navigate the tensions produced by technological affordances.

Practical implications

Taken together the findings prompt organizations to think about the extent to which communication needs to be visible throughout the organization, and specifically about the ways in which communication can be made available over time. Persistence of communication can help teleworkers to manage the blurring boundaries between their work and non-work time if they can engage with work-related communication at their discretion, as the information stays available over time. More specifically, the findings suggest that it might be worthwhile to offer employees ways to reduce communication visibility while highlighting the specific advantages of curating information for future reference. This would require a stronger focus on content management functions of various organizational ICTs that may afford bounded and unbounded visibility (van Osch & Steinfield, 2018). This would help organizations capitalize on the potential advantages of persistence of communication over time while trying to mitigate any potential negative side effects of communication visibility.

Interventions could relate to modifying the default sharing settings of various social and collaborative technologies so users can decide which profiles and posts are visible.

The findings of this study are especially relevant considering the changes wrought by the COVID-19 pandemic and the impact of the pandemic on our work lives. Transitions to remote work settings have made individuals and organizations increasingly reliant on mediated work practices. This change is consequential for the social structures in organizations as social structures reshape in response to pandemic distress (Jo et al., 2021), and workers rely on technology to reduce feelings of workplace isolation (van Zoonen & Sivunen, 2021). In addition, interdependencies of workers may increase task setbacks when work is conducted remotely or across boundaries (Chong et al., 2020) and lead to extensive work hours and stress (Sull et al., 2020). Our findings highlight that ICT affordances may both exacerbate and remedy these concerns. For organizations concerned with mediated work practices cultivating the persistence of information and communication through organizational change may benefit workers to a greater extent than promoting the visibility of information and communication that may equally be afforded by the same technologies.

Limitations and future research

Besides the merits of this study, several limitations need to be acknowledged. First, the LCS approach provides valuable information about the intra-individual changes in the outcomes that can be attributed to baseline levels of visibility and persistence. However, our study does not establish causality between the studied constructs. Even though our design allows us to exclude the influence of stable third variables, the influence of those that vary over time cannot be ruled out (Zapf et al., 1996). Additional randomized experimental designs manipulating the availability of technological affordances are needed to establish the causality of the relationships more firmly. In addition, the positive correlations between stress and TASW on both measurement occasions may hint at an interesting relationship between these outcomes. Specifically, stress and TASW might be reciprocally related such that increases in stress lead workers to respond with more TASW. More TASW in turn may further exacerbate stress, creating a negative spiral of escalating TASW and detrimental well-being outcomes. Future research utilizing longitudinal designs with more measurement occasions may explore such longer-term implications.

Second, it is difficult to determine the optimal time lag between measurements. The findings demonstrate that a 9-month time lag is a reasonable timeframe to detect significant effects of affordances on subjective stress and TASW. Notably, during the study, we had to balance between conducting the study using an optimal research design, respecting the organizations' wishes (i.e., avoiding overlap with other campaigns and surveys), and relatedly navigating the global health pandemic that emerged after the first wave of data was collected. We acknowledge that the difficulties in collecting data and the absence of control variables related to the pandemic present limitations to the current study. However, an employee survey conducted independently of our research suggested that employee engagement was up 6% in 2020, and the company reported in March 2020 (2 months prior to our second survey) that the production sites had neared pre-pandemic outputs bringing the situation "close to normal." In addition, many workers were already part of a team that operated globally and relied heavily on technology-mediated work practices. Regardless, one might speculate that a transition to remote work practices that were implemented locally, during challenging times, might affect perceived affordances, subjective stress, and work practices more generally (Kowal et al., 2020). As such, a limitation of this study is that we are not able to discern the exact impact of the pandemic on our model. Future research may consider the impact of group-level changes in work conditions. In addition, technological affordances might additionally demonstrate short-term effects on stress and TASW. Thus, future research could benefit from testing shorter time lags to reveal the potential short-term implications of technological affordances.

Third, in this study, we have relied on the TASW measure developed by Fenner and Renn (2010). However, some of the statements used in this scale seem to assume reasons for engaging in these behaviors or are not neutrally phrased—for example, *I feel my smartphone or computer is helpful in enabling me to work at home at nights or on weekends*. Other studies have suggested alternative operationalizations of TASW (in relation to smartphone use) and measure compulsive checking behaviors and availability (e.g., Derks & Bakker, 2014; Eichberger et al., 2021). Considering that it is increasingly important to understand what constitutes supplemental work and the ways in which technologies facilitate such practices in a work environment where spatial and temporal boundaries are increasingly fading, future research may consider ways to develop a more fine-grained measure for studying TASW.

Finally, we relied on self-reports for all our measures. Although common method bias doesn't seem to be a concern in our data (e.g., both positive and negative relationships between variables; Holman et al., 2010) and we utilized latent changes in each variable between two occasions (Li et al., 2014), using other reports for measuring behavioral responses might more objectively establish whether affordances affect such outcomes. For instance, TASW could be assessed by one's spouse or supervisor, while spouses might equally have interesting insights into the psychological state of a worker at a given time (Roberts & Levenson, 2001). Nevertheless, the findings presented in this study expand the value and contribution of an affordance perspective on technology use. By moving beyond the implications for knowledge sharing and collaboration, we demonstrated that affordances of organizational ICTs may have different psychological and behavioral implications.

Conclusion

Our study contributes to the growing body of literature on the affordances of organizational ICTs, and the results demonstrate that visibility and persistence have diverse implications beyond technology use. Specifically, the findings suggest that visibility is positively related to increases in TASW while persistence is negatively related to increases in TASW. Furthermore, persistence is negatively related to changes in subjective stress, while visibility is not significantly associated with subjective stress. Overall, the findings advance theorizing on affordances by suggesting that affordances of organizational ICTs may not only reflect possibilities for action that may affect subsequent usage behaviors but may represent probabilities for action with consequences beyond technology use. Hence, the findings highlight the importance of

considering the ephemerality of communication visibility as persistence is negatively related to more distal outcomes of employee-technology interactions. These findings are especially important in contemporary work settings that are characterized by an increasing reliance on remote and mediated work practices in the wake of the pandemic. Hence, a deeper engagement with the ways in which affordances impact subjective work experiences and behaviors is urgently needed.

Note

1. This study is part of a larger research project funded by the Academy of Finland. Several publications on related topics draw from data collected at the same research site (at different times), see for instance van Zoonen et al. (2021b). The study presented by Treem et al. (2022) draws on the first wave of the data presented here. The relationships presented in the current study have not been analyzed or presented in previous publications. The data underlying the measurements of persistence, stress, and TASW used in this study have not been analyzed or used in any prior publications. Visibility at T1 in the current study overlaps with the visibility concept that is used as a mediator between technology use and knowledge sharing intentions in Treem et al. (2022).

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