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# A Market Survey of Remote Work Platforms and Digital Workplace Analytics: An Analysis of How People Are Working Remotely and on What Types of Platforms

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# **A Market Survey of Remote Work Platforms and Digital Workplace Analytics: An Analysis of How People Are Working Remotely and on What Types of Platforms**

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For well over 3 years now, a large portion of the global workforce has endured and, in many cases, thrived in remote work contexts. At the same time, there has been a great proliferation of various tools, digital workplace platforms, and new companies that have come onto the market to fill a capability gap that exists. Our interest is in examining as many of these tools that we can find and comparing them in terms of the extent to which they claim to promote workplace culture. Our metrics are based on whether these digital workplace platforms use traditional, questionnaire-based assessments of culture or go beyond that with novel digital markers, such as natural language processing. We identify 12 candidate platforms that have novel culture metrics or interfaces and perform user-experience evaluations.					
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## 1. Introduction

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Just as it is important to understand the frequency, antecedents, and broader consequences of remote work, it is also imperative to explore the various types of digital platforms available for remote work and their effects on workers and firms. Here we investigate a broad set of platforms and tools that have arrived on the market, which aim to ameliorate some of the difficulties in remote work. These digital workplace platforms and tools intend to provide their users with insights for improving aspects of their work style (e.g., communicating inclusively), and promise to enhance a team's experience and overall performance. High-performing teams do not appear overnight but develop over time. Recognizing the importance of communication within businesses will improve their performance and team culture. The COVID-19 pandemic created a major shift in how companies distributed their responsibilities for remote work. With little-to-no preparation, individuals were forced to move their work online in addition to adjusting to stressors in everyday life. Learning to navigate work exclusively online forced a culture change within companies. Both the employer and their employees had to reevaluate how to successfully transition business models to continue meeting its goals, how to create or update policies and procedures, and how to implement changes throughout operations while generating profits. As of 2022, many companies continued to have a large majority of their employees working from home. Recognizing the lack of face-to-face interactions has the potential to lead to decreased employee engagement, this in turn may lead to unsatisfied employees undermining a company's success. For example, Zoonen et al.<sup>1</sup> studied how with a lack of face-to-face interaction, employees are less likely to have validation with their coworkers and supervisors. Validation comes through visual cues including body movements, eye contact, facial expressions, and hand gestures. A proactive company may counter this by increasing feedback examples for peers, one-on-one meetings, and performance reviews.

How to make effective teams is of pressing interest and technology may help with various processes involved in developing teams. In addition, so can leveraging what we know about diversity, equity, and inclusion (DEI) to design workplace cultures that impact effective teams. There are now workplace platforms that have been created at the intersection of these two DEI themes as a cultural component of effective organizations/teams. The first contribution of our paper is to highlight and briefly describe the marketplace of these platforms as they currently exist. Doing so highlights some important differences across platforms. The dimensions that these platforms vary on are their target users (either business- or consumer-facing),

their implementation of novel data (either surveys or non-survey data), and their implementation of novel analysis (either regressions or machine learning [ML]/AI).

These differing factors generate different concerns across platforms. For example, business-facing platforms need to worry about data being shared with both employer and employee, which is an ethically charged relationship. Also, non-survey data may infringe on privacy; will employees be held responsible for facial expressions or tones of voice? Furthermore, certain platforms raise issues about the acceptability of fully recording the actions of people who they interact with (without gathering expressed consent).

### **Prior Research on Remote Work Platforms and Team Performance Metrics**

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Organizations around the world are pursuing improvement of DEI factors to enhance their respective cultures. While it may seem obvious how to assess organizational diversity along certain dimensions such as ethnicity, age, gender, and other readily recognizable features or things one can ask of teammates, there are certain facets of diversity that warrant deeper investigation. For this reason, Lix et al.<sup>2</sup> studied a type of cognitive diversity that they referred to as discursive diversity. They analyzed remote work digital communications on the Slack platform from collaborators on the Gigster.com platform. Essentially, they used advanced natural language processing (NLP) to study the variance in communication over the lifetime of projects. They found that when teams effectively modulated discursive diversity across the ideation and coordination phases of software development, they had better results with respect to hitting successful product milestones for their customers.

Microsoft Research issued a comprehensive report that describes not only their own internal future-of-work studies but also a review of the extent of science<sup>3</sup> on the topic. In it, the authors chronicle a multitude of research that identifies how burnout has risen during the pandemic, how technology can build interpersonal trust, and where hybrid work maximizes individual productivity. Notably, Samrose et al.<sup>4</sup> presented an iterative design and related user-experience research on a prototype version of the Microsoft Teams digital workplace platform. Their intent was to understand how to make video-conferencing more inclusive and thereby more effective. Users evaluated post-meeting dashboards of behaviors the AI classified as inclusive based on language sentiment, vocal tone, and engagement patterns with meeting participants. Results indicated that users found the meeting dashboards useful for increasing inclusivity. Since that publication, others from Microsoft Research<sup>5</sup> and elsewhere have looked at more privacy preserving approaches to

understand inclusive meetings based on metrics such as overlapping speech without having to analyze the content of speech.

## 2. Digital Tools in the Workplace

### 2.1 Description of 12 Leading Remote Work Platforms

We have described some of the prior research on existing remote work platforms. Next, we list 12 of the leading remote work platforms based on online searches and subject-matter expert focus groups. These digital workplace tools are binned into four different high-level categories: 1) metaverse coffee shops, 2) voice transcription, 3) traditional workplace metrics and behavioral interventions, and 4) personalized coaching. Table 1 briefly summarizes these platforms. We identify whether the platform/tool is intended for organizations or individuals and whether they provide any analytical capabilities like those previously described (e.g., assessing vocal tone or prosody in the context of evaluating meeting inclusion). When the platform/tool does have analytical capabilities, we describe whether/how those capabilities exceed those of humans (e.g., inferring inclusivity using computational linguistics).

**Table 1 Summary of digital workplace platforms and tools**

Category	Platform name	Intended end-user	Analytic capabilities (Yes/No)	Technological capabilities (e.g., beyond human means of storage or processing)
Metaverse Coffee Shop	<a href="#">Teamflow</a>	Organization	No	NA
	<a href="#">Kumospace</a>	Organization	No	NA
	<a href="#">Pluto</a>	Organization	No	NA
	<a href="#">Gather</a>	Team	No	NA
Voice Transcription	<a href="#">Otter</a>	Individual	No	Text-to-speech conversion using NLP
	<a href="#">Fireflies</a>	Individual	No	Text-to-speech conversion using NLP
	<a href="#">Huddl</a>	Individual	No	Text-to-speech conversion and AI recommendation system using NLP
Traditional Workplace Metrics and Behavioral Interventions	<a href="#">Culture Amp</a>	Organization	Yes	NA
	<a href="#">Instill</a>	Organization	Yes	NA
	<a href="#">Lattice</a>	Organization	Yes	Open-ended survey questions using NLP
	<a href="#">15Five</a>	Organization	Yes	NA
Personalized Coaching	<a href="#">Poised</a>	Individual	Yes	Facial recognition using ML, text-to-speech conversion using NLP

### **2.1.1 Metaverse Coffee Shops**

This category comprises persistent, video-based platforms that are either 2- or 3-D virtual workplace designs. A cross-cutting characteristic is that they are a departure from traditional video-conferencing.

*Teamflow* is an all-in-one collaboration hub platform designed to recreate the physical experience and atmosphere of an in-person office where users can move around and connect with other coworkers through a live 2-D metaverse with features such as video chat, spatial audio, multiple screen shares, whiteboard, notes, online games, and more.

*Kumospace* is another live 2-D video metaverse platform similar to Teamflow but marketed with a prominent feature of single-sign on (SSO) integration, which increases security implemented with OpenID Connect and OAuth 2.0 protocols for SSO.

*Pluto* is a live 3-D video metaverse platform aimed to host internal (team building, social hours, holiday parties, etc.) and external events (welcome receptions, networking, after parties, etc.) for companies or teams working remotely or hybrid.

*Gather* is a web-conferencing platform that caters to a younger, “Generation Z” demographic. It offers users the ability to directly interact with others and move around in 2-D metaverse space (but with limited rooms and spaces). Users’ representations are more pixelated graphical avatars versus live video screen icons.

### **2.1.2 Voice Transcription**

This category offers productivity enhancing capabilities by unburdening meeting participants from taking notes and also archiving automatically transcribed meeting minutes.

*Otter* is a meeting transcription tool that turns voice conversations into easily accessible meeting notes users can review after the meeting. Users can edit, comment, or view the shared conversations recorded by Otter. Conversations include both written and audio transcripts of the meeting. These can also be edited and refined after the meeting.

*Fireflies* is another platform that transcribes and saves audio files from live meetings. They use AI to transcribe the meeting and collaborators can access the files after the meeting. They also have a feature called “Smart Search” that allows users to search in three areas: AI filters, sentiment filters, and topic trackers.

*Huddl* helps organize meeting content so it can be searchable and tracked after the meeting. This platform uses AI tools to transcribe the meeting, allows users to

capture screen shares of the meeting, and connects with other platforms to eliminate manually intensive workflows.

### **2.1.3 Traditional Workplace Metrics and Behavioral Interventions**

Recently, Zenger and Folkman<sup>6</sup> discussed how using 360 performance reviews may increase self-understanding in the workforce. Traditionally, companies used top-down performance reviews that only allow supervisors to provide feedback to their subordinates. Zenger and Folkman<sup>6</sup> expressed their belief that using 360 performance reviews may further improve identifying employees' positive traits as well as areas of improvement. Overall, this tool can improve conversations between supervisors and their employees regarding job performance. Increasing interaction and communication between supervisors and employees creates a psychologically safe and engaging work environment. When reinforced positive and negative constructive feedback is given regularly, employee involvement and feedback increase. Employees have an easier time giving feedback to managers when they feel their opinions are being heard. This gives individuals a sense of belonging, leading to a trusting environment while creating a happier and healthier business culture.

*Culture Amp* empowers teams with employee engagement and performance and development tools. Culture Amp makes it easy to have one-on-one meetings with employees to help keep teams aligned. This platform provides companies access to expert training for administrators, managers, and employees to improve company culture.

*Instill* seeks to transform culture management by incorporating continuous assessment of employee traits using machine learning. Instill provides data-driven insights on how to empower leaders to create culture regarding inclusion, innovation, productivity, retention, and performance.

*Lattice* allows managers to give their employees feedback and employees to ask for feedback in real time, which improves performance and allows for more engagement between team members. This platform also allows meetings to be more productive by setting goals, creating growth plans, and providing additional feedback.

*15Five* allows managers to become most effective through consistent communication with their teams. This platform also offers performance coaching and professional development and allows HR and People Ops leaders to network with one another to create further impact at the organization.

### 2.1.4 Personalized Coaching

*Poised* is in a category by itself; it uses AI to provide digital coaching in communication by giving users real-time feedback during online meetings. This tool works with online video conferencing platforms and records the audio and video of the user using the platform. Users can receive a summary of their performance after their meetings and receive suggestions for communication improvements in various areas including confidence, clarity, energy, empathy, and emotion.

## 3. Comparative Analysis Across the Platforms

### 3.1 Deep Dive Into Three Platforms

We decided to perform primary user-experience research on three of the platforms. For the metaverse coffee shop platforms, we chose to evaluate Teamflow based on their apparent high-growth status since start-up (Table 2) and to get first-hand insights into what contributed to their success as one of the top 100 innovations of 2021 as featured in Time magazine.<sup>7</sup> Previous research on the Microsoft Teams platform in terms of meeting analytics has already been done<sup>4</sup>; however, to our knowledge *Poised* stands on its own as one of the only commercially available tools already on the market that provides meeting analytics. Lastly, we analyzed the Instill platform because of a pre-existing collaboration.

**Table 2 Poised coaching traits**

Coached traits	Sub-categories	Descriptions	Scoring
Confidence	Filler words	Short words to fill pauses (e.g., “um,” “uh,” “like”).	Percentage of words that were filler words: Good (<3%), Okay (<5%), Too Many (<5%).
	Pauses	Strategically pausing helps emphasize key points.	Percentage of sentences with meaningful pauses: Need More (<20%), Okay (<30%), Good (<30%).
	Hedging words	Phrases used to convey uncertainty.	Percentage of hedging sentences: Good (<4%), Okay (<6%), Too Many (<6%).
Clarity	Conciseness	Communicating with complex phrasing increases understanding difficulties for listeners.	Percentage of sentences where no issues with conciseness were found: Low (<96%), Okay (<98%), Good (<98%).
	Pace	Maintaining a good speaking pace helps engage listeners.	Words per minute (wpm): Good (<180 wpm), Slightly Fast (<210 wpm), Fast (<210 wpm).
	Rambling	Speaking aimlessly without a goal.	Percentage of excessive wording, unnecessary detail, and confusing explanations: Good (<5%), Medium (<20%), High (<20%).

**Table 2 Poised coaching traits (continued)**

Coached traits	Sub-categories	Descriptions	Scoring
Energy	Vocal variation	Varying pitch creates more energy and emphasizes certain words.	Pitch variation in Hertz (Hz): Low (<15 Hz), Adequate (<30 Hz), Good (<30 Hz).
	Volume	Speaking more loudly increases energy.	Loudness: Too Soft (<10%), Adequate (<20%), Good (<20%).
Empathy	Inclusive language	Sensitive or noninclusive phrases make others feel uncomfortable.	Number of sensitive phrases: Good (<0.1%), Low (<1%), Too Many (<1%).
	Questions asked	Asking questions helps increase mutual understanding.	Number of questions asked: Low (<3%), Some (<5%), Good (<5%).
	Interrupting others	Reducing interruptions helps prevent miscommunication.	Number of interruptions: Good (<2%), Some (<5%), Too Much (<5%).
	Encouragement	Encouraging words build trust and motivation.	Number of encouraging phrases: None (<3%), Some (<7%), Good (<7%).
Emotion	Positive tone	Speaking positively increases self-confidence.	Rated out of 5.
	Negative tone	Speaking negatively hurts persuasion and influence.	Rated out of 5.

### 3.1.1 Teamflow: All-in-One Collaboration Hub for a Virtual Office

*Teamflow* is a virtual office, all-in-one collaboration hub where remote teams can casually and professionally meet virtually, brainstorm, share documents, and do anything else you would typically do at an in-person office. Founded in 2020, it has remained successful and was named one of the 100 best inventions of 2021 by Time magazine in the productivity category.<sup>7</sup> *Teamflow* strives to emphasize one’s accessibility and comfort level in a virtual world by claiming to increase a team’s productivity, efficiency, and mental health through the features offered by the platform.

On *Teamflow* users are able to customize their own virtual office layout with or without *Teamflow*’s prebuilt templates, where users can design their space with rooms and furniture of their choice by creating private rooms for one-on-one meetings and having the ability to create social rooms, drop-in lunch hours, and more. Once logged into the *Teamflow*’s workspace, if a user decides to turn on their cameras, a circular icon displays their live video as an avatar in the *Teamflow* metaverse. By using the arrow keys along with a mouse, the user can roam the virtual office. By being able to “walk” over to a coworker for a quick question, *Teamflow* claims that this boosts team efficiency because it is much faster than creating and sending a coworker a Zoom link. Additionally, mimicking the in-person experience of walking in the office, the spatial audio feature in the

environment allows users to hear conversations near them and walk in and out of any interesting/relevant discussions.

Users are able to see coworkers' schedules, schedule meetings, and integrate third-party applications such as Figma and Google Docs without having to leave the Teamflow workspace. There are many features compared to the limitations of other video-conferencing apps like Zoom—such as, multiple users being able to screen share, which is unmatched for pair programming (per user testimonials). Most importantly, Teamflow is created as a persistent meeting space, which means that information is literally distributed across a 2-D metaverse, where all one's documents are available as needed on that one application. Therefore, users do not need to dig through nonspatial file repositories or other hard drives.

### **3.1.2 Poised: AI Coaching Platform for Virtual Meetings**

*Poised*, founded in 2020, is an AI-powered digital-coaching tool in communication and provides real-time feedback during online meetings. The company's mission is to improve and democratize the world's verbal communication by helping people enhance their speaking skills and bridge the gap between professionals.

This tool works with online video-conference platforms including Zoom, Microsoft Teams, and Google Meets; it records the audio transcription and video recording of the person using the platform. Note that Poised only records the person using the tool, not the other people in the meeting. Poised is run in the background and, when connected with the user's calendar, can record meetings automatically. When Poised is actively recording a meeting, it uses facial recognition and transcription analysis to provide feedback on various aspects of the user's communication. They provide coaching on the following categories: confidence, clarity, energy, empathy, and emotion. Poised provides an overall score for each of these categories based on measurements from various facets such as filler word usage, pace and interruptions, number of questions asked, and more. Table 2 lists the five main traits they coach as well as their individual subcategories and how they are scored.

Before downloading and utilizing the app, users complete an initial questionnaire to provide personalized feedback in future meetings based on their responses. Questions include the user choosing their industry, job function, experience level, and aspects of their communication style they would like to improve. The purpose of the initial questionnaire is to account for other factors that affect one's communication style and also to calibrate feedback based on, we assume, peers in the same career field and seniority in their roles.

There are ostensible benefits to using Poised. Poised can help make the transition from working in the office to working from home easier because they help the

process of strengthening one's speaking skills. They also provide real-time feedback and tips for communication skill development. And, by saving past recordings, users can review their performance and receive personalized feedback for future meetings.

Poised, like other products, has benefits, but also raises concerns surrounding privacy. Poised explicitly addresses privacy issues regarding user data that are collected. Their website informs users that their information is not shared with outside parties, and users can email Poised to have their data deleted and removed. Some questions to consider regarding the data being recorded include the following. Is the data that is being recorded and saved too invasive? People make non-choice-action decisions that include facial expressions and spoken tone. Is this something people should actively change about themselves? Moreover, informed consent occurs only once. Having flexible consent would be more attractive. For instance, users should be able to select which categories they want to focus and improve on, so that not everything about them is being collected.

In summary, Poised provides personalized communication feedback in future meetings based on responses from the questionnaire and observations made from previous meeting recordings. They have a coaching area to guide users with focusing on specific areas of improvement. And, they have a progress report that summarizes their recorded data from past meetings in addition to the ability to review the performance during past individual meetings.

### **3.1.3 Instill**

*Instill.ai* is a company that seeks to transform organizational management by developing a culture operating system. Instill provides data-driven insights to empower leaders to create culture regarding inclusion, innovation, productivity, retention, and performance. Currently, Instill focuses on documenting and designing culture. The company has already created two scales measuring culture and individual value identification.

In the future, Instill plans to create multiple assessments that also look into culture. The first will focus on measuring feelings of belonging and inclusion in the workplace while the other will measure culture by using ML and NLP. Overall, Instill plans on analyzing users' speech through email, Slack, and Zoom—correlating the results of the original assessments and how they communicate over these platforms. Once this step is completed, researchers will then use a regression analysis to identify how far individuals are from the model fit. This will allow measuring the feelings of belonging and inclusion from individuals rather than an organization.

Instill incorporates the HEXACO personality test\* into their product, which is shown to create a more extensive image of a user’s personality. These results share significant insight into how each individual functions and communicates, leading to better team performance and a higher successful product rate. There are six categories HEXACO examines the following six categories: honest-humility, agreeableness, emotionality, conscientiousness, extraversion, and openness.

Employees are encouraged to download the Instill app that integrates with Slack. Once the app is installed, users take a short test regarding their working style and communication preferences and are then given a “personality type.” The app allows coworkers to view their team’s personality types, how they prefer to interact and communicate, and view the company’s vision and mission statement. This feature is beneficial because it allows coworkers to see a clearer depiction of how their team may act and interpret information. In the future, Instill also plans to add their platform in Zoom and Gmail and incorporate recommendations on users’ dashboards to increase their scores, which promotes a stronger company culture.

### **3.2 A Comparison of Platforms Across Capitalization Metrics**

As investors find incredible interest in the domain of remote work start-up companies, we created a comprehensive list that includes the recency of the company’s founding as well as their progress raising money (see Table 3).† It is remarkable that the companies in the “metaverse coffee shop” category attracted relatively high early funding rounds at a high cadence (e.g., both Teamflow and Gather raised over \$40M within the same year).

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\* Copyright 2009, created by Drs Kibeom and Ashton.

† Financial information is available open source. Most of it was obtained from Crunchbase (2023 Crunchbase Inc, all rights reserved).

**Table 3 Digital workplace platform metrics**

<b>Platform name</b>	<b>Year founded</b>	<b>Funding timeline</b>	<b>Additional notes</b>
Teamflow	2020	Five funding rounds with total funding amount of <b>\$49.9M</b>	Featured in Time magazine's, <i>The 100 Best Inventions of 2021</i> <sup>7</sup>
		<b>Aug 12, 2020 / Jan 1, 2021 / Jan 6, 2021 - Seed Rounds</b> \$3.9M raised in three seed rounds by three investors with the leading investor being <i>Menlo Ventures</i>	
		<b>Mar 23, 2021 - Series A</b> \$11M by three investors with leading investor being <i>Battery Ventures</i>	
		<b>Jul 26, 2021 - Series B</b> \$35M by three investors with leading investor being <i>Coatue</i>	
Kumospace	2020	Two funding rounds with total funding amount of <b>\$24.9M</b>	NA
		<b>Apr 21, 2021 - Seed Round</b> \$3M by six investors with leading investor being <i>Boldstart Ventures</i>	
		<b>Dec 9, 2021 - Venture Round</b> \$21.9M by one investor	
Pluto	...	...	<i>Pluto</i> was acquired by <i>Fluxon</i> on Apr 26, 2022
Gather	2020	Two funding rounds with total funding amount of <b>\$76M</b>	NA
		<b>Mar 11, 2021 - Series A</b> \$26M by eight investors with leading investor being <i>Sequoia Capital</i>	
		<b>Nov 3, 2021 - Series B</b> \$50M	

**Table 3 Digital workplace platform metrics (continued)**

<b>Platform name</b>	<b>Year founded</b>	<b>Funding timeline</b>	<b>Additional notes</b>
		Three funding rounds with total funding amount of <b>\$63M</b>	
		<b>Sep 15, 2016 - Seed Round</b> \$8M by three investors with the leading investor being <i>DFJ DragonFund and Draper Associates</i>	
Otter	2016	<b>Nov 20, 2017 - Series A</b> \$10M by five investors with the leading investor being <i>Horizons Ventures</i>	NA
		<b>Feb 25, 2021 - Series B</b> \$50M by 11 investors with the leading investor being <i>Spectrum Equity</i>	
		Five funding rounds with total funding amount of <b>\$19M</b>	
		<b>Jul 31, 2017 / Dec 21, 2018 - Convertible Note and Pre-Seed Round</b> \$100K by three investors	
Fireflies	2016	<b>Jul 1, 2018 / Oct 28, 2019 - Seed Round</b> \$4.9M by eight investors with the leading investor being <i>Canaan Partners</i>	NA
		<b>May 24, 2021 - Series A</b> \$14M by two investors with the leading investor being <i>Khosla Ventures</i>	
		Two funding rounds with total funding amount of <b>\$6.3M</b>	
Huddl	2017	<b>Sep 20, 2017 / Jul 22, 2020 - Seed Round</b> \$6.3M by six investors with the leading investors being <i>Bain Capital Ventures, Bloomberg Beta, and Propel Venture Partners</i>	NA

**Table 3 Digital workplace platform metrics (continued)**

<b>Platform name</b>	<b>Year founded</b>	<b>Funding timeline</b>	<b>Additional notes</b>
		Six funding rounds with total funding amount of <b>\$257.5M</b>	
		<b>Mar 4, 2015 - Series A</b> \$6.3M by four investors with the leading investor being <i>Felicis Ventures</i>	
		<b>Mar 7, 2016 - Series B</b> \$10M by three investors with the leading investor being <i>Index Ventures</i>	
Culture Amp	2009	<b>Jun 15, 2017 - Series C</b> \$20M by four investors with the leading investor being <i>Sapphire Ventures</i>	NA
		<b>Jul 19, 2017 - Series D</b> \$40M by seven investors with the leading investor being <i>Blackbird Ventures</i>	
		<b>Sep 3, 2019 - Series E</b> \$120M by 10 investors with the leading investor being <i>Sequoia Capital China</i>	
		<b>Jul 29, 2021 - Series F</b> \$100M by 10 investors with the leading investors being <i>Sequoia Capital China</i> and <i>TDM Growth Partners</i>	
Instill	...	...	NA

**Table 3 Digital workplace platform metrics (continued)**

<b>Platform name</b>	<b>Year founded</b>	<b>Funding timeline</b>	<b>Additional notes</b>
		Nine funding rounds with total funding amount of <b>\$328.5M</b>	
		<b>Sep 30, 2015 / Mar 22, 2016 – Pre-Seed Round</b> \$120K by four investors with the leading investor being <i>Y Combinator</i>	
		<b>May 12, 2016 - Seed Round</b> \$2.8M by 11 investors with the leading investor being <i>Thrive Capital</i>	
		<b>Jul 31, 2017 - Series A</b> \$6.4M by three investors with the leading investor being <i>Thrive Capital</i>	
Lattice	2015	<b>Apr 26, 2019 - Series B</b> \$15M by five investors with the leading investor being <i>Shasta Ventures</i>	NA
		<b>Oct 11, 2019 - Series C</b> \$25M by one investor, <i>Tiger Global Management</i>	
		<b>Jul 14, 2020 - Series D</b> \$45M by seven investors with the leading investor being <i>Tiger Global Management</i>	
		<b>Mar 23, 2021 - Series E</b> \$60M by eight investors with the leading investor being <i>Tiger Global Management</i>	
		<b>Jan 19, 2022 - Series F</b> \$128M by 10 investors with the leading investors being <i>Dragoneer Investment Group, James Bergen, Thrive Capital, Tiger Global Management</i>	

**Table 3 Digital workplace platform metrics (continued)**

<b>Platform name</b>	<b>Year founded</b>	<b>Funding timeline</b>	<b>Additional notes</b>
		10 funding rounds with total funding amount of <b>\$94.1M</b>	
		<b>Apr 12, 2012 – Pre-Seed Round</b> Money raised during this round has not been publicly announced.	
		<b>Aug 5, 2013 - Venture Round</b> Money raised during this round has not been publicly announced.	
15Five	...	<b>Jan 15, 2013 / Oct 2, 2014 / Jan 1, 2017 - Seed Round</b> \$3.3M by 16 investors	<i>15Five</i> acquired <i>Emplify</i> on Apr 27, 2021
		<b>Nov 20, 2018 / Nov 29, 2018 / Dec 4, 2018 - Series A</b> \$8.2M by eight investors with the leading investor being <i>Origin Ventures</i>	
		<b>Jun 18, 2019 - Series B</b> \$30.7M by seven investors with the leading investor being <i>Next47</i>	
		<b>Jul 21, 2022 - Series C</b> \$52M by seven investors with the leading investor being <i>Quad Partner</i>	
		One funding round with total funding amount <b>\$4.5M</b>	
Poised	...	<b>Jun 9, 2021 - Seed Round</b> \$4.5M by 10 investors with the leading investor being <i>Wing Venture Capital</i>	NA

### **Ethical Concerns Across Platforms: Privacy, Responsibility, and Consent**

The different capabilities across platforms raise ethical concerns over privacy, responsibility, and consent. As with the introduction of many new technologies, the ethical concerns around *privacy* are paramount. While there are many such concerns within the 12 platforms, two are highlighted here. First, the number of users being able to access one’s data entered in these platforms. As highlighted in Table 1, a primary difference across platforms is the end-user: half of the companies focus on organizations whereas half focus on the individual. Platforms focused on the individual create issues with the individual needing to relinquish data to the technology platform. More interestingly, however, is that platforms focused on

organizations will necessarily enlarge one's circle of people with access to their data. Managers and coworkers may be able to observe an individual's data that they previously could not without the technology. This adds a new dimension to these relationships. For instance, many of these platforms rely on psychometrics (i.e., HEXACO). Without these platforms it is unlikely that one's manager or coworkers would know one's scores on such tests. Is it permissible for these platforms to make such data more widely available within one's network of relationships? A second privacy concern is related to the new *type* of data being collected and analyzed. Certain platforms (i.e., Poised) collect "non-choice" data such as facial expressions and tone of voice. By definition, one does not consciously choose to display this data and such data has typically been unnoticed and unanalyzed. Now, however, technology has unearthed a constellation of non-choice data types. Does one have a right to privacy in terms of reserving the usage of non-choice data? Sometimes facial expressions or tones of voice are meant to have subtle implications. Making such behavior explicit may destroy its purpose (i.e., to be subtle). More directly, however, oftentimes non-choice reactions are entirely unintentional. Do others have the right to analyze one's actions that by definition one does not intend to make public? Furthermore, is one *responsible* for behaviors they do not intend? Can we fire someone based on non-choice data?

In addition to these types of direct questions pertaining to *responsibility*, more subtle concerns also emerge. Some platforms are performing tasks of a type that are outside of human capability (e.g., analyze minute facial expressions and aggregate a relative proportion of participants' turn taking in meetings). In contrast, other platforms perform types of tasks within human capability but at a more advanced or precise level of detail. For example, while individuals can *roughly* remember what people said in a meeting, certain platforms (i.e., Otter, Huddl, and Fireflies) allow individuals to access the *exact* words said in a meeting. A pressing concern is that these platforms record the text/speech of individuals who did not consent to have their actions recorded. For instance, one individual in a meeting can transcribe the words of *everyone* in the meeting even if no one else consents or is even informed that this transcription technology is being applied. This raises serious ethical concerns around privacy and responsibility. In terms of responsibility, for example, how would voice transcription be weighed as evidence of behavior? Imagine that Ann's manager is given a transcript of a meeting where Ann allegedly said something worthy of being fired. Upon the manager's investigation, no one in the meeting remembers whether Ann said this. Furthermore, when confronted, Ann is genuinely surprised by this revelation of what the text says she said. Is Ann responsible for what the text transcription said she said? Is it justifiable to use the transcript *alone* (i.e., without support from a human) to fire her? Similarly, could we use a transcript *alone* to promote someone?

If we value the transcript, we are implicitly weighing the validity of the platform against the validity of human memory. While we may be tempted to assert that these platforms produce more reliable sources of information than human memory, this is at least debatable, given the nature of errors made in algorithms relying on NLP.

Many of these questions appear to be addressable at the individual level through *consent*. However, in the platforms focused on organizations, it is likely that the consent is being *directly* requested from one's manager and, perhaps, *indirectly* from one's peers and coworkers (in terms of their having already consented). Therefore, an element of coercion exists in the demand for consent. For instance, it does not seem reasonable that one could *freely* (i.e., without penalty) decline from using a platform that their managers and coworkers are all using. However, this does not disqualify the technology, as we have already seen this happen in the past. For instance, just because one cannot decline usage of email without penalty does not mean that we should deem the usage of email unethical. We should merely recognize the cost of introducing such technologies while weighing them against their benefits.

As a final note in favor of these platforms, some research finds that people *prefer* to be monitored by an algorithm rather than a human.<sup>8</sup> In 2021, Raveendhran and Fast<sup>8</sup> studied the psychology of behavior tracking acceptance in the workplace. They believed when human tracking was done by a computer algorithm, individuals were more accepting compared to when it was human operated. They found that both a low concern about potential negative judgment and a subjective sense of autonomy were two psychological factors that drove participants to accept human tracking. The comparison between algorithms and humans providing feedback were framed to provide the same level of capabilities. Nonetheless, it is critical to examine ethical issues given that there will not be obvious resistance against it. Of course, just because people want it does not make it ethically foolproof. Regardless of the relative benefits, developers and organizations using these tools should at least be aware of the socio-technical issues (e.g., ethics and privacy), when deploying these technologies.

## 4. References

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## List of Symbols, Abbreviations, and Acronyms

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2-/3-D	two-/three-dimensional
AI	artificial intelligence
DEI	diversity, equity, and inclusion
Hz	hertz
ML	machine learning
NLP	natural language processing
NSIN	National Security Innovation Network
SSO	single-sign on
wpm	words per minute

- 1 DEFENSE TECHNICAL  
(PDF) INFORMATION CTR  
DTIC OCA
  
- 1 DEVCOM ARL  
(PDF) FCDD RLB CI  
TECH LIB
  
- 1 DEVCOM ARL  
(PDF) FCDD RLB RW  
P KHOOSHABEHADEH  
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