

Is a Return To Office a Return To Creativity? Requiring Fixed Time In Office To Enable Brainstorms and Watercooler Talk May Not Foster Research Creativity

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ABSTRACT

In the aftermath of the Covid-19 pandemic, many professionals, including researchers, have transitioned into hybrid work. One concern arising from this transition is the cost to creativity in an environment of variable co-presence. We interviewed 24 researchers from several disciplines and varying levels of seniority, across 7 research labs in academia and industry about their hybrid work patterns and sources of creativity. Co-present ‘brainstorming’ and serendipitous ‘watercooler’ conversations are both often cited as arguments for mandating co-located work patterns in research organisations. Contrary to the dominant account which associates co-presence with increased creativity, we find that the flexibility of hybrid work, and carefully managed co-present interactions punctuating a regime of focused individual work, is the main catalyst of creativity. We find that the ‘problem-oriented discussion’ over time is a more powerful pattern for researcher collaboration than the ‘brainstorm’, that these discussions benefit greatly from the freedom to choose work locations afforded by hybrid work. We also find that serendipitous ‘watercooler’ conversations, while reported as valuable for collegiality, are reported as less valued for their contribution to creativity. We suggest that scheduling time in office should extend temporalities beyond the weekly cadence, and that tools and timing for serendipitous productivity and serendipitous collegiality do not necessarily have to be coupled.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

hybrid work, research, creativity, scheduling, brainstorming, spontaneity, serendipity

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1 INTRODUCTION

We learned the hard way from the COVID-19 pandemic that remoteness is not the barrier it once was to productivity [1, 27, 29]. However, a Nature study on the impacts of the pandemic on STEM scientists’ productivity [40] reported lack of in-person interactions decreasing opportunities for open and creative discussion for work and sharing research outputs, and disconnection from colleagues slowing adaptation to new work and positions. Post-pandemic, many organizations are still deciding how to transition from mandatory fully-remote work to a new format, whether that be permanent remote work (e.g. GitHub [31]), some form of hybrid schedule (e.g. SAP [47]), or requiring a permanent ‘Return to Office’ (e.g. Amazon [5]). For many organizations, the choice of format is partially based on the need to support innovation, of which research creativity is an aspect, and thus hybrid work represents a dilemma.

If collaborating in-person is important to research creativity, then colleagues need time together – with a key assumption being time together in a physical workplace – but this stands in tension with the flexibility of hybrid that employees desire [15, 27, 81, 95]. Some studies advocate for fixed common hybrid schedules (e.g., all team members synchronise their office and remote work days) [14], while others suggest that fixed common schedules are less inclusive [81, 82].

The dilemma is exacerbated by managerial presenteeism paranoia and, more generously, the ‘common good’ pulling towards fixed schedules [43], against employees individual desire for flexibility and, crucially, negative experiences of hybrid interactions. The key interactions noted as missing above might colloquially be referred to as brainstorming and watercooler talk. Hybrid meetings are a particular source of negative experiences, with local participants both deliberately and accidentally excluding remote participants [18, 77]. During the pandemic, knowledge-workers in various industries reported difficulties with remote brainstorming [59] and watercooler conversations [99]. Even before the pandemic, hybrid brainstorms were reported as very difficult to run inclusively [78], and hybrid watercooler-style informal talk has a similarly long history of difficulty [30]. So, given these struggles with technology to support hybrid brainstorming and watercooler talk, what

should the nature of hybrid flexibility be with respect to research creativity?

While the impact of hybrid and remote work on office workers has been well studied, there is still little work focused on the specific needs of scientific researchers. Scientific research is an intensely dynamic, variable, and creative form of knowledge work, and the effects of hybrid work (and thus employee guidelines and workplace policies) may not generalise from studies of other types of office work to research. This study aims to fill this gap, to understand researchers' hybrid work experiences, and in particular to explore the factors that drive them to be creative (as opposed to the typical focus on productivity, e.g. [27]).

We conducted interviews with 24 researchers across 7 research labs (4 industry research labs and 3 universities) in the UK, China, and New Zealand, who had autonomy to choose where to work, and worked in deep collaboration with others. Contrary to the dominant account which associates co-presence with increased creativity, we find that the flexibility of hybrid work, and carefully managed co-present interactions punctuating a regime of focused individual work, is the main catalyst of creativity. Further, we find that the 'problem-oriented discussion' is a more powerful pattern for researcher collaboration than the 'brainstorm', that these discussions benefit greatly from the freedom to choose work locations afforded by hybrid work. We also find that serendipitous watercooler talk, while reported as valuable for collegiality, are reported as less valued for their specific contribution to creativity. We suggest that scheduling time in office should extend temporalities beyond the weekly cadence, and that tools for serendipitous productivity and serendipitous collegiality do not necessarily have to be coupled.

2 PRIOR WORK

At the time of writing, the latest systematic review of the literature on flexible working practices [85] finds many contradictions regarding its multidimensional aspects and societal implications. Core to these contradictions is ambiguity and tensions about the nature of flexibility. In our brief review of prior work, we outline four key areas of potential ambiguity and tension that inform our interview results and discussion. These are: researcher creativity, brainstorming and creativity, collaboration and physical collocation, and hybrid scheduling.

2.1 Researcher creativity

Research innovation depends on the creativity of researchers, their ability to come up with great ideas and generate new insights. The most adopted definition for creativity delineates that creative ideas cannot be generated by the same set of generic rules as familiar ideas, thus indicating that creativity depends on conceptual changes in thinking [17]. Miller [58] found that the creativity of Albert Einstein and Pablo Picasso was triggered in remarkably similar circumstances. Neumann [62] later added that both individuals possessed a strong sense of aesthetics, indicating that regardless of discipline, the mechanism and psychology of creativity is similar.

Many studies measure researcher productivity and creativity as the number of publications, patents, citations per researcher (e.g. [76, 90]), though these measures can fail to reflect other kinds of productive and creative activities [25, 55]. Previous work has identified

several factors for research creativity, including personal factors such as intrinsic motivation, experience, risk-orientation, and environmental factors such as autonomy and institutional resources [4]. Great research breakthroughs depend on social support and collaboration [45]. Interdisciplinary collaboration is especially critical, and additionally, researchers needed to be relaxed but focused, to be creative, a state often achieved while taking light physical activity [62]. For our study, the question here is to what extent does a flexible work schedule provide space and time for thinking?

2.2 Brainstorming

The 'brainstorm' was first popularised by Alex Osborne in the 1940s and '50s [66, 71]. Osborne was an advertising executive and his perspective was that of creativity in the visual and performing arts, and mass media. The technique saw a resurgence with the promotion of "design thinking" [21] within organisations, which calls for the application of techniques from industrial design and branding for ideation and creativity in all aspects of business practice. A particularly formulaic example of design thinking is encapsulated in the 'design sprint' [9], attributable to Silicon Valley graphic and user experience designers, which incorporates multiple forms of structured brainstorming.

The design thinking movement has manifested a particular vision of creativity in the corporate world, one in which a group of co-located individuals frenetically 'ideate' in a time-constrained setting, preferably with the aid of sticky notes. The appeal is straightforward: the highly social and collaborative nature of brainstorming meetings is enjoyable and comforting. Brainstorming is also extremely popular in higher education [3], and while this does not necessarily translate to popularity in professional academic research, there is an intuitive overlap in methods of creativity.

The mess of colourful drawings, wall scribbles, and sticky notes that emerges from the process is visually exciting. Since visual arts, mass media, graphic design, etc. are easily and commonly conceived of as 'creative', it is a seductive proposition to generalise those methods to all knowledge work. The value of in-person brainstorming is prominent in both lay theories of creativity [73] but also a factor in a surprising amount of academic research. As a recent review makes clear [71], much contemporary creativity research falls into one or both traps of measuring creativity through the highly reductionist and ecologically invalid counting of 'ideas' generated in short sessions (e.g., Brucks and Levav [22]), or generalising from creativity in the visual arts to all other knowledge work (e.g., Herman and Hwang [41]).

Such activities were designed for a particular kind of in-person collaborative activity. However, as noted above, hybrid video meetings, even with effective digital whiteboarding tools, are fragile and asymmetric [63, 77], and stubbornly resistant to digitisation [32]. If in-person brainstorming is the intuitive model of creativity, then it is not surprising that the difficulty of hybrid brainstorming [78] is considered a blocker to organizational innovation. However, this may mistake the process, and its visual outcomes, for the actual moments of creativity that matter. For our study, this raises the question of whether scientific research creativity manifests itself primarily (or exclusively) in the intensity of an exciting

collaborative activity, or if there are other modes and times that are relevant?

2.3 Collaboration and physical collocation

Collaboration, whether in shared office spaces, as well as remote international collaborations, improves research productivity [39, 49, 52], with powerful patterns emerging from remote cross-geography collaboration [26, 75, 93]. Research collaboration was reported by many studies that boost the creation of new knowledge and higher research productivity in producing both quality and quantity of scholarly output [39, 52]. Although physical proximity has been identified as an important element for scientific collaboration [49], more international research collocation is taking place due to the rising mobility in the modern world [75], which often leads to publications with better quality and more citations [93]. However, such positive effects of collaboration on productivity vary greatly between low- and high- productivity researchers.

Remote work is associated with fewer unwanted distractions [80], easier management of household responsibilities [87], less commuting [11], improved health [16] and greater job satisfaction [97]. Nonetheless, remote work causes challenges for work-life balance, career progression, and workplace sociality [12, 24, 28, 69, 100, 101]. A study analysed data on the communication patterns of approximately 61,000 Microsoft employees in the United States between December 2019 and June 2020 [24]. It revealed that remote work has led to employees' collaboration networks becoming more static and siloed, making it challenging for employees to establish connections with weak ties. This suggests that fully remote work can present difficulties in acquiring and sharing new information across teams. New hires were found to miss onsite work the most, as they may face heightened risk of disconnected [24, 101].

A good relationship with co-workers correlates with high productivity [7] and greater job satisfaction with a high retention rate [10]. BCG surveyed 12,000 professionals employed before and during COVID-19 in the US, Germany, and India, and found that workers who self-reported satisfaction with social connectivity with their colleagues are two to three times more likely to have maintained or improved their productivity on collaborative tasks than those who are dissatisfied with their connections [27]. While a good relationship with co-workers is important for productivity [7, 10, 27], an inappropriate use and emphasis on teamwork can exhaust employees and sap productivity [92]; collaboration alone does not guarantee productivity. For our study, since the upshot of the above is that collaboration and communication alone do not guarantee effectiveness and productivity, then what factors do researchers consider to be critical to their creative research outputs?

2.4 Serendipitous Encounters and Research Creativity

The primary value of serendipity for research creativity is the chance discovery of novel information [57, 65] which could impact almost any stage of the research process, from planning and methods, through analysis, to the conclusions drawn, as well as broader processes such as spinning up new projects. As colloquial references to "watercooler" and "hallway" talk indicate, physical collocation has long been cited as affording serendipitous encounters,

which are, in turn, claimed to be key enablers of organizational innovation in general [33, 48, 98], and scientific creativity in particular [96].

Perhaps even more than meetings, though, serendipitous encounters are very complex phenomena to recreate for remote and hybrid work [12, 30, 37, 79]. Fully remote serendipity is possible, if not 'solved', with information serendipity provided by recommendations and feeds in enterprise social media [54] (e.g. Chatter by Salesforce, Workplace by Meta, Viva Engage by Microsoft (née Yammer)) and physicalised serendipity provided by avatars navigating around virtual office maps [67] (Gather, Knock, Kosy, Sococo, Wurkr). Flexible hybrid work adds the complexity of not knowing whether colleagues will be in the workplace on any given day. This leads to half-empty offices as "commute-regret" [86] creates the vicious circle of not coming in oneself in case one's colleagues also do not come in [83]. For our study, then, the questions are whether research creativity really relies on physical proximity as a conduit for 'just-in-time' information or novel information, and how does that form of serendipity relate to the fabric of collegiality?

2.5 Scheduling

Existing studies are mostly limited to considering a weekly cadence when exploring desired amount of post-covid work onsite/offsite time. Bloom [15] suggests that fixed office day may be a better option for employers. In China in 2014, workers who worked 4 days a week remotely had a 50% lower rate of promotion compared to their office colleagues. New hires were recommended to come more often to the office in the initial period to bond with other new recruits. While Bloom believes that hybrid work can be valuable, he also believes that organizations should mandate specific coordinated days in office [14]. His argument is that hybrid is harder to manage and that it also may lead to less diversity because choice of days to come in is not equally distributed. Those with more external obligations (e.g. caring responsibilities) may be at a disadvantage compared to those with fewer or who can shift the burden onto others (often men shifting the burden on to women).

However, other research argues that fixed office days may make a hybrid workplace less inclusive. Mallett et al. [56] argue that to better understand what policy is optimal for employees to maximise the benefit of a hybrid workplace, we need to hear more voices in the post-COVID-19 era. Skountridaki et al. [82] report on a large-scale UK study with 80 workers and over 2700 surveys responses to surveys during the Covid-19 pandemic. They suggest that employee preferences should be meaningfully considered to make the transition smoothly to the future of a hybrid work era. To maximise the benefits of the hybrid workplace, several crucial factors need to be considered when arranging the schedule of hybrid work, including 1) the nature of work/tasks; 2) the perceived effectiveness of in-person meetings; 3) the perceived quality of offsite office vs onsite office; 4) individuals' mental and physical conditions, and work-life balance concerns; 5) desire or undesired social interaction; 6) commuting time and transportation to be onsite. For our study, the two questions arising are whether a weekly cadence is the most effective for creativity, and to what extent inclusiveness issues are considered to be a crucial part of whatever cadence is most desirable?

In brief, prior work highlights the importance of considering multiple factors when examining what drives creativity in a research setting. The core concern for hybrid work policy is the question of whether scientific research creativity, as a subset of innovation more generally, relies solely on intensity of collaborative activity or whether there are other modes and times that are relevant. To answer this question, we conducted semi-structured interviews with professional academic and corporate researchers, focusing on the participants' hybrid working experiences and how they felt about factors such as productivity, creativity, technologies, and community when working onsite versus offsite. By examining these factors, we hope to gain insight into the effectiveness of weekly cadence for creativity and the extent to which inclusiveness issues factor into a desirable cadence.

3 METHOD

3.1 Participants

We recruited researchers, defined as anyone from industry and academia who contributes to academic-style research studies, through purposive sampling [23, 70]. Through a screening questionnaire we selected participants: 1) with at least two months' experience of hybrid work (defined as regular work outside shared office premises [44]); 2) can choose where to work; 3) spend 40% or more of their time on research; 4) work in collaboration with others.

We recruited twenty-four participants (12 men, 12 women, 0 non-binary/other) through our contacts and emails to research institutions in industry and higher education. Demographics of our participants are given in Table 1. We donated £25 to UNICEF UK for each participant. The study was approved by an institutional ethics board. We recruited participants and conducted interviews from September 2021 to October 2021.

3.2 Interview Protocol

We designed semi-structured interviews about participants' hybrid working experiences, mainly focused on their perceived creativity when onsite versus offsite. Participants were first asked general questions about their past and current working patterns. They were then asked to reflect on factors that drove them to be creative and how they feel about their creativity when at shared office premises versus offsite. Interviews were conducted and recorded via Microsoft Teams video conferencing tool, lasting 55 minutes on average.

Participants were asked to discuss 1) factors that drove them to be productive and how they feel about their productivity when onsite versus offsite; 2) factors that drove them to be creative and how they feel about their creativity when onsite versus offsite. For example, participants were asked questions such as "What is the most creative aspect of your work?", "Could you list 3 to 5 factors that contribute to your creativity?" and "What factors tend to hinder your creativity?"; 3) their perceived important technologies for hybrid working environment, and whether they consciously changed their behaviours between synchronous and asynchronous communication when onsite versus offsite; 4) how they felt about a sense of community in the hybrid workplace. For example, participants were asked questions such as "How has hybrid work impacted your relationships with co-workers compared to the pre-Covid era?",

"What challenges do you face in developing and maintaining relationships with co-workers in a hybrid work environment?", and "In your opinion, what factors contribute to a team working well together in a hybrid setting? What makes them not well together?"; 5) their preferred hybrid working mode.

Transcribed semi-structured interview data was co-analysed using inductive thematic analysis [20, 88]. We first independently read and coded all the transcripts for different factors contributing to researcher creativity. We initially coded creativity factors such as "non-working screen-free time doing non-work-related activities", "uninterrupted time", "shared whiteboard and document tools", "quiet spaces", "discussions with colleagues", and "long focus periods with fewer meetings", etc. Additionally, we coded preferred hybrid working modes such as "flexibility", "onsite preferred for socialising and co-creation", and "task-dependent arrangements". We collaboratively grouped these into themes, presented in the next section.

Our study did not find significant differences between industry and academic researchers in terms of productivity and creativity factors, and perceptions of important technologies for hybrid working environments. Nonetheless, potential differences in creativity perspectives or practices may still exist between the two groups. The observed consistency in our study could be attributed to the increasing collaboration between industry and academia, resulting in more similar behaviours and attitudes. Future research could investigate potential differences between these groups by applying different methodologies, incorporating larger sample sizes, or focusing on specific sub-disciplines or contexts where such differences may be more apparent. This exploration could contribute to a deeper understanding of creativity and productivity in hybrid workplaces for both industry and academic researchers.

4 FINDINGS

4.1 What creativity means to researchers

What is an appropriate way of scoping creativity for this study? Creativity can encompass the generation of an idea through the synthesis of multiple perspectives; something one would expect to be easier being together with other people, or new people. The creative process, such as in writing or coding, can also be the construction of new narratives, or generating the structure of code. This presumably is easier when alone and focused.

In this study we could have used a pre-determined definition for creativity to design the interview protocol. For example, Boden defines creativity as either 1) exploring a well-defined space of ideas to discover previously unknown ideas, or 2) creating a new idea space to explore [17]. Boden requires ideas to be surprising, novel, and valuable to be creative. However, we were concerned that this might have set the bar for creativity too high and dissuaded participants from sharing more frequent, everyday examples of creativity, which was important to us in the context of evaluating guidelines for hybrid research. The alternative is to start from experiences that participants themselves perceived as creative acts. This is the ordinary language philosophy [51] approach we adopted.

In our sample, common examples of participants' creative acts included: defining or discovering a new research problem (e.g., P18: "the creative part is to find novelty in the broad topics"), or

Table 1: Anonymised participant demographics. Participants were drawn from three corporate research institutions and three universities across the UK, China, and New Zealand. Participants had a mix of management and non-management roles.

Code	Gender	Organisation	Country	Role (Manager=M)
P1	F	Company A Research Org	China	Senior Researcher
P2	M	Company A Research Org	China	Research Software Development Engineer
P3	M	Company A Research Org	China	Principal Researcher
P4	M	Company A Research Org	China	Senior Researcher
P5	M	Company A Research Org	China	Principal Research Manager (M)
P6	M	Company A Research Org	UK	Principal Researcher
P7	M	Company A Research Org	China	Researcher
P8	F	Company A Research Org	China	Senior Researcher
P9	M	University A	NZ	Senior Lecturer
P10	M	Company A Research Org	UK	Senior Researcher
P11	M	Company B Research Org	UK	Research Scientist
P12	M	University B	UK	Professor (M)
P13	M	Company A Research Org	UK	Principal Research Software Engineer Lead (M)
P14	F	Company A Research Org	UK	Principal Research Manager (M)
P15	F	Company A Research Org	China	Senior Researcher
P16	F	Company A Research Org	UK	Principal Scientist (M)
P17	F	University C	UK	Lecturer
P18	M	Company C Research Org	UK	Senior Research Engineer
P19	F	Company A Research Org	UK	Principal Researcher (M)
P20	F	Company A Research Org	China	Principal Researcher (M)
P21	F	Company A Research Org	UK	Senior Researcher
P22	F	Company A Research Org	UK	Senior Researcher
P23	F	Company A Research Org	UK	Senior Researcher
P24	F	Company A Research Org	UK	Senior Researcher

critical engagement with the literature, and applying their domain knowledge to solve a well-defined problem (e.g. P21: “*synthesising ideas from the research and trying to think about how you could apply them to new problems*”). P10 describes creativity as “*this cycle of having a hypothesis [...] reading [...] trying to come up with solutions*”. For research managers, it may involve setting agendas for their reports (e.g. P5: “*the most creative part is finding the right research direction for my direct reports and my interns*”).

These were the kinds of activities that participants reflected on when discussing their creativity. Some of these creative activities constitute the “puzzle-solving” of Kuhn’s conceptualisation of “normal science” [50], while others constitute the framing of such puzzles.

4.2 Factors contributing to research creativity

We identified six factors that contribute to research creativity: high quality focus time, active rest, a diverse information diet, externalisation tools, motivation and autonomy, and problem-oriented discussions.

4.2.1 High quality focus time. The first factor is uninterrupted focus time. Participants cited several properties of a good focus session: One must be alone and it must not be possible to be disturbed. Even those with private offices felt that they could be disturbed by a knock on their office door, e.g. P17: “*it’s the feeling that I might be interrupted*”; P4: “*people can see me, and I do not feel very relaxed*”; P12: “*even if I shut the door, I just don’t relax in the same way that I do at home*”. It must be a long stretch of time (multiple hours) (e.g., P21: “*I need blocks of time [...] a 30-minute meeting in the middle of my afternoon [...] can ruin the work that I’m doing that day*”;

P21: “*I need to [...] allow my mind to wander [...] if I knew I had a meeting in 20 minutes, I’m not going to be able to [...] think deeply*”; P10: “*uninterrupted time [...] when my days are very scattered with small meetings [...] it’s really hard [...] to solve] really hard problems*”). One must be in a state of physiological comfort: well-nourished, well-rested, in a comfortable position, at comfortable light and temperature levels (e.g., P2: “*if I’m hungry I can’t be creative*”; P9: “*if I get a good night’s sleep*”, P13: “*temperature control [...] access to food and water, and toilet facilities also very important*”). One must be in a state of mental comfort: undisturbed by intrusive thoughts of work pressures or personal issues (e.g., P21: “*stress inhibits creative thinking*”).

4.2.2 Active rest. The second, related factor is non-work, non-screen time. Screens were cited as sources of interruptions (e.g., P14: “*I don’t think very well when I’m in front of a computer*”). Several participants mentioned going outdoors, taking walks or other light physical activities, or specifically not working (e.g., P3: “*when I need to think about something deeply, for example, when walking on the road, walking by the river or doing other non-work-related things, I would be able to think more [...] during remote work, the frequency I think deeply about some problems would be much higher*”; P6: “*I do remember quite a lot of ideas coming up on a bike ride to work or back*”; P13: “*I often have really great ideas while playing with my daughter or [...] [anything] not in front of a screen is actually great for my creativity. I’ll often be [...] playing a puzzle with her or maybe getting her ready for bed or, taking her to the park to the playground.*”; P14: “*if I really need to think about strategy, then I can go and sit in my garden, take my shoes off with my feet in the grass, and actually this is a very productive place [...] to be able to go and*

take half an hour in the garden where there's almost zero transition time is important for efficiency.”). Many stressed the importance of having variety in work environments (e.g., P7: “if we think that office is becoming repetitive, you should go home, spend some time there, and then if home becomes repetitive, so it's really not a matter of comparing, it's a matter of change [...] change boosts creativity.”; P1: “Sometimes I just want to change the environment [...] if I have worked from home for a long time, I will [...] go to the office”). Rest from work in these forms is well-documented to both replenish mental energy as well as give the subconscious an opportunity to work on problems [68, 74].

4.2.3 Diverse information diet. The third driver of creativity for research is a diverse diet of information. This included reading academic articles and non-academic resources (e.g., P12: “reading a journal article can be creative act where you engage in a ‘discussion’ with the author”; P4: “reading helps me to gather information from papers, blogs, websites from the Internet or other sources”; P11: “we're a very interdisciplinary team. We bring up papers from our communities and then I get exposed [to] other disciplines”; P3: “important information from different information channels, or [...] Twitter”). It included attending talks (e.g., P5: “sometimes I got inspired by [...] talks from the senior leadership team”). Having open-ended conversations with other researchers was also an important part of the information diet (e.g., P4: “exchange my thinking with colleagues or collaborators”; P13: “Going to lunch has been amazing for my creativity because now I have this period of time when I can have technical conversations with my peers that are unbounded by kind of a meeting agenda”; P15: “If I just think by myself [...] I might be limited by my vision. So if I can frequently chat with other colleagues or people from different areas I will be more creative”).

4.2.4 Externalisation tools. A fourth driver of creativity is the use of whiteboards, notebooks, and other externalisation tools, both individual and shared. P15: “I just go to a focus room to write down the main points on the whiteboard and try to organize the story”; P17: “I need a lot of white space to map my ideas on [...] to just map my thoughts and ideas around, like building blocks and how I can combine them.”; P8: “it's hard for me to express something that needs drawing with my mouse. But I can do that with papers and pen.”; P10: “with the team [...] being able to just draw stuff on the whiteboard”.

4.2.5 Motivation and autonomy. Fifth, participants mentioned passion, motivation, and autonomy. One must be interested in the work one does, and have a reasonable amount of flexibility regarding what to work on and how to achieve it. P3: “the strongest source comes from subjective, as a person, so your passion and curiosity. And there's no magic there. If you are doing something you don't like. No matter how people push you [...] you will have no good creativity.”; P21: “I also want everyone else to also be enthusiastic for the project [...] we amplify each other's [...] motivation”; P22: “I can be more creative when I have space and freedom to choose the topic [...] less interfered by my manager”; P9: “management control structure where you're telling them exactly what they need to do [...] that's not learning, and that's not creativity [...] I say to the pupil this is the general area [...] I want you to take ownership [...] that's where I get the best outcomes”. This mirrors previous studies of scientific productivity, which find that high productivity individuals were characterised

by “more belief in voluntary determination of deadlines, and more selflessness of motive” [91].

4.2.6 The myth of the brainstorm versus the problem-oriented discussion. Finally, while open-ended brainstorming was not seen as an important factor for creativity, a particular type of conversation emerged, cited by nearly every participant, as being a critical contributor to their creativity. We call this the **problem-oriented discussion**.

The problem-oriented discussion is a conversation between researchers targeted at a specific topic. Like a brainstorm, the problem-oriented discussion involves rapid ideation, sharing of perspectives, and exposing previously unseen connections. Unlike a brainstorm, which requires explicit divergent thinking, the appointment of a leader, striving for quantity of ideas, and the deferral of judgment [35, 66], the problem-oriented discussion repeatedly invokes the collaborative critical academic judgement of its participants in equal capacity. Problem-oriented discussions often aim to achieve a shared consensus about a problem to solve and delegating responsibilities among co-workers. As P10 puts it, “I can produce much more efficient outcomes through more deliberate discussion with my colleagues. In my experience it's not the spontaneous discussions that you have, it's more you get to know your colleagues over time, and then you know who to ask and when.” P18 stresses that “because we were doing research jobs, so most of the time we require discussion and also feedback”. P21's creative process involves “having meetings with people where we'll talk about the problems that we're working on, and then they'll have questions about it and then, sometimes even just by talking about the problem, you can be inspired to think about it in a new way”.

The problem-oriented discussion has two objectives: to collectively define problems, and to collectively agree upon a course of action. The first, per Kuhn's model of scientific progress, corresponds to the identification of puzzles to solve; formulating a research problem whose rules and parameters are understood and well-defined.

Interestingly, as several of our participants undertook work in interdisciplinary teams, they were often talking across paradigms (P11: “talking to friends who are not in the domain [...] in other disciplines, you just throw your idea and then you see [how it is] perceived from a more general [group] [...] You need to do reading, then discuss it with others [...] then] you would need more time again with yourself, refine the idea.”). Within corporate settings, the value of the research to external stakeholders (e.g., customers and product teams) were also considered. Therefore unlike in Kuhn's model, research problems are often selected on the basis of their intrinsic value and without assurance that the problem has a solution. Nonetheless, unlike in a brainstorm the constant exercise of expert judgment is critical to achieving a problem definition consensus.

When a problem has been defined, a course of action needs to be established. This involves planning and delegation of activities, often along lines of individual subject matter expertise, particularly in interdisciplinary teams. The problem-oriented discussion shifts back and forth fluidly between problem-definition and action planning. Problem-oriented discussions punctuate periods of focused individual work. Over the course of a project the problem definition is often revisited, refined, or changed. Towards later stages of the

project (as defined by the approach of a fixed external deadline, e.g., a paper) there may be more activity planning and delegation. E.g., P16: “it’s clarity on what needs to be done, ability to quickly contact in the same time all the people that that are involved to accelerate decision making”; P13: “you have these periods, when you’re kind of ideating and trying a bunch of different ideas [...] then you find that thing to work on, and then it’s all about really focusing on that, developing it, getting it ready to publish [...] then [when you finish there is] this amazing explosion of creativity, because it’s almost like it’s been building up and pent inside of you [...] you need this kind of expanding out and then contracting in. I think that’s part of the creative cycle”.

Problem oriented discussion can be done remotely (and in some cases, even asynchronously, through email or text chat), although there are some obstacles. The main obstacle to remote problem-oriented discussion is the difficulty of creating shared externalisations of ideas, most conspicuously notable in the numerous mentions of whiteboarding, which is widely perceived as difficult to do remotely. E.g., P14: “You can’t see what people are talking about. You can’t follow people where they are on the whiteboard is very confusing.”; P6: “with [online meetings] it feels very one person at a time [...] whereas when you’re in a physical presence with people, more things can happen at the same time and your brain can distinguish them.”

An intriguing possibility is that of the asynchronous problem-oriented discussion, facilitated by whiteboarding tools and collaborative documents. Some participants mentioned this had been possible as well, and even had benefits over synchronicity (e.g., P17: “we had an interdisciplinary research meeting [using Miro, a whiteboarding tool] [...] we presented our work and people could make comments on it [...] if we would be in the same room, I don’t think people would really leave notes”; P24: “I find [conversations] quite like overload [...] hard to focus on more than an hour [...] I’ve very much preferred them to be async [...] I really like writing a document to someone else over like a couple of days and reading their thoughts.”). More research is needed on how to run these and make them effective.

4.3 Enforced schedules antagonise research creativity

This section focuses on the issue of scheduling hybrid work, and in particular problematising the common conception of hybrid work as implying a weekly schedule. In our study, participants worked effectively at a wide variety of regular and irregular cadences, ranging from 2-3 days weekly at employer-provided office premises to as little as once every two months. Above all, participants emphasised the need for flexibility, control, and autonomy over where to work. Participants favoured different workplaces for different tasks, consistent with previous studies of hybrid work.

4.3.1 Effective working cadences vary widely. Some participants worked effectively to a weekly cadence, e.g., P1: “one or two days at home a week is good”. Others had cadences that were more irregular or had more infrequent visits to employer-provided office premises, e.g. P12: “control and autonomy are the key factors. And the balance itself will probably shift at different times”; P10: “I think being able to really say you can work fully remote if you want [...] leaving it really

up to the individual to choose [...] I’ll probably still come in every two or three weeks [... or] one week a month. But then then maybe one month I would say no.

4.3.2 Predetermined or enforced cadences undermine the value of hybrid. A predetermined or enforced cadence, particularly a weekly one, undermines many core value propositions of hybrid work. Enabling people to respond to emergent personal needs is a core value proposition of hybrid. Many of our participants cited personal events that required them to work in a specific location. E.g., P5: “if there is something urgent, for example, with my family or with all other things I can choose a different work time”; P24: “I’m not from this country. Sometimes I want to go back to my home country [...] maybe for a week or more to enable me to travel”. This flexibility translated into greater productivity and sense of well-being. An enforced cadence would undermine this.

Enabling people to respond to emergent work needs is a core value proposition of hybrid. Participants reflected how they scheduled co-located and remote time strategically to meet urgent deadlines. Participants remarked how academic research is intensely dynamic; it is not white collar ‘factory work’ that can be utilised and produced at a steady rate; teams and individuals transition through periods of differing and unpredictable activities and are constantly re-evaluating their work plans. An enforced cadence would undermine this. E.g., P1: “the task I think is a major factor”; P4: “if we have a deadline [...] I would rather be staying at home. In fact, many colleagues are like this, that is, when the deadline is approaching, they will choose not to come to the company, but to stay at home.”; P21: “there’s a particular deadline coming up and now I need to do an entire week [...] focused on my own type of work [...] having the freedom to choose when I come into the office”.

Enabling cross-geography collaboration is a core value proposition of hybrid. Participants mentioned carrying out collaborations across cities and countries, and how these collaborations strengthened due to the experience gained by the shift to remote work (e.g., P13: “before COVID [...] there’s a bunch of people in [one office] that are sitting in the room. And then there’s people from [other offices] who are calling in. And they always felt that they were like second class citizens in the meeting [...] As a result of COVID all meetings went from [that to] a Teams meeting that everybody is calling into. It completely leveled the playing field for everyone. And that helped a large variety of things up in terms of the team feeling connected [...] and that’s why as a team, we decided to stay remote first [...] because we didn’t want to lose this new dynamic in which everyone felt like they were equal”). Cross-geography collaborations are among the most fruitful for academic research, since academic specialisations are so narrow that the group of experts best suited to addressing a particular problem are often scattered across disparate geographies.

Enabling people to move to more affordable locations is a core value proposition of hybrid. Participants remarked about the high cost of living and how being empowered to move to a more affordable area improved the quality of life for themselves and their family, and this improvement in well-being translated in turn to higher productivity and creativity. The assumption of a weekly cadence would undermine this. E.g., P10: “I could fully choose I would probably choose to live in [expensive city ...] and take the bike [to work ...] but that’s not the situation.”; P15: “Either you have to live in

very old and small and crappy apartment. Or you have to commute [... anyway] I really don't enjoy [office location city] to be honest."

Less commuting is a core value proposition of hybrid. Participants mentioned how the elimination of the commute enabled them to reclaim time for sleep, life, and work. The elimination of the commute enabled greater physiological comfort and more ways of achieving a work-life harmony, which translated into improved creativity. The assumption of a weekly cadence would undermine this. E.g., P18: *"3 hours of commute time a day. Working from home just saves me all this time";* P7: *"I don't spend time commuting, so it's 1.5 hours more I work per day [...] the commute really brings a lot of inflexibility [...] I can sleep a little bit better because I don't have to come so early.";* P17: *"the commute for me is not just the time, it's just how tired it might be making me to commute"*.

As a corollary, protecting the environment through avoiding carbon-emitting commutes and having to wastefully light and heat multiple spaces is also a value proposition of hybrid. The assumption of a weekly cadence would undermine this, too. Reducing office space waste is a core value proposition of hybrid. But having shared cadences exacerbates the problem of office waste: offices must be large enough to accommodate all employees at once during the designated office days, and lie completely unused at other times. Sourcing from a wider, more diverse and inclusive talent pool is a core value proposition of hybrid. Hybrid work allows employers not only to cast a wider net geographically, but also in terms of gender, age, disability, ethnicity, family status, and socioeconomic status: all of which have documented effects on where people live, their personal needs and commitments, their ability to commute, their ability to succeed with traditional employer-provided office infrastructure, and therefore, their ability and willingness to work a certain job.

4.4 The myth of the watercooler conversation

Alongside the brainstorming, serendipitous 'watercooler' or 'hallway' conversations are argued to be a source of just-in-time and novel information that is critical to innovation. However, according to our participants, the importance of these events is largely overstated. Serendipitous encounters can build trust, and for some can indirectly impact their well-being at work through a sense of community, but they were not reported as direct drivers of productivity and creativity.

4.4.1 Prerequisites of a productive watercooler conversation. There are at least two prerequisites for a watercooler conversation to result in research productivity or creativity. The first prerequisite is a pre-existing relationship: participants must be familiar enough with each other to desire a sustained spontaneous conversation. This relationship cannot be built (or is very difficult to build) through serendipitous encounters alone; participants must begin from a base of some other shared experience. E.g. P23 *"I think it's definitely important for us to have met. [...] at least at the in the initial stages. Once you've met them once, you sort of have an idea of what's going on, and then after that sort of rekindling or yeah, or starting research collaborations is easier, but I think it's hard right off the bat."* The second prerequisite for a productive watercooler conversation is common ground – participants must share some mutual interest or expertise in order for one to contribute meaningfully to the work

of the other. E.g. P13 *"Going to lunch has been amazing for my creativity because now I have this period of time when I can have technical conversations with my peers that are unbounded by kind of a meeting agenda "*; P3 *"There are too many papers in the literature. [...] But if you have some friends [...], people would share with you some papers [... and] this allows you to keep in pace with the world."*

4.4.2 Most watercooler conversations are not directly productive. Watercooler conversations can take place between colleagues working on the same project or different projects. Both prerequisites above (pre-existing relationship, and common ground) are satisfied by team members working on the same project, however such work progresses on the basis of planned encounters and therefore doesn't require the watercooler to be effective. Moreover, for many the watercooler break is an opportunity for disengagement and rest (which are key drivers of productivity), and so, ironically, work-related conversations may be detrimental. E.g. P17 *"Sometimes I even want to be isolated that I don't have to talk to anyone when I'm thinking something which might sound weird. [...] the extra effort on communicating in particular ways that they are not native to me as well [...] the small talk, I would say it's not my strength."*

Many encounters by the watercooler do not satisfy one or both prerequisites for productivity, and therefore the conversation cannot directly contribute to either participant's work. Even when both prerequisites are met, there is no guarantee that participants will have a productive discussion. E.g. P10 *"I mean, they would always say, oh we need these productive discussions at the coffee table or at the coffee machine or in the lunch break, but then it sounds like every day you would have super productive discussions all the time. That's of course not how it works. [...] it's more like you get kind of continual exposure to other people and then you get to know their specialties, their expertise, and then you have the ability to ask someone when it's needed for your project. It's not like these things advanced completely spontaneously. It's much more deliberate."*

4.4.3 Collegial benefits of watercooler conversations. By relieving serendipitous interactions from the expectations of productivity, we can appreciate its collegial benefits. These benefits are not reasons in and of themselves to seek out serendipitous interactions or make decisions around hybrid working schedules. Awareness of these benefits may heighten the experience for those who for other, stronger reasons, have chosen to work at facilities.

Watercooler conversations can improve mental well-being through a sense of community. E.g. P16 *"During breaks you are faced with mundane things rather than intelligent conversation. Those like insightful conversation it's really helpful, opening minded, energizing, and it's definitely much more interesting than thinking whether I should be putting out the washing."* Watercooler conversations can also build trust; P20: *"A few days ago one of my colleagues had something to ask me. It's a very short question so he came knocking at my door [...] but after that something came across so I asked back some questions which I would not ask if I was at home or in other situation [...] we had a conversation like half an hour conversation which would not happen if I was at home and I feel it's closer for us."*

The importance of productive watercooler talk may be higher in some work cultures than others. That being said, any discussion of hybrid work should involve strategies for more intentional

productive remote conversation to reduce the *reliance* on water-cooler conversations, which are inherently uncertain and unevenly distributed.

5 DISCUSSION

What sort of space is that which separates a man from his fellows and makes him solitary? I have found that no exertion of the legs can bring two minds much nearer to one another.

Henry David Thoreau, Walden (1854)

Our participants' experiences align with the Wallas model for the process of creativity [94]. Wallas' model broadly comprises of four stages: preparation (gathering materials, focusing the mind on a problem), incubation (where the subconscious takes over and nothing happens externally), illumination (the idea appears in nascent form), and verification (the idea is articulated). Our participants relied heavily on focused solitude for preparation and verification, and on a diverse information diet for preparation. They relied on non-work, non-screen time to incubate their ideas.

Creativity, and the 'brainstorm' meeting, are often asserted to be important reasons for physical co-location. Our study finds that, for researchers, collective co-located in-person creativity is largely a myth. Co-located brainstorming sessions can be enjoyable, but they are not necessary, and they are certainly not sufficient. Rather, researcher creativity most benefits from long stretches of solitary focus, punctuated by problem-oriented discussions, an arrangement that is much easier to achieve with hybrid and fully remote work.

While our study does not show direct evidence *against* brainstorms, many previous studies and meta-analyses do. Brainstorming can lead to a loss of innovation due to "groupthink" effects [61]. Ideas that surface during a brainstorm represent thoughts that are easily and immediately available from the periphery of a problem [2]. On the contrary, ideas in research must be defended in terms of their novelty, significance, rigour, and nuance. These properties are all antagonised by the brainstorm format. It is therefore unsurprising that brainstorming was never mentioned by our research participants as a driver of creativity. Nor are we advocating for the 'lone creative genius' [60]: interaction with collaborators is key to the diverse information diet and problem-oriented discussions that drive research creativity.

As a reminder, the 'brainstorm' was itself born of creativity in the arts [66], and has surged to popularity with the rise of 'design thinking' within organisations [9, 21], which calls for creativity in all aspects of business practice. We argue that, while valuable, the design thinking movement has distorted the conception of creativity in knowledge work to a one-size-fits-all model. Such a model has intuitive appeal, especially to managerial cultures seeking a highly visible practice which can account for the otherwise opaque nature of innovative thinking. For researchers this has laid a misleading emphasis on short-term, co-located creativity, whereas our data supports a model of creativity very similar to that conceived by Wallas, involving the slow incubation of ideas over days, weeks, months, and years. An organisation that wants to improve its creativity would be much better advised to invest in this systemic form of creativity, which remote and hybrid work can support to a much greater degree than all co-present work, than to promote co-location in the expectation that 'brainstorming' will increase creativity.

Our data show that the creative practices of one craft cannot be naively grafted onto another, particularly one with a history as deep, and expert practices as rich, as scientific research. Any discussion of creativity in remote work inexorably devolves into a discussion of the efficacy of the brainstorm and how these are difficult to do remotely. This is a red herring. We must let go of the notion that brainstorming meetings are creativity manifest. The researcher's mind is a crucible in which a diverse information diet must simmer, perhaps for years, before the right connections are made. The key to improving systemic, institutional creativity is to empower researchers to achieve long periods of focused solitude, rest and physiological comfort, and frequent environmental changes. This is not easily achievable in an all co-located setting, and harder still on a fixed hybrid schedule. Research creativity is a long-term game. The greatest prizes will be won by research organisations that empower researchers to imbibe a rich diet of information sources, incubate ideas over long periods of focused solitude and rest, punctuated by opportunities for problem-oriented discussion. How can this be achieved?

As we noted above, there are many companies working on space-and-time administration products, such as deskbird, Officely, Microsoft Spaces, Robin, and Tactic. Such products, though, tend to focus on ad hoc or recurring bookings for a subset of employees who will be together at one time. Similarly, standard calendar systems with features for displaying working places and working hours [42], while well-intentioned and undoubtedly useful for some scenarios, entrench [84] both the assumption that hybrid cadences should be weekly and the assumption that they should be regular. The experiences of our participants show that in the case of scientific research, for a variety of reasons, both assumptions may be wrong, and when combined they may be damaging, for they introduce all the challenges of hybrid and remote working while reaping very few of the benefits.

The problem-oriented discussion is defined primarily in relation to the satisfaction of intellectual goals rather than time on task. While there are, of course, time issues such as contracts and deadlines, and logistical work that has defined boundaries, research creativity itself is generally elastic in its timing of individual and collective activity. Similarly, serendipitous encounters are clearly valued for both work and social trust and bonding. However, constant regular co-location is just a vehicle for encounters that are, by definition, a-periodic sparks. They cannot be forced by more co-location, and while this might raise the odds of sparks occurring, organizations should question how much of their innovation they wish to leave to the chance of the single factor of location, rather than intentionally creating a rich environment of multiple factors of informational just-in-time-ness or novelty, many of which do not or should not rely on location [53].

5.1 Implications

Taken together, then, the implication is that *both organizational practice and tools need a refresh* to find a way to use innovation culture to drive time and space administration, not the other way around. The simplest way would be to drop the weekly cadence and explore longer and elastic cadences in which time together is driven by goals – some productive, some social – at times when they will

be helpful and inspiring. Atlassian’s “Team Anywhere” approach to distributed work [6], for example, treats remote-first as standard and provides local teams with authority and methods for occasional co-location that suit them. This practice, however, requires work across a range of existing calendar and communication tools on the part of employee groups to manage.

Further, it will not be enough *just* to design the ultimate new collaboration tool, such as virtual whiteboarding or brainstorming tool [32, 34, 36], visual representations of offices in 2D (e.g. Gather, Soccoco) or 3D virtual reality (e.g. Meta Horizon Workrooms, World Economic Forum’s Virtual Global Collaboration Village) [38, 89], or exotic forms of cross-reality telepresence [46]. Such new technologies will be needed, but they will not be the holistic answer to the problem.

One of the lessons of the pandemic and the new future of work is that solutions conceived without holistic consideration can have deleterious consequences. For example, as Riedl et al [72] argue, the videoconferencing fatigue experienced by many people during the pandemic stemmed not only from limitations of the technology interacting with expectations around unmediated non-verbal aspects of communication (which Bailenson [8] concentrated on) but also on intensive and/or inappropriate use. Without training, guidelines, and technological support, meetings became a one-size-fits-all ‘solution’ to the sudden change to mandatory remote work – scheduled back-to-back, all day, every day, for any context that they could potentially conveniently handle [13].

Not only should HCI researchers and designers consider the wider socio-technical context in designing solutions, we might also have a duty to consider implications such as how people will be trained to use any designed solution in terms of fitting in to broader organizational and personal goals. If this does not happen, well-designed technologies may languish. The adoption problem is not new, of course, but we should try to avoid it catching us out. A corporate research lab reported rolling out Mobile Robotic telepresence robots as one way of overcoming the problem of hybrid serendipity. Remote colleagues could join a robot any time and drive around encountering colleagues, but it was found that on the days remote colleagues were not office, they specifically did not want to talk to their colleagues because that was focused work or personal time, so employees had adjusted to reserving the desire for watercooler talk for days in office [19]. This was one primary reason for low uptake of the robots. So, for the workplace scheduling dilemma of enabling research creativity, before designing solutions, HCI may need to explore how to facilitate discussions between managers and employees that promote understanding of the factors affecting research creativity and what the process of testing adoption will be.

The ultimate goal for the HCI community should be to take the burden of this kind of dilemma off organizations, managers, and employees. This is a potential application of generative AI tools. Trained on the sets of documents, calendars, people skills, outputs etc. that manifest the logistics and resources of an organization, and with knowledge of team and organizational goals and desired culture of achievement, fine-tuned generative AI systems could improve the holistic support of creative research practice by iteratively suggesting and adjusting time, space, and tool needs. Such systems would also learn from individual, team, and organizational work

over time, using this to suggest changes to practices and potentially also design and test new features for existing tools or wholly new tools, bespoke, to fit the time and space needs of research creativity.

6 CONCLUSION

To study how decisions around hybrid working schedules affect the creativity of researchers, we interviewed twenty-four participants involved in research across multiple research institutions and countries, with a range of hybrid working experience and styles. We found that the key contributors to research creativity are focus time, active rest, a diverse information diet, tools for externalising ideas, motivation and autonomy, and problem-oriented discussions with other researchers.

We found that enforced schedules for office presence antagonise research creativity because effective working cadences vary widely, and enforced schedules hinder researchers’ ability to respond to emergent work and personal needs. We found that the common arguments for serendipitous encounters (‘watercooler’ or ‘hallway’ conversations) largely do not apply to researchers, as these encounters are not cited as a driver of creativity. The same is true of ‘brainstorms’, often cited as a reason for enforcing physical co-presence, but which do not drive researcher creativity. Conversely, when researchers are forced to adhere to office presence schedules, ostensibly to improve creativity through serendipity and brainstorming, this can backfire and have the opposite effect due to the attendant loss of access to *real* drivers of creativity.

Modern organizational culture is obsessed with collaboration, which can mistakenly translate into the inclusion of every stakeholder in every activity. This can seriously hinder research productivity, in part through what Newport describes as ‘solitude deprivation’ [64]. What we have found is that collaboration isn’t about being together. Time apart makes us better collaborators; time apart makes us more creative together. Time, as our most precious resource, should not be wasted on a single bet of fixed or permanent co-location – it must be used intentionally to foster the multiple conditions of creativity.

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