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TEMPORAL STRUCTURE AND FLEXIBILITY

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ABSTRACT

Autonomy in work organisation and temporal flexibility are viewed as two major advantages of remote work and distance learning. However, in the field of telecommuting, temporal flexibility may be restricted by organizational or social constraints. Moreover, flexibility is usually indirectly and subjectively measured. This paper proposes an objective and replicable technique to measure scheduling and the temporal flexibility of tasks. Twelve teleworkers participated in a study using this technique. Results showed that telecommuting leads to a lengthening of predicted work duration relative to legal work duration. Temporal flexibility was not very high and varied according to tasks. The less flexible tasks were scheduled first by teleworkers and served as anchors around which they scheduled their other activities. Finally, the scheduling technique presented here may also be useful for studying temporal factors in distance learning.

KEYWORDS

Time flexibility; Measurement technique; Scheduling; Telecommuting; Temporal structure.

INTRODUCTION

The development of distance learning using new communication technologies presents multiple advantages for students. Students view temporal flexibility as a major factor for choosing this kind of learning (Romero, 2010). With distance learning, students feel it may be easier to accommodate the various need of work, family and study. A parallel can be made with telecommuting. Although presented as a new way of working that is advantageous both to companies and employees, the reality of distance working is quite the opposite. While workers reported a positive feeling about perceived autonomy and job satisfaction, for example (Gajendran & Harrison, 2007), finding an appropriate balance between different life domains was neither easy nor instantaneous (Metzger & Cléach, 2004). In this paper, we will focus on the temporal dimension of remote working. A major problem with previous research on telecommuting lies in the methodologies chosen to study those situations (Steward, 2000). For the most part, these studies have used questionnaires or interviews in which subjects give their subjective impressions. An objective and replicable method is lacking, especially for measuring temporal flexibility. This paper proposes such a method, inspired by scheduling models taken from work on Artificial Intelligence. After defining the temporal characteristics and requirements of remote working, we will review the main results of studies on time management in telecommuting. Then we will present a study that uses a replicable technique to accurately measure temporal flexibility. After discussing the main results, we will examine how this technique may also be useful in the domain of online learning.

Telecommuting, like online learning, implies distance from the place where the result of the work is expected (organization or academic centre). For telecommuting, depending on the employee's contract, the duration of distance work may vary from 1 or 2 days per week to 100% of work time. In all cases, working outside the company implies greater autonomy in the management of work time. According to Macan (1994), time management requires three important factors:

1) Setting goals and priorities,

2) Making lists, planning, scheduling ("mechanics of time management"),

3) Preference for organization.

In fact, distance learning or working requires not only that an employee manage his or her own working time, but also that they coordinate with others' schedules. The idea of being able to communicate with each other at any time and in any place may raise problems not only for personal time but also for compatibility with others' time. When the work is done from home, which is not always the case for teleworkers but certainly more frequent for online learning, another constraint is the family's schedule (children, spouse). Temporal flexibility, viewed as a major advantage in remote working, is in fact limited by organizational and social constraints (Konradt, Schmook & Maleke, 2000). Moreover, there is often a gap between stated and real flexibility (Steward, 2000). Teleworkers feel privileged because of their situation, so they count work hours differently: they do not count short breaks or their overtime. In fact, more than flexibility, the reality of teleworking is often a

significant extension of work duration (Metzger & Cléach, 2004). Another source of the difference between real and perceived flexibility may be linked to a confusion about terminology. Often, temporal flexibility is confused with reactivity. Teleworkers generally appreciate being able to react to unforeseen events or emergencies, which is obviously reactivity. Temporal flexibility is a priori associated with fewer temporal constraints, but as will be seen later, this lightening or even removal of constraints is not usually associated with success in teleworking. Lastly, as already mentioned, flexibility is most often measured subjectively, and this may lead to various interpretations. On the whole, remote working generally leads to greater autonomy in time management and more temporal flexibility. However, there are organizational and social constraints that may reduce this flexibility, and there are also differences between 'objective' and perceived flexibility, which raises the question of how teleworkers manage their time.

Teleworkers are a very heterogeneous population. Although it is difficult to establish a precise definition, a teleworker may be considered to be an employee who works outside of his or her firm relatively regularly and during a variable period of time. Contact with the firm and colleagues is made through telecommunication (email, phone, internet, etc.) (Metzger & Cléach, 2004). Some teleworkers are volunteer for this kind of work, but it is not always the case. The experience is generally less positive when this option is forced on the employee.

The temporal distribution of work in these situations is generally fragmented. Teleworkers report frequent interruptions for doing domestic tasks like the laundry or cleaning (e.g. Tietze & Musson, 2002). Those little breaks are not seen as problematic because the perceived flexibility enables them to complete the work at other times. Consequently, as already mentioned, the counting of work time is very different for telecommuters. Usually, they do not count short breaks or meals, but neither do they count overtime. The duration of work for a day is often much longer than a traditional day of work (Metzger & Cléach, 2004; Steward, 2000). This perceived flexibility in fact leads to a lengthening of the working period, especially in the evenings and on weekends. The main difficulties mentioned with telecommuting are social isolation and overlapping of work and family spheres (Konradt, et al., 2000; Steward, 2000). However, a meta-analytic review of 46 studies (Gajendran & Harrison, 2007) showed that telecommuting had small but beneficial effects on work-family conflicts: a negative correlation appeared between telecommuting and work-family conflict. Despite the fragmentation of work, teleworkers perceive working from home as being very effective (Tietze & Musson, 2002). Their engagement in work is intensive because of the absence of interruptions which are frequent in the traditional office. In fact, interruptions may be accepted if they can be controlled by the worker and do not come from others in an unexpected manner. Teleworkers have the feeling that they do more work in less time. The decision of how to use this "extra-time" differs depending on the person. Some teleworkers feel obliged to invest this time in more work (this is compatible with the extension of work duration). The conditions for success with teleworking appear to relate less to the elimination of temporal constraints and more to a modification of them. Boundaries and constraints are necessary for working successfully at home. In the study by Tietze and Musson (2002), respondents to the interviews said that they had self-discipline and routine behaviours associated with the beginning and ending of work. A temporal structure is a necessity to succeed in the

management of work time, even though the boundaries may be blurred. Steward (2000) found three organization modes for teleworking:

1) Conservation of a traditional practice from 9 am to 5 pm for example ;

2) Working out of phase, without temporal structure: working all day or through the night; and

3) Establishing a new temporal structure allowing the integration of the different life domains (work, family, leisure).

The second mode of telecommuting often leads to failure. The first may cause tensions with family life, while the third is the most efficient but would appear to be less easy to put into practice (cf. Metzger & Cléach, 2004).

Almost all studies about telecommuting have used interviews and questionnaires about the lived experience of teleworking. Participants explained their usual organization a posteriori after the work had been done. While there may be autonomy in time management, it may be important to have information about the planning and scheduling of tasks (cf. Macan, 1994). Given the prominence of maintaining a temporal structure for the success of telework, it is important to analyze whether temporal flexibility actually occurs in teleworking or whether it is merely a perception of workers. Here we present a technique that may provide information about those two points. This 'temporal constraints scheduling technique'[1] (TCST) (Valax, 1998) was used with twelve teleworkers.

METHODOLOGY

PARTICIPANTS

Twelve teleworkers participated in the experiment. Seven of them practiced 'nomad' telecommuting, for example, working in several teleworking centers, in their firm, at customers' workplaces, or at home. Five of them practiced 'pendular' telecommuting - that is, working between the firm and a teleworking center. The first mode of telecommuting may be considered as full-time telecommuting whereas the second is more occasional. All the participants worked in the field of Information and Communication Technologies.

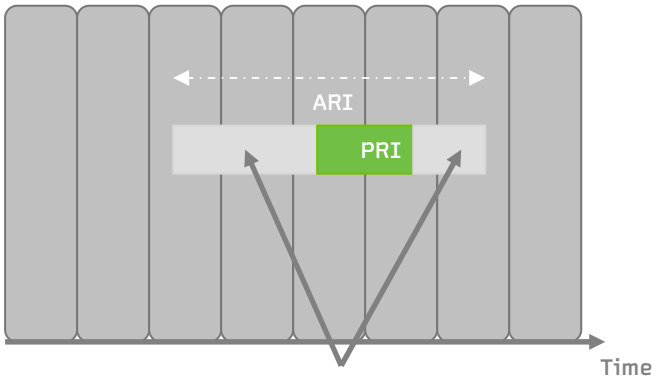
MATERIAL

We used the TCST which consisted of presenting a time scale to the participants. They had to schedule a particular task. The participant had to graphically represent a given task by two interlocked intervals . See figure 1:

A) An Admissible Realization Interval (ARI), symbolizing the distance between the earliest start date and the latest possible end date of the task. The ARI thus represents the different possible places they could locate this task on the scale.

B) A Probable Realization Interval (PRI), representing the most probable position on the time scale and the estimated duration of the task.

Figure 1. Temporal Constraints Scheduling Technique (TCST): graphical representation of the Admissible Realization Interval (ARI) and the Probable Realization Interval (PRI) for a given task.



The difference between ARI and PRI represents the flexibility of the task.

PROCEDURE

Before gathering the schedules of tasks, we needed first to define the tasks done by the participants. Semi-directive interviews enabled us to define the main tasks. Nine tasks were taken into consideration and categorized into three types:

1) Production tasks (leading to invoicing) including writing (W) notes or files for the client, services carried out on behalf of the clients (S), and appointments (AP) with clients;

2) Maintenance tasks (necessary for production tasks) including using Mediated Information and Communication (MIC): emails, Internet searches, meetings (M) with colleagues or superiors, administrative (Adm) tasks, auto-training (AT) with technology;

3) Peripheral tasks like travelling (Tv) or lunch (L).

After defining the tasks, participants had to schedule each of the nine tasks for future days. They were given a graph with a horizontal time axis, divided into hours, and a vertical axis where they defined tasks to be carried out (among the nine that were present on the top of the graph). They had to schedule the tasks on this daily graph, determining the ARI and the PRI for each task. A neutral example was presented first. In total, the schedules of 27 days were analyzed (13 for 'nomad' and 14 for 'pendular'). Data was collected in the telework centers.

To characterize the temporal requirements of the tasks, we also asked participants to evaluate each task on a scale of one to five based on three aspects:

1) To what point the task requires the participation of other people (e.g., meetings),

2) To what extent the task is divisible into smaller segments that can be done at different times (i.e., responding to emails),

3) To what extent the task can be interrupted and taken up again later without much difficulty (i.e., reading emails as opposed to reading a report).

RESULTS AND DISCUSSION

We will first present the average duration of tasks for a day, then the temporal requirements estimated by subjects for each task, and, lastly, the flexibility of the tasks.

The task durations are represented by the PRIs. The sum of those durations for a medium day is equal to 11h30mn. Medium duration was lower for 'nomad' (10h05) than for 'pendular' (12h47) telecommuting. The majority of the time was devoted to production and maintenance tasks (79.7%). The PRI duration for each task was analyzed according to the type of task and the kind of telecommuting (nomad vs pendular). The only aspect that had a significant effect on PRI duration ($F(2,179) = 29.15$, $p<.0001$) was the type of task involved. Production tasks took the longest amount of time, followed by maintenance, followed by peripheral tasks. The type of telecommuting had no effect on PRI duration ($F(2,179) = 2$, NS), nor did the interaction between task and telecommuting ($F(2,179) = 0.42$, NS).

Participants had to rate the tasks from one (not much) to five (very much) according to the three aspects of temporal requirements mentioned previously: the 'collective nature,' 'divisibility,' and 'interruptibility.' As can be seen in table 1, the temporal requirements varied according to the task.

Table 1. Average estimation (five-point scale) of temporal requirements of tasks based on three dimensions: collective, divisible, interruptible. (W = Writing, S = Services, AP = Appointment, MIC = Mediated information and Communication, M = Meeting, Adm = Administration, AT = Auto-training, Tv = Travelling, L = Lunch).

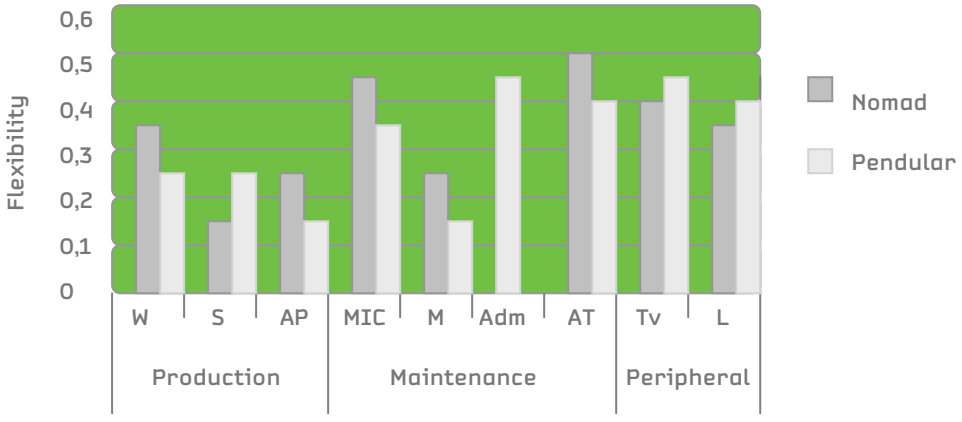
Tasks	Temporal Requirement		
	'Collective'	'Divisible'	'Interruptible'
Production			
W	1,7	**4**	**4**
S	3,6	2,9	3,3
AP	**5**	1,4	1,5
Maintenance			
MIC	2,1	**4**	**4,1**
M	**5**	2	1,7
Adm	3	3,7	3,6
AT	1	3	**4,5**
Peripheral			
Tv	1	1	1,4
L	**4,6**	1,3	1,5

The collective dimension refers to appointments, meetings and lunches. The participants rated appointments, meetings and lunches as the most 'collective' of the temporal requirements, while writing, self-training and travel were rated the least collective.

The less collective tasks were writing, self-training and travel. The 'divisible' dimension concerns writing, using mediated information and communication. The less divisible tasks were peripheral ones (travelling and lunch). The 'interruptible' dimension characterizes the same kind of tasks as the 'divisible' ones, with self-training in more. Tasks most difficult to suspend were appointments, meetings and peripheral tasks.

Temporal flexibility of tasks is represented by the ratio between the PRI (Probable Realization Interval) duration and the ARI (Admissible Realization Interval) duration. Flexibility (Fx) for each task unit was calculated using the formula: Fx = 1-(PRI-ARI). When Fx = 0, PRI = ARI, flexibility is minimal, when Fx = 1, PRI = 0, flexibility is maximal. As previously stated, variance analysis showed only a significant effect of the type of tasks on flexibility ($F(2,179) = 11$, $p<.0001$). The type of telework ($F(1,179) = 0.12$, NS) and the interaction ($F(2,179) = 1.78$, NS) had no effect. Average flexibility is equal to 0.35, which is rather low. Production tasks are less flexible (0.24) compared to maintenance (0.36) and peripheral tasks (0.42). Figure 2 shows some differences between the two types of teleworking.

Figure 2. Average flexibility according to tasks (W = Writing, S = Services, AP = Appointment, MIC = Mediated information and Communication, M = Meeting, Adm = Administration, AT = Auto-training, Tv = Travelling, L = Lunch) and type of telework (Nomad, Pendular).



In addition, the most flexible tasks are MIC (Mediated Information and Communication), administration, self-training and the two peripheral tasks: travelling and lunch. The least flexible ones were services carried out of behalf of clients, appointments, and meetings.

The purpose of this study was to test an 'objective' technique for analyzing time management of telecommuters who, at first glance, seem to have considerable autonomy in organizing their work. We wanted to see how participants actually planned their work tasks and whether there was a real temporal

flexibility in their planning. After discussing these points, we will examine what this study can contribute to research on temporal factors in online learning.

We compared two types of telecommuting: nomad (full-time teleworkers in several locations) and pendular (occasional teleworkers in two different locations). There was very little difference between these two kinds of teleworkers. The average duration of the projected work time exceeds the legal duration (10h36 instead of 7h00), and this is compatible with previous studies (Metzger & Cléach, 2004 ; Steward, 2000). Thus, it seems clear that telecommuting leads to an extensive period of work. Temporal flexibility of tasks is generally limited; however, some tasks present more flexibility than others.

Another interesting result emerged from participants' explanations. During the scheduling phase, participants were encouraged to explain what they were doing. An analysis of their explanations revealed that a number of rules governed their creation of schedules. One of these rules was to first schedule the less flexible tasks (like services for clients, appointments and meetings) and then, in a second phase, to locate the remaining tasks in the available time intervals. This kind of strategy shows the importance of having a temporal structure. Indeed, in a study on the planning of daily tasks, Valax (1986) showed that the temporal structures constructed and used by a population of farmers are characterized by pivotal tasks which had a fixed duration and location. These tasks, which provided the overall structure for the plan, served as temporal markers for the scheduling of other tasks. In various domains, like the dating of memories (e.g. Friedman, 1993), or dynamic environment management (Carreras, Valax, & Cellier, 1999), temporal frames structured by reference points have shown their usefulness in temporal management. Moreover, sociologists claim that behaviour based on routines (structured and regular patterns) is of primary importance to develop a sense of self and identity (Tietze & Musson, 2002).

Considering the link between flexibility and tasks, our results showed that the least flexible tasks were generally the ones that had the most spatial and temporal requirements (like the collective tasks). In addition, these least-flexible tasks were also the ones that were most central to the actual nature of the job itself (i.e., production tasks as opposed to emails or lunches). The more the participants considered the tasks to be flexible, the more they also considered them to be divisible and interruptible. It seems clear that the cognitive requirements of tasks need to be taken into account in planning when and where they will be carried out. The fragmented character of work at home mentioned in the introduction may be valid for some specific tasks but is not applicable to all tasks.

The results of this study offer arguments that support Steward's hypothesis (2000) that flexibility is more a "feeling" that teleworkers have than an objective reality of the situation. However, our study is based on a relatively small sample and further research is needed before firmly establishing our conclusions. Nevertheless, the technique presented here may be a useful tool for comparing different studies.

CONCLUSION AND IMPLICATIONS FOR A PRACTICE

Telecommuting and online learning share common characteristics, such as the autonomy of work organization, the need to communicate with others (whether peers or instructors), and sometimes the need to work with other people at the same moment (synchronicity). The question about the optimum timing for scheduling discussions or feedback for effective learning are better answered in the literature on education than in the literature on time psychology. Indeed, we are mostly interested in this case in time as a dependent variable rather than an independent one; we study more how people perceive, manage or represent time than how time impacts on other activities. The psychological research on time may help studies about online learning in providing methods for measuring temporal factors. The TCST presented here allows researchers to studying planning, scheduling, and flexibility, and it can also be used to compare the predicted and actual accomplishment of tasks. These results on flexibility have two important consequences for online learning. The first concerns the low flexibility that was observed. As a large percentage of online learners already have busy schedules (work, family, etc.), the temporal flexibility offered by online learning may only result in an increased workload for these students. The second important result relates to the link between flexibility and the cognitive requirements of tasks. To be able to plan tasks relative to learning, people have to set goals and priorities (cf. Macan, 1994), to break these down into subtasks and then to schedule these subtasks. This scheduling needs to take into account task requirements, and especially whether the task is divisible or interruptible. In fact, some tasks with a high cognitive requirement (such as writing a paper) may be difficult to suspend and easily disrupted by interruptions. These kinds of tasks are not very flexible and because of this, they need to be scheduled at specific times. Finally, the need for a temporal structure for successful teleworking may also be applied to online learning situations. In every case, "out of phase" learning prevents the student from exchanges with others. The question of sharing a temporal frame with others is difficult and has not yet been sufficiently studied (Romero, 2010). The need to coordinate and make a compromise between different temporal structures (work, home, study, other's planning...) remains a major difficulty. More research needs to be done on this collective aspect of time management to enhance the group activity in distance work and learning.

References

Carreras, O., Valax, M.-F., & Cellier, J.-M. (1999). Réduction de la complexité temporelle dans le contrôle d'un micro-monde dynamique. *Le Travail Humain, 62*(4), 327-346.

Friedman, W. J. (1993). Memory for the time of past events. *Psychological Bulletin, 113*(1), 44-66.

Gajendran, R. S., & Harrison, D.A. (2007). The Good, the Bad, and the Unknown About Telecommuting: Meta-Analysis of Psychological Mediators and Individual Consequences. *Journal of Applied Psychology, 92*(6), 1524-1541.

Konradt, U., Schmook, R. & Malecke, M. (2000). Impacts of telework on individuals, organizations and families – a critical review. *International Review of industrial and Organizational Psychology, 15*, 63-99.

Macan, T. H. (1994). Time management – test of a process model. *Journal of Applied Psychology, 79*(3), 381-391.

Metzger, J.-L., & Cléach, O. (2004). White-collar telework: Between an overload and learning a new organization of time. *Sociologie du travail, 46*, 433-450.

Romero, M. (2010). Gestion du temps dans les activités projet médiatisées à distance. Doctoral Dissertation, Toulouse, France.

Steward, B. (2000). Changing times – the meaning, measurement and use of time in teleworking. *Time & Society, 9*(1), 57-74.

Tietze, S., & Musson, G. (2002). When 'Work' Meets 'Home' – Temporal flexibility as lived experience. *Time & Society, 11*(2-3), 315-334.

Valax, M.-F. (1986). Cadre temporel et planification des tâches quotidiennes. Etude de la structure des plans journaliers chez les agriculteurs. *Le Travail Humain, 49*(4), 371-374.

Valax, M.-F. (1998). Technique de recueil de données pour l'étude de la position des tâches quotidiennes. *Le Travail Humain, 61*(2), 187-199.

Footnotes

[1]Technique d'ordonnancement par contraintes temporelles.