Workplace stress in real time: Three parsimonious scales for the experience sampling measurement of stressors and strain at work

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SUPPLEMENTARY MATERIAL S3: ESM protocol and scales

The supplemental material S3 includes a detailed description of the experience sampling methods (ESM) protocol used in the study, and the exact indication of items wording in Italian (presented via screenshots of the smartphone application used in the study) (Xiong et al., 2016), with English translations.

1. ESM protocol

The ESM protocol (Figure S3A) consisted of three non-consecutive workdays (i.e., Monday, Wednesday and Friday) during which participants received seven notifications per day, from 9:15 to 18:15. The first ESM questionnaire ('baseline' questionnaire: only including strain items) was scheduled at 9:15 and could be filled until 10:15, whereas the following questionnaires ('work' questionnaires, including both strain and stressors items) were scheduled from 10:30 to 18:15, each 80 to 100 min randomly determined, and the mobile application was set to accept data entries within 20 min from each notification, after which responses were considered as missing. Similar designs were used by previous ESM studies on workplace stress (e.g., Johnston et al., 2016). To minimize interruptions of work activity, participants were explicitly instructed to ignore the notifications when necessary (e.g., during a meeting), and especially if they were not at work (e.g., during lunch break).

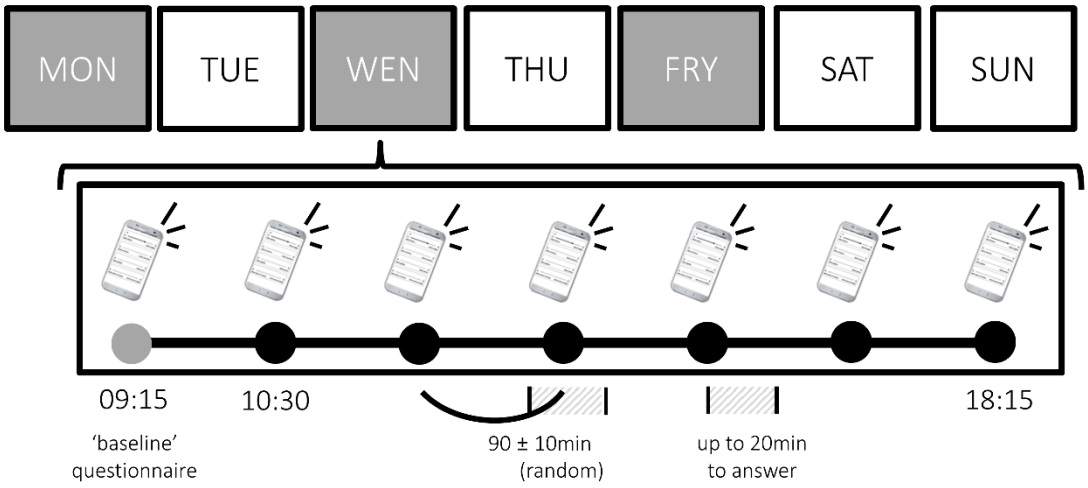

Figure S3A. Experience sampling protocol at the week (upper panel) and day level (lower panel). Black dots in the lower panel indicate the six scheduled 'work' questionnaires, following the 'baseline' questionnaire (gray dot).

2. ESM scales

The figures below show the screenshots and the English translation of the ESM form used in our study, including the items and response format of the Italian adaptation of the Multidimensional Mood Questionnaire (MDMQ) (Figure S3B), the work sampling measures (Figures S3C, S3D) the Task Demand Scale (TDS) (Figure S3E), and the Task Control Scale (TCS) (Figure S3F). The scales are presented following the exact order by which they were administered to participants in the 'work' questionnaires.

2.1. Momentary strain

The Italian adaptation of the MDMQ (Figure S3B) was included in both the 'baseline' and the 'work' questionnaires, and always presented at the beginning. The MDMQ was back-translated in Italian, thanks to the help of two bilinguals. Following the suggestion of Peter Wilhelm, we integrated the original items with three additional items (i.e., Negative Valence: "in a positive-negative state", Tense Arousal: "nervous-placid", Fatigue: "fatigued-rested").

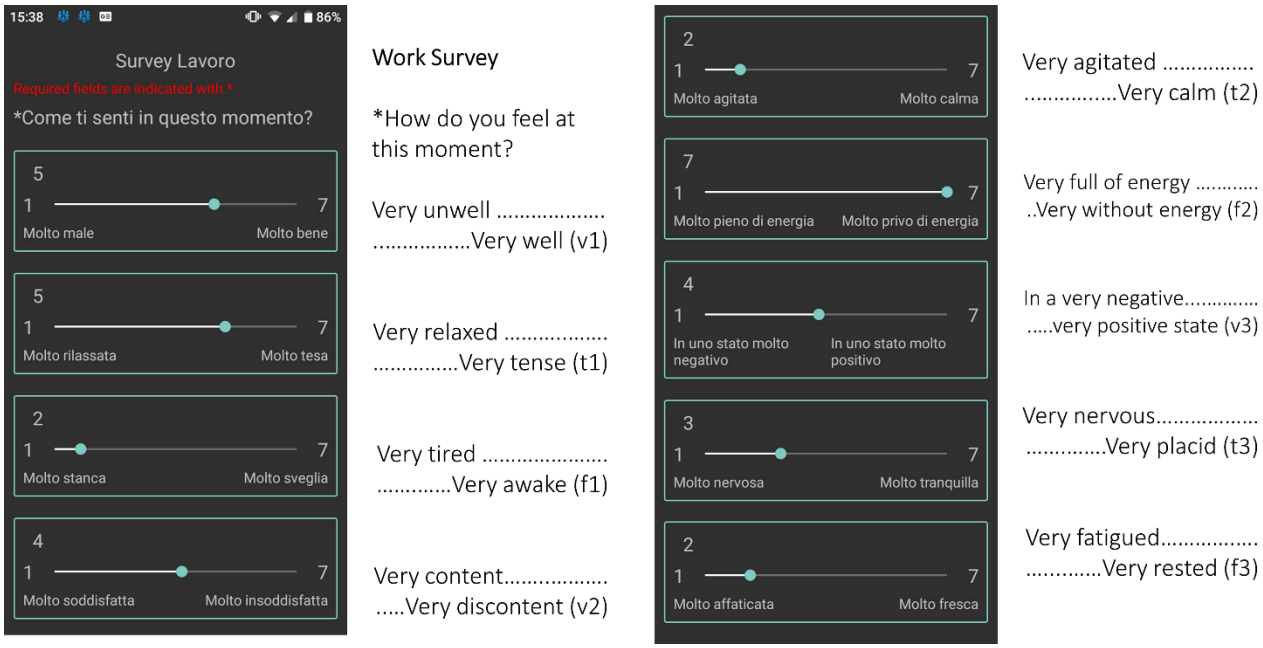

Figure S3B. Items measuring the three dimensions of the MDMQ (i.e., Negative Valence = v1, v2, v3; Tense Arousal = t1, t2, t3; Fatigue = f1, f2, f3) using a Slider/Likert mixed response format. Note that the scores of items v1, f1, t2, v3, t3, and f3 were reversed before data analysis, coherently with our operationalization of affective strain as negative mood.

2.2. Work sampling measures

Work sampling measures were used to capture relevant contextual concomitants of ESM ratings and, specifically, to simulate how the proposed set of scales could be potentially used to collect information associated with features of the last work task performed by the respondent. Work sampling measures were based on the multilevel work sampling categories proposed by Robinson (2009), very similar to Westbrook & Ampt (2009), including the type ('what') (Figure S3C) and mean of work ('how'), and the people involved in the task ('whom') (Figure S3D).

To define relatively exhaustive but mutually inclusive task categories (see Robinson, 2009), we focused on the typical activities involved in knowledge work, as defined by Kelloway and Barling (2000). According to the authors, and further expanded by Reinhardt et al (2011), knowledge work is characterized by predominantly mental activities, including (1) the

acquisition of existing knowledge through research and learning, (2) the packaging or teaching of knowledge, and (3) the application of existing knowledge to current problems. Compared to routine workers, knowledge workers are characterized by frequent problem-solving and creative thinking, increasing job demand, high degree of reciprocal interdependence (team working), autonomy (high job control), and work uncertainty (see also Benson & Brown, 2007). Knowledge work generally characterizes those professions associated with information technology and high-tech industry (e.g., engineers, software developers, telecommunication specialists), research (e.g., scientists and professors, R&D workers), financial and legal services (e.g., accountants, lawyers), and other highly qualified positions (e.g., physicians and psychologists).

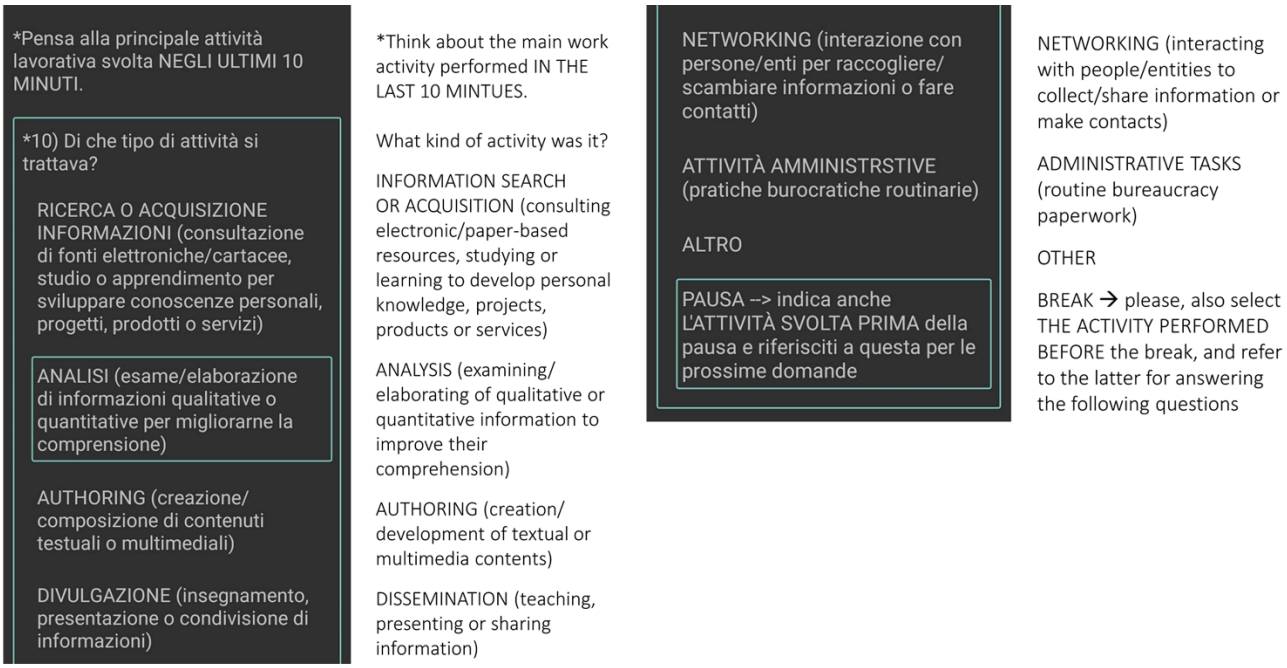

Figure S3C. Work sampling item measuring the type of work activity ('what') using a multiple-choice response format (multiple options could be selected).

Response categories indexing the 'how' and 'whom' categories (Figure S3D) were identical to those proposed by (Robinson, 2009) for design engineers.

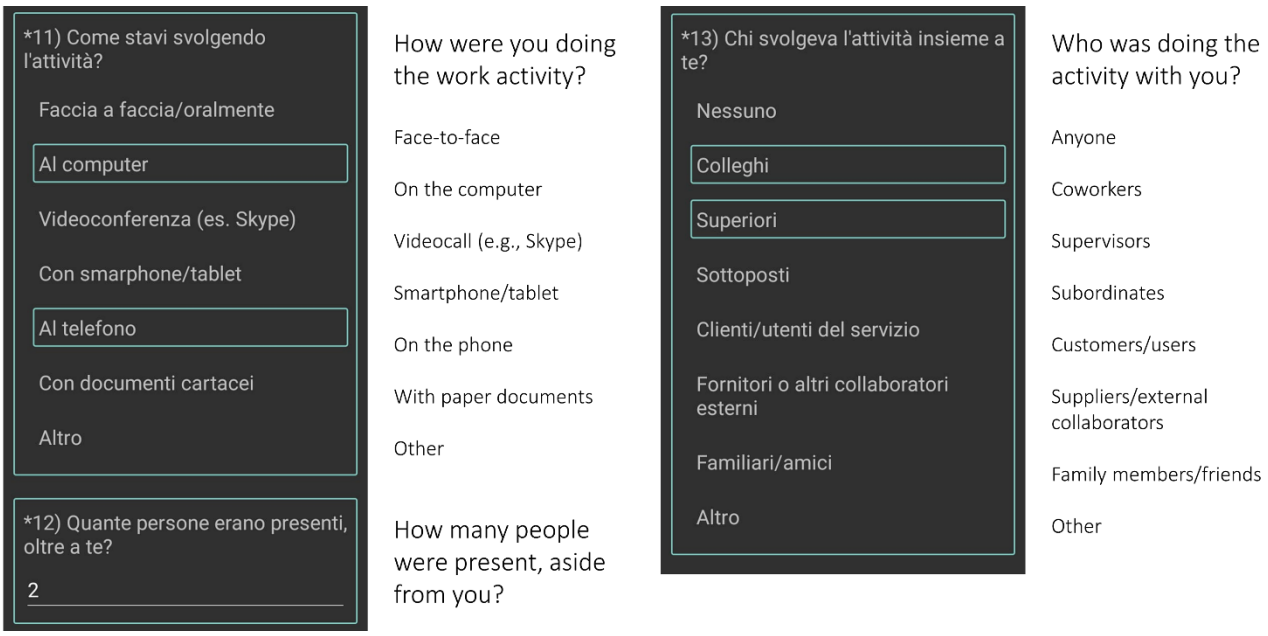

Figure S3D. Work sampling items measuring the mean of work ('how'), the number of people present (not used in our study), and people involved ('whom'). 'How' and 'whom' categories were rated using a multiple-choice response format (multiple options could be selected). Item 12 was not considered in the present work.

2.3. Momentary stressors

Momentary stressor scales were adapted from existing retrospective scales, and situational measures indexing a parsimonious number of stressors that were found to be highly relevant for, and common to, several occupations.

2.2.1. Task Demand Scale

The *Task Demand Scale* (TDS) (Figure S3E) was developed by adapting three items from the Quantitative Workload Inventory (Spector & Jex, 1998), validated in Italian by Barbaranelli, Fida, & Gualandri (2013), and shared by the Job Content Questionnaire: "do too much", "work

fast", and "work very hard". A fourth item ("doing multiple things at once") was included to account for the multi-tasking component of Task Demand, whose manipulation was found consistently associated with higher mental demand and physiological activation (see Wetherell & Carter, 2014).

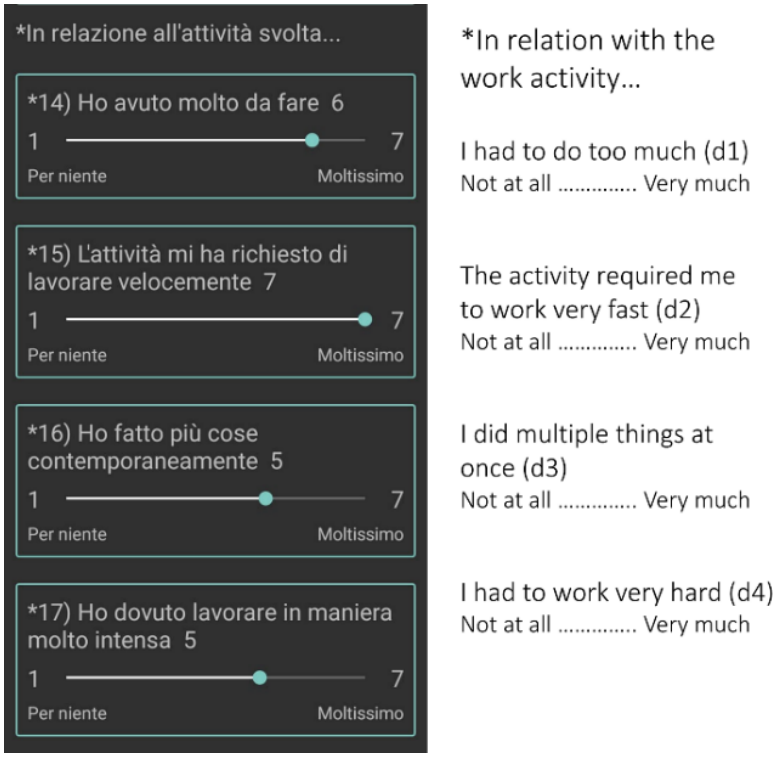

Figure S3E. Items included in the Task Demand Scale (TDS) using a Slider/Likert mixed response format.

2.2.2. Task Control Scale

The Task Control Scale (TCS) (Figure S3F) consisted of two items from Kamarck et al. (1998)'s Diary for Ambulatory Behavioral States (DABS), and an additional item from the Instrument for Stress-oriented Task Analysis (ISTA) by Semmer, Zapf and Dunckel (1995) (i.e., "could decide how this task was performed"), similar to that used for measuring Task Autonomy by Hofmans, Gelens and Theuns (2014).

Figure S3F. Items included in the Task Control Scale (TCS) using a Slider/Likert mixed response format.

2.2.3. Situational Constraints Inventory

The *Situational Constraints Inventory* (SCI) (Figure S3G) was developed and included as well, but not considered in the present study. The SCI was adapted from the Organizational Constraints Scale (Spector & Jex, 1998), validated in Italian by Barbaranelli et al (2013), by selecting the most prevalent items from (Pindek et al., 2019): "interruptions", "inadequate help from others", "organizational rules and procedures", and "poor equipment or supplies", "your supervisor", and "inadequate training". To reduce the length of data entry, and to account for the possibility that some constraints could be virtually absent in some cases (e.g., "your supervisor" when the respondent *is* the supervisor), the SCI was implemented as a multiple-choice question, in which respondents were asked to select one or more constraints (including "none of these conditions") among those listed above. A checklist response format (instead of a set of Likert scales as in the original Organizational Constraints Scale) was regarded as coherent with the conceptualization of the SCI as a formative indicator (Spector & Jex, 1998).

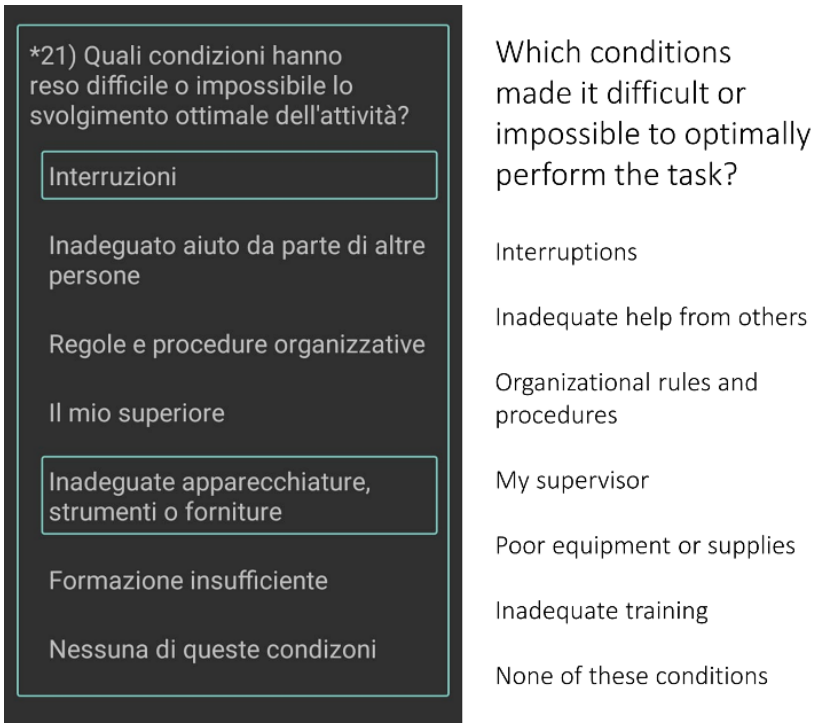

Figure S3G. Situational Constraints Indicator (SCI) using a multiple-choice response format (multiple options could be selected).

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