5
ACTION REGULATION THEORY

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1 Background

The Hawthorne experiments (Roethlisberger & Dickson, 1939) are a milestone in social science.[2] The investigators set out to understand the effects of illumination on workers' performance. A group of selected employees moved to a specially prepared space and worked under varying lighting conditions. The results were surprising: regardless of the direction and magnitude of change in lighting, the work output of the employees increased. These results led to a seminal series of studies concerning the relationships between employers and employees. The investigators realised that the special experimental setup and effects of the social situation, such as informal relationships between employees and investigators, were crucial for the understanding of the results. The focus of the investigations thus was shifted from the work environment to the social relations. It was concluded that the physical environment at work was relatively unimportant regarding workers' performance.

This conclusion, however, is based on the oversimplified assumption that there is a direct cause-and-effect relationship between physical conditions and human behaviour. Because workers' output was not improved by changes in lighting levels but by social relations, the investigators assumed that light levels were irrelevant to performance. Psychologists now know that there are complex cognitive processes that mediate the effects of physical conditions on human behaviour (Frese & Zapf, 1994; McGrath, 1976; Miller, Galanter, & Pribram, 1960).

Action theory is concerned with the processes that intervene between environmental input and behaviour: the regulatory functions of cognition (Frese & Zapf, 1994). Human action is regarded as regulated by goals in a cybernetic control loop (Miller et al., 1960). A general model of human action can be described as an action cycle that consists of the following steps (Frese & Zapf, 1994; Norman, 2013):

- perception of the environment,
- interpretation,
- appraisal and goal development,
- plan generation,
- decision, and
- execution and monitoring of the plan.

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In its more general formulation this approach assumes causal relations between the environment and individual reactions (see Figure 5.1). It assumes that individuals react to features of the environment perceptually, affectively, and behaviourally. The three components of this model form the basis of much applied research in industrial and organisational psychology (e.g. Spector, 1992) and environmental psychology (e.g. Bell, Greene, Fisher, & Baum, 2001). Outcomes in this model may consist of behaviour (e.g. performance), attitudes (e.g. satisfaction), cognitive results (e.g. learning), or emotional reactions (e.g. mood). There is considerable evidence for this general causal chain (Spector, 1992).

A more detailed account of the effects of the work environment on work activities and worker's experience based on the action cycle (as described earlier) is provided by the action regulation theory.

1.1 Basic principles of the action regulation theory

Action regulation theory has a long history in German work and organisational psychology (Hacker, 1998; Volpert, 1982, 2003). The basic tenet of this theoretical approach is that work is goal directed. Action regulation theory emphasises the cognitive regulation of actions. It "relates remarkably well to current cognitive models of human activity" (Roe, 1999, p. 238) and integrates several theoretical approaches.

Action regulation theory allows the independent definition of demands (regulation requirements), resources (regulation possibilities), workload factors (regulation problems), and health (Ducki, 2000). Furthermore, action regulation theory focuses on the interplay between the objective world and subjective reactions and experience. For these reasons, action regulation theory is considered as particularly well suited for the analysis of human-environment interactions.

Additionally, human activity is considered as integrated in physical environments and societal contexts since individuals regulate their actions based on information they receive from the environment and modify their environment through action. Despite this consideration of context, physical environments and conditions of action are hardly addressed from the perspective of action regulation theory. As an explanatory framework it is useful, because action regulation theory addresses principally all forms of environmental demands. Research and application related to this theory, however, have mainly focused on the design of work tasks and learning (Hacker, 2003), work and stress (Frese & Zapf, 1994), proactive work behaviour, and entrepreneurship (Zacher & Frese, 2018).

In this chapter, the focus will be on the basic elements of the theory as they relate to the work environment.

1.2 The hierarchical-sequential model of action regulation

Miller et al. (1960) introduced the concept of cybernetic regulation in action psychology and developed a model that forms the basis of current action regulation theories, such as the German action regulation theory (Frese & Zapf, 1994). According to Miller et al. (1960), an actor

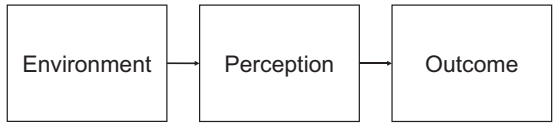

Figure 5.1 Traditional model of individual responses to organisational conditions (Morgeson & Campion, 2003; Spector, 1992)

compares situations or stimuli with expectation parameters or plans. In the case of incongruence, he tries to reach congruence through action. He then compares the new situation with his plans and decides whether new action is needed in order to produce congruence. Such comparison processes are modelled as cybernetic TOTE (test-operate-test-exit) units (Figure 5.2, left) that can be nested hierarchically (Figure 5.2, right). The cybernetic theory of action regulation models the translation of goals into plans, and the execution of plans through action and feedback.

On the basis of the cybernetic theory of action regulation, the hierarchical-sequential model of action regulation was proposed by German work psychologists (Frese & Zapf, 1994; Hacker, 1998; Volpert, 1982). It is based on the assumption that human activity can be characterised as goal-oriented and conscious. Action is oriented towards a mentally anticipated result and deliberately regulated towards this goal.

The hierarchical-sequential model of action regulation describes action from a process and a structural point of view. The process component focuses on the sequential aspects of action and the structural component refers to its hierarchical organisation.

The core unit of action regulation is a cyclical unit comparable to the TOTE units developed by Miller et al. (1960): As a function of goal setting, series of transformations of the environment are produced. In work contexts, goals are defined by work tasks (as they are understood and interpreted by the worker). The sequence of transformations is defined through a preliminary run before performance (i.e. the execution of a series of transformations) begins; the transformations are queued to be worked through (Volpert, 1982). Then feedback takes place and the degree of goal attainment is examined. If differences remain, transformations are repeated and adapted, or the goal is modified.

Figure 5.3 shows Volpert's (1982) model of the cyclical unit. The descending arrow and the straight arrows from left to right show the generating process of transformations (based on goal

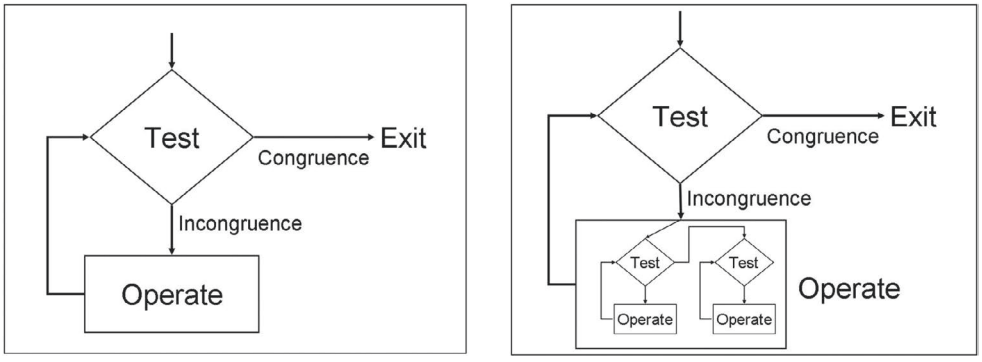

Figure 5.2 Basic test-operate-test-exit (TOTE) unit (left) and hierarchical structure of TOTE units (right) (Miller et al., 1960)

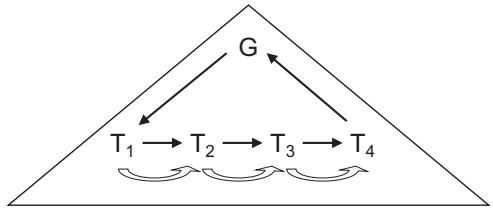

Figure 5.3 The cyclical unit (Volpert, 1982): goal is reached through a sequence of transformations

G transformations, T1 to T4 are generated). These transformations are sequentially worked through when the generating process is finished (curved arrows). After the last transformation is performed, feedback about goal attainment follows (ascending arrow). If the achieved state corresponds to the goal, the cyclical unit is completed.

Every cyclical unit is part of a system that is composed of multiple interlaced cyclical units. Complex action structures emerge when multiple cyclical units are connected in a hierarchical order (see Figure 5.4). On the lowest level, base units represent directly performable operations, and on the highest level a peak unit represents a hypothetical general goal. In principle the number of levels and the number of transformations is arbitrary, but there are psychologically substantiated reasons to assume only three levels (Frese & Zapf, 1994; Hacker, 1998): (1) a level of stereotyped and automated movement sequences which are executed without conscious attention (as long as they remain undisturbed by external circumstances); (2) a level of flexible action patterns where execution happens by means of operation sequences learned before, guided by perception of signals that have been learned before; and (3) an intellectual level, where situations are analysed, and action sequences planned. Actions concerned with problem-solving are regulated on this level in the form of analysis of goals and environmental conditions, decision-making, and planning. Regulation on this level is laborious and resource limited. It works in a serial mode, and feedback is interpreted step by step (Frese & Zapf, 1994). Regulation on the intellectual level is necessarily conscious.

The hierarchical-sequential model of action regulation can be described as a model of interlaced cyclical units: a cyclical unit can be the transformation part of a higher unit. Reversely, the transformation parts of a cyclical unit can be described in its structure as a cyclical unit. In a context of occupational activities, the starting point for actions is the work task (Hackman, 1969). With complex actions higher-order goals are formed and partial goals and sub-goals are derived. Thus, a hierarchical action plan in the form of goals and transformations develops. The execution of actions occurs sequentially in the form of operations that change the environment. Goal attainment is fed back to the next higher level. The sub-goals are worked through in a sequential order (Figure 5.4).

In the action process initially only a rough planning of partial goals takes place (Frese & Zapf, 1994). The generation of more detailed subunits occurs successively. This implies that disturbances can be corrected on the level where they occur and thus do not necessarily negatively impact higher-order goals. Therefore, unexpected environmental changes or errors in planning

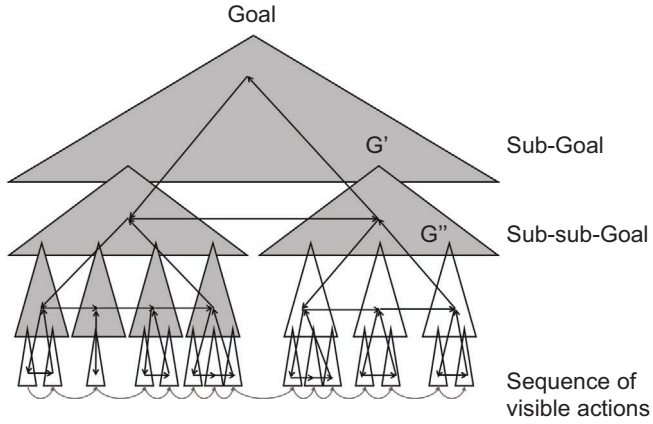

Figure 5.4 The hierarchical-sequential organisation of action (Frese & Zapf, 1994; Volpert, 1982)

or execution of transformations do not lead to disruptions of the pursuit of a higher-level goal but to modifications or repetitions of lower-level cyclical units. Thus, the model of hierarchical-sequential organisation regulation allows the explanation of stable long-term goal-oriented and at the same time flexible actions.

1.3 Regulation requirements and regulation possibilities

Dealing with simultaneous multifactorial requirements in work contexts, workers must decide how they want and can deal with these requirements in order to work effectively and efficiently. The regulation requirements are related to properties of the hierarchical-sequential organisation of action (Frese & Zapf, 1994). The main regulation requirement is complexity. Complexity describes a set of decision necessities. Tasks and goals with a high complexity require a high degree of regulation. Complexity is understood as an interactive term and refers to a person's skills in relation to the necessities of the situation (Frese & Zapf, 1994). Decision necessities are based on the number of different goals, plans, and feedbacks that have to be regulated and organised in time and the nature and number of relationships within and between goals, plans, and feedback (Dörner & Schaub, 1994).

In contrast to industrial regulation, in human actors often multiple goals are active simultaneously (Hockey, 2000). Switching between goals during a workday is thus a characteristic feature of human action. However, in order to attain important goals, this flexibility has to be regulated by maintaining goals as anticipated future states in the feedback process and to adapt behaviour according to the differences of the feedback process.

Goal-oriented behaviour always implies the overcoming of the natural tendency to switch to other goals (Hockey, 2000). This process implies regulation costs (i.e. regulation efforts). The maintenance of performance under unfavourable conditions is connected with extra regulation because the effort to reduce differences of the feedback process increases (greater difference or more difference) and the distraction through multiple goals has to be tackled. A constant effectiveness of action can be accompanied by reduced cognitive and emotional efficiency. Unfavourable conditions do not normally influence the effectiveness of actions, but efficiency deteriorates because unfavourable conditions require compensatory control (Hockey, 1997). Compensatory control is a performance protection strategy – an adaptive regulation process that supports goals with high priority at the expense of goals with lower priorities. Compensatory control is a response to external threats (e.g. stressors) by increasing effort and concentrating more on goals considered important. The cost of this regulation may be decrements in non-focal aspects of tasks and a neglect of personal needs and other goals.

Control describes the possibilities available for an actor to have an impact on the conditions and on his/her own activities in relation to the goals (Ganster & Fusilier, 1989). In contrast to complexity as a set of decision necessities, control describes a set of decision possibilities (i.e. a resource).

Classes of regulation problems can be distinguished which act as stressors because they disturb the regulation of action (Frese & Zapf, 1994; Greiner & Leitner, 1989) (see Figure 5.5). They can be subdivided into regulation obstacles, regulation uncertainty, and overtaxing regulation (Frese & Zapf, 1994). Regulation obstacles or barriers directly influence action regulation and require short-term reactions. Regulation overtaxing in contrast is related to continuous conditions that reduce mental and physical performance over longer periods (e.g. the workday) (Greiner & Leitner, 1989).

Regulation obstacles are conditions that hinder the accomplishment of work results because they make it harder or impossible to pursue a goal and to regulate an action. Regulation obstacles

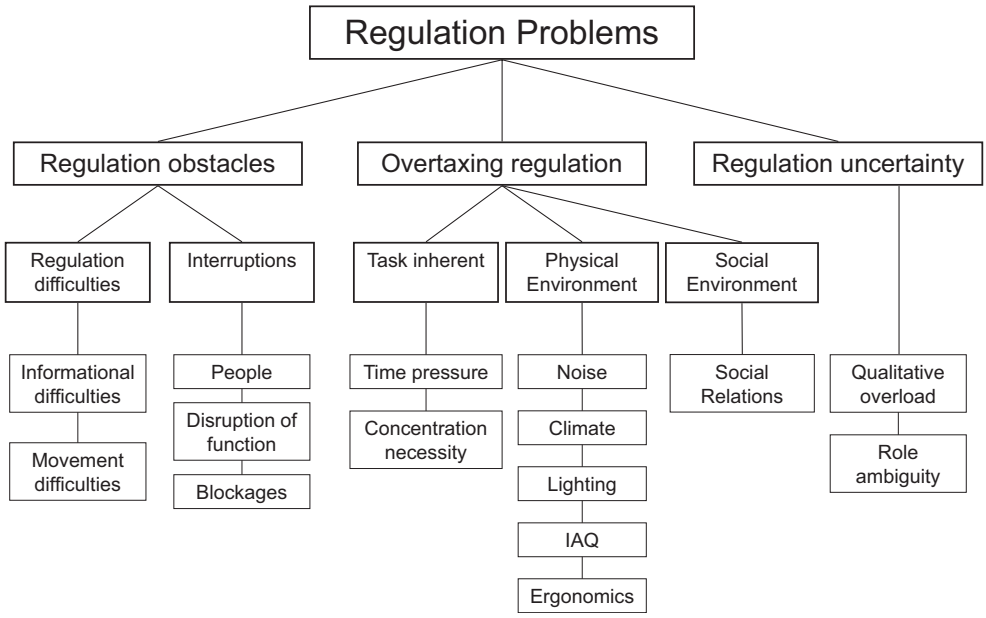

Figure 5.5 Classification of regulation problems (based on Frese & Zapf, 1994; Greiner & Leitner, 1989; Leitner, 1999)

are stressors because they require additional effort for task completion. They necessitate repetition of the action, the making of detours, and/or use up regulation capacity that is then subtracted from the main task.

Regulation obstacles can be subdivided into interruptions and regulation difficulties (Figure 5.5). Interruptions are unpredictable outside events (such as a computer breakdowns or phone calls) that disrupt an ongoing activity. Interruptions are regulation obstacles because they force the actor to restart a task or because, due to interruptions, parts of the task already completed may be lost. Regulation difficulties are conditions that impede efficient execution of tasks. They appear when access to task-relevant information is unnecessarily difficult or when movements need extra effort, for example due to inadequate tools. Regulation obstacles may have their roots in organisational problems (e.g. lack of supplies) or the social environment.

Regulation uncertainty describes a state in which the actor is confused about how to achieve a goal because he's unable to determine which kinds of plans are useful or what feedback can be trusted (Semmer, 1984). In this case a lack of information is not the cause, but rather the inconsistency or ambiguity of information.

Overtaxing regulation describes a state of overload due to overstimulation related to required speed and intensity of regulation. Time pressure or quantitative overload of the working memory or concentration, for example, is a typical stressor. In order to complete a task, more processing resources have to be allocated to regulation and thus more effort is expended. For this class of regulation problems, permanent conditions of time pressure or bound attention are characteristic, as are environmental conditions that do not constrain working activities (like regulation obstacles do) but exceed human performance capacities.

Social stressors such as hostile colleagues, conflicts with colleagues or supervisors, unfair treatment by colleagues or supervisors, and a negative group climate can be considered as overtaxing

regulation because they divert attention from the main tasks to thoughts and worries about social relations. Thus, social stressors consume regulation capacity (Dunckel, 1991).

Action regulation theory assumes that human beings actively deal with their environment. Regulation requirements (complexity) and corresponding regulation possibilities (control) lead to positive effects (i.e. satisfaction) because they address human needs such as a feeling of competence or pride over achievement (Zapf, 2002). On the other hand, regulation problems do not address needs and impede goal-directed acting. Regulation problems thus act as stressors.

1.4 Action regulation and stress

The transactional view of stress (Lazarus, 1966; Lazarus & Folkman, 1984) describes a process linking stressors, strain, and coping: stress arises from perceived environmental demands that exceed a person's perceived resources and capacity. Appraisal of a situation and personal resources starts coping behaviour. Coping behaviour refers to two things: first, it refers to the stress-generating problem, for example the handling of an additional task. Second, it refers to dealing with the emotions activated in this process. Thus, coping takes effort and thereby produces fatigue and consumes resources. According to Hockey's (1997) compensatory control model, individuals use performance-protection strategies when dealing with environmental stressors. Performance protection is realised through increased subjective effort (psychological process) and/or sympathetic activation (physiological process). The greater the activation, the greater the costs for the individual. Short-term effects of compensatory control in the regulation of performance under stress consist in inefficient strategies. Long-term effects may be a draining of energy and a state of exhaustion.

According to the transactional view, stress is seen as a product of the complex and dynamic transaction between the person and the environment, rather than a product of one of these components on its own. In order to keep these transactions manageable in research, the transactional model is often reduced by the concept of stressors. Stressors are job or work features that increase the probability of stress reactions and stress-related outcomes (Kahn & Byosiere, 1992, Semmer, McGrath, & Beehr, 2005). Stressors are not defined on the individual level but on the level of populations. Each individual perceives the same objective environment somewhat differently, and stressors do not lead to stress reactions in every individual. Like some people are more resistant to infections than others are, some are more resistant to certain stressors. Stressors therefore are considered as risk factors and not as determinants of stress reactions and outcomes. Stress reactions are indicated in one or more of the following signs: verbal reports of being stressed or overtaxed or the like; observable behaviour, and physiological signs (Semmer et al., 2005).

While in cognitive theories of stress (e.g. Lazarus & Folkman, 1984) the concept of appraisal is central for the examination of the relationship between the person and their work environment, the tradition of work and job design emphasises objective[3] characteristics of jobs. The reasons for this emphasis on objectivity are twofold: first, it is rooted in the theoretical tradition of action regulation theory that aims at contributing to job design. Second, there is empirical evidence of correlations between objective work characteristics and individual health and well-being. From a practical point of view, the reason for emphasising the objective nature of work and work environments is that work and environmental design is usually accomplished without taking individual factors into consideration (Zapf, 1993). While individual appraisal is obviously unique, it is not idiosyncratic (Semmer et al., 2005). It is therefore possible to identify patterns in the way people appraise specific work conditions. This is particularly so with patterns that relate to the way the workplace is seen to threaten a person's health and well-being.

In terms of action regulation theory, stressors are equalised with regulation problems (Frese & Zapf, 1994; Greiner & Leitner, 1989). Regulation problems act as stressors and impair work

performance because they require extra regulation efforts. This additional regulation effort in turn can lead to overtaxing of regulation and lead to stress reactions and stress-related outcomes.

This approach allows for a conceptualisation of stressors that is not dependent on worker appraisal but does not omit mental processes in general. Stressors are conditions that interfere or are incompatible with mental regulation processes such as information processing, planning, and movement execution.

2 Applicability to workplace studies

The concept of psychological stress allows for an extension of the job and work design literature towards the analysis and design of the physical environment. It encompasses not only short-term stress episodes but also emphasises long-term impacts on health and well-being. Furthermore, it acknowledges the possible influence of moderating variables such as control (e.g. job decision latitude or environmental control) and social support.

Research on work and stress has focused on psychosocial, organisational, and job design aspects but largely ignored the potential effects of the physical environment (Vischer, 2007).

Environmental stressors interfere with mental regulation processes and/or consume resources that otherwise would be used for task-related activities. In terms of the action regulation theory described previously, environmental stressors act as regulation problems because they impede goal-directed regulation. Therefore, environmental stress leads to frustration and dissatisfaction. Endangering the fulfilment of accepted tasks has been found to be experienced as stressful and tends to correlate with psychosomatic symptoms (Greiner, Ragland, Krause, Syme, & Fisher, 1997; Leitner & Resch, 2005; Semmer, Zapf, & Greif, 1996). Evidence of the (small) negative effects of situational constraints (i.e. regulation problems) on performance and satisfaction is reported by O'Connor et al. (1984).

Action regulation theory has mainly been applied in order to study negative aspects of work, specifically stress. Action regulation theory, however, also considers positive aspects such as learning and individual development through acting (and therefore values the complexity of work tasks highly). The two foci on stress and learning do not allow the assessment of positive effects of the physical work environment. The theoretical framework therefore has to be completed with an approach that permits the study of environmental impacts that lead to higher well-being, better health, or higher performance. The absence of regulation problems or stressors does not fulfil human needs. Workers not only need freedom from regulation problems but also want environmental support for the activities they perform. The concept that captures these aspects is environmental comfort (Vischer, 2005, 2007). Environmental comfort contains the satisfaction with the relationship between individual goals and physical, functional, and psychological aspects of the physical work environment. It links the assessments of office environments by their users to outcomes such as performance and well-being.

The experience of comfort is understood as guided by similar regulatory mechanisms as stress. Comfort is thus a physiology-oriented concept not of neutral sensation (sensu Fanger, 1970) but of neutral regulatory demands from the physical environment. Comfort is thus conceived as a psychological concept. The measurement of comfort should focus on satisfaction with comfort because the concept of satisfaction should relate to longer periods than sensation does. Thus, while sensation may be an adequate measure in laboratory studies, satisfaction is considered more appropriate in field studies. Satisfaction with aspects of environmental comfort includes the possibility of individual adaptation to environmental conditions in order to achieve comfortable levels (Nicol & Humphreys, 2002). Furthermore, conceptualising comfort as satisfaction considers the multidimensional nature of comfort. For example, an empirical study

found that seating comfort is based on a sense of well-being, relief, and relaxation, as well as on the appearance of the chair (Zhang, 1996).

From the theoretical perspective of action regulation, stressors are defined as regulation problems. The general taxonomy of regulation problems (Figure 5.5) can be translated into a taxonomy of regulation problems for office work that is related to the physical office environment (see Figure 5.6).

Regulation obstacles are conditions that make it harder or impossible to pursue a goal or to regulate an action. The subcategory of regulation difficulties refers to conditions that impede efficient task execution. In office work such conditions are noise (Leitner et al., 1993), ineffective design of workspaces, and crowding (Schultz-Gambard, Feierabend, & Hommel, 1988). Noise requires higher concentration, for example for an individual's own telephone calls. Ineffective workspace may impede task execution on the level of movements (spatial barriers, dysfunctional arrangements). Crowding is associated with excessive stimulation, scarce resources, and behavioural constraints and aggravated action regulation.

The second subcategory of regulation obstacles refers to interruptions. In office settings, the main source of interruptions and distractions are other people (Baethge, Rigotti, & Roe, 2015; Jett & George, 2003).

Overtaxing regulation refers to speed and intensity of regulation and the risk of physiological and psychological overload. Conditions belonging in this category are time pressure and concentration necessity (Zapf, 1993) as task inherent factors. Furthermore, environmental factors such as noise, climate, lighting, indoor air quality, and ergonomics are task unspecific risk factors for overload or overstimulation (e.g. Sundstrom, 1986). In relation to the social environment, problematic social relations due to conflicts may overtax regulation. Social density is a second factor of the social environment that is relevant for overtaxing regulation. Social density is associated with overstimulation and impairs focusing and concentrating abilities (Oldham & Rotchford, 1983).

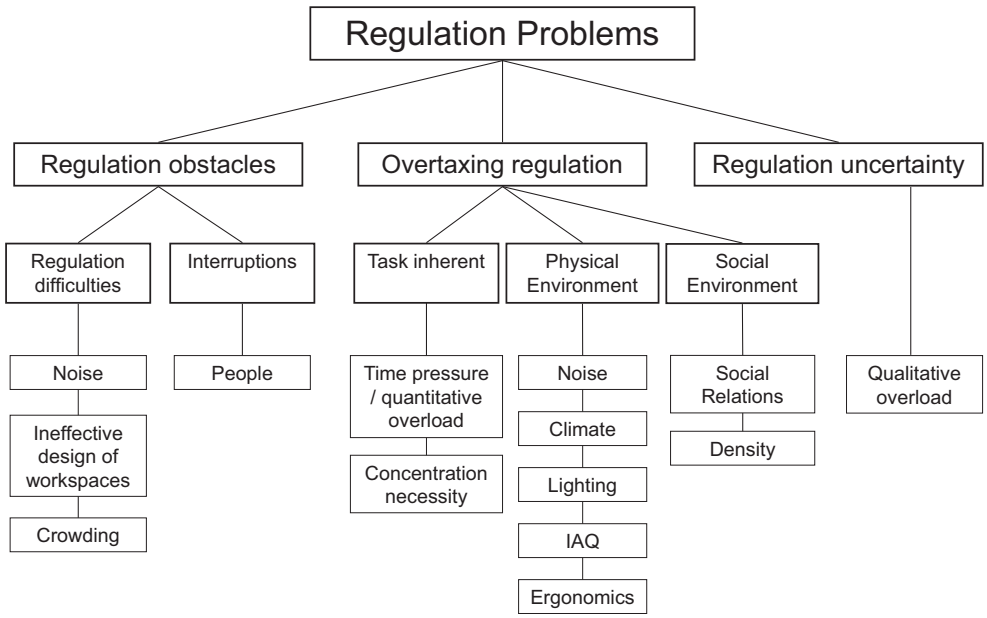

Figure 5.6 Regulation problems in office work

Noise appears as a stressor in two different ways. First, noise acts as a regulation difficulty for specific tasks requiring extra effort. Second, noise may overtax regulation as a task unspecific stressor that leads to cognitive overstimulation. Task unspecific stressors do not require extra regulation effort but must be borne by the job incumbents.

Regulation uncertainty describes a state in which an actor is confused about how to achieve a goal because s/he is unable to determine which kinds of plans are useful or what feedback can be trusted (Semmer, 1984). This concept is strongly associated with qualitative overload, a state that is characterised by excessive requirements on working memory as much as too many pieces of information must be kept in memory simultaneously and for too-long periods of time.

From the perspective of action regulation theory, the far most important resource is control. Control describes the amount of regulation possibilities an individual worker has (see also Chapter 11 Two-Process Theory of Perceived Control). A second resource is social support, a concept that has been shown to buffer negative effects of work stressors in many studies (Kahn & Byosiere, 1992; Van der Doef & Maes, 1999). Although social support is not derived from action regulation theory (which has an individualistic cognitive focus), it is usually considered in action regulation–based research on work stress, well-being, and health (Frese, 1995). Considering the physical environment, further resources can be identified. Privacy (see also Chapter 6 Privacy-Regulation Theory) and control over one's own physical environment are two facets of autonomy that are likely to act as instrumental resources (De Croon, Sluiter, Kuijer, & Frings-Dresen, 2005). Furthermore, comfort may play a role as an intrinsically valued resource.

By understanding environmental conditions as regulation problems or regulation possibilities, action regulation theory serves as a micro-theory that relates environmental demands with experience of stress, that is, a theoretical approach that allows explanations of why certain (environmental) conditions may act as demands or stressors (regulation problems) or resources (regulation possibilities). Action regulation theory thus allows for a better identification and understanding of environmental influences, as part of work conditions, on employees.

3 Methodology/research approach

Action regulation theory has been applied in many fields (Frese & Zapf, 1994; Hacker, 2003; Zacher & Frese, 2018), and many research methods are used. Work-related research based on action regulation theory tends to take place in (field) experimental settings and field studies (Hacker, 2003), and some researchers attempted to combine objective with subjective measurements (e.g. Greiner et al., 1997; see also Hacker, 2003).

The observational interview is a method that is more frequently used in research based on action regulation theory than in other approaches. This method combines elements of observation and enquiry since the research focus often lies on thinking processes. With observational interviews, person-independent work analyses are carried out. These analyses combine external characteristics of activities with an understanding of the work processes and action structures of work activities (cf. Leitner & Resch, 2005).

Generally, the action regulation theory provides a framework of how a person deals with tasks, including objects and the environment. This framework comprises the generation of action plans, the execution of actions and monitoring of goal achievement, and how cognitive resources are activated. This framework can be further developed for the analysis of effects of the work environment, for example it allows the definition and identification of demands and resources as well as regulation problems. More knowledge on the interplay between the objective world and subjective reactions and experience can serve as a basis for the development of theory-based instruments for the assessment of work environments in terms of their

health-impairing or -promoting function and the analysis of action strategies of execution regulation, that is, coping with environmental demands and using environmental resources to achieve goals and maintain health and well-being.

4 Limitations

A limitation of the action regulation theory is its disregard of person-variables (such as individual preferences, personal taste, and individual dispositions) and social influences. These aspects should not be neglected when the main aim of research consists in explaining certain behaviour as it relates to work environments. Generally, however, it is assumed that social influences will be balanced over a sample of organisations analysed and that person-related effects will be balanced in the sample of participants.[4]

5 Theory relevance to practice

Action regulation theory combines motivational regulation and execution regulation of actions. Thus, it emphasises the role of the environment for work activities. Furthermore, it provides a basis for differentiating between different forms of regulation problems and their measurement or assessment. Action regulation theory refers to the resource limitation of intellectual (conscious) regulation and stipulates that well-practiced routines are regulated by less effortful modes. However, information from the environment may trigger mindful processing, for example when barriers or opportunities relevant to one's work appear. Changes in the environment may therefore require more conscious processing. This effect can be deliberately used by modifying the environment to create signals, for example when managing work safety. On the other hand, practitioners must be aware that any change in the environment may lead to conscious processing and with that to positive or negative reactions of the affected workers.

6 Further reading

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Notes

1 This chapter is largely based on parts of the theory sections of my unpublished PhD thesis.
2 Although the scientific value of the Hawthorne studies is disputed (e.g. Carey, 1967; Parsons, 1974) and they have never been published in scientific journals, they are noteworthy because they stand for a paradigm shift in the history of social science.
3 Objective characteristics of jobs are not necessarily physical characteristics. Rather, objective characteristics are conceived as independent of a specific person's cognitive and emotional processing and are inter-individually agreed physical or social facts (Frese & Zapf, 1988).
4 In statistical terms this assumption is known as the central limit theorem. It states that with sufficiently large samples sizes, sampling distributions of means are normally distributed (Tabachnick & Fidell, 2007).

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