CHEMICAL ENGINEERING TRANSACTIONS
VOL. 48, 2016
A publication of AIDIC
The Italian Association of Chemical Engineering
Online at www.aidic.it/cet
Guest Editors: Eddy de Rademaeker, Peter Schmelzer

ISBN 978-88-95608-39-6; **ISSN** 2283-9216
DOI: 10.3303/CET1648152

Functional Model for Organisational and Safety Culture

Pasi L. Porkka

Postgraduate, Tampere University of Technology at Pori, Pohjoisranta 11, PL 300, 28101 Pori, Finland
pasi.porkka@tut.fi

Cultures are usually defined as shared values, attitudes and behaviour of certain group. The core of culture is inside person's mind. Only through behaviour or other actions of persons the culture becomes visible and shareable. Cultural artefacts and all other perceptible signs of culture are formed through action. From this perspective culture requires functionality. It does not exist nor spread without activity of individuals.
In systems theory there is a methodological distinction between theoretical system and empirical system. Theoretical system "is a complex of concepts, suppositions, and propositions having both logical integration and empirical reference". Empirical system is "a set of phenomena in the observable world that is amenable to description and analysis by means of a theoretical system". However, in cultural context, theoretical models usually describe only properties of the empirical system. Usually the functionality of the culture is left undefined. Therefore theoretical models may have flaws in their ability to describe the functionality of the culture, which is essential part of the culture.
In this paper we use a novel functional model to explore the functionality of the most commonly used culture models. We inspect Schein's organizational culture model, Cooper's reciprocal safety culture model and Johnson's cultural web. We study them and their functionality with our own functional model, which integrates person to sociotechnical system and shows person-sociotechnical system interaction.
This study clearly shows that if culture's basis is in shared mental models, then the question whether organization is or has culture is absurd. As Antonsen has pointed out certain mandatory organizational features are clearly structural and not cultural. We also emphasize the behavioural aspect when defining cultural issues. The shared mental model alone is not sufficient requirement to define a feature as a cultural artefact, nor is the behaviour all employees share. Behaviour or action is cultural artefact only when the members of the culture have truly free will to choose their behaviour

1. Introduction

Most organizational culture models are based on the shared mental models of individuals (Schein 2004; Ravasi & Schultz 2006). These mental models include values and beliefs, which have been called "the bedrock of culture" (Deal & Kennedy 2000, p.4). Organizational culture represents the collective values and beliefs and it can become visible only through behavior or another human action. In all these models the shared aspects in the organization where considered as part of the culture (Reiman and Oedewald, 2007).
These internal psychological models are highly personal. Some of these models are used as guidelines with which one operates in the world. Thoughts, values and other cognitions need some kind of action to be exposed to other people. As long as they are solely inside peoples' minds they cannot be shared nor be confirmed. Gherardi and Nicolini have described safety as "aspect of practice" (2002, p.216), but also organisational and safety cultures are aspects of practice. In this context internal psychological factors require some kind of corporal activity to be exposed. All human behavior is considered as an action and these actions include talking, writing and all other socially interactive methods of communication.
As far as we know, in the literature of organizational culture, this issue of culture's method of action has been left undefined. We have developed a meta-model, which describes the person – sociotechnical system interaction.
In systems theory there is a methodological distinction between theoretical system and empirical system. Theoretical system "is a complex of concepts, suppositions, and propositions having both logical integration and empirical reference". Empirical system is "a set of phenomena in the observable world that is amenable to

Please cite this article as: Porkka P., 2016, Functional model for organisational and safety culture, Chemical Engineering Transactions, 48, 907-912 DOI:10.3303/CET1648152

description and analysis by means of a theoretical system" (Laszlo & Krippner 1998). However, in cultural context, theoretical models describe only properties of the empirical system. Usually the functionality of the culture is left undefined. Therefore theoretical models may have flaws in their ability to describe the functionality of the culture, which is essential part of the culture. Our functional model shows the interaction between an individual and an organisation and thus unites theoretical and empirical systems.

2. Functional model

The functional meta-model is based on the systems point of view. Both person and organisation are modelled as systems. The systems theory models real world entities as technical systems (Hollnagel 2014). Systems theory states several properties a system must have, but we concentrate to just one of those, namely openness. The openness of a system means that a system has means of interaction with its environment. Environment is defined as everything that does not belong to the system itself, but has some kind of effect to the system. According to Buckley the interchange is essential factor underlying the system's viability (1967). Basically the interaction with environment means some kind of flow in and out of the system. The major types of system flows are materials, energy and information (Sawyer 2004). When the flow is entering the system it is called input or originally inflow (von Bertalanffy 1950) and when the direction is out from the system it is output (outflow). The input and output provide means for the system to interact with its environment. The action of processing the input is called throughput. The system causes its own behaviour or output. Same input in different systems is likely to produce different output (Meadows 2008). The system can also evaluate the output flows and get valuable feedback from its performance. Input, output, processing and feedback are the key elements we use in our models of person and organisation as open systems.
Another important issue is the level of analysis concerning organisation and person. When studying the organisation, the level is macro, but when the research subject is an individual, the level is micro. When both person and organisation are studied together and in same model, the model unavoidably has to include both micro and macro levels of analysis. This is important issue, since the person modelled in a socio-technical system is acting only in certain roles. In the organisation level there are no personal issues concerning individuals. Basically, this model provides means for studying the personal issues in the organisational level. In Figure 1 the basic interaction of organisation and person is presented.

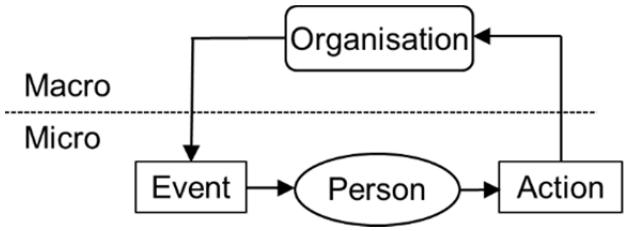

Figure 1: Organisation and person interacting with each other.

Figure 1 shows how organisation and person are interacting. All persons, regardless their status and role in the organisation, can gain information from the organisation only through their sensory system. In this model all observable signs and actions from the organisation are treated as events. They are inputs for the person, with which the person can detect the status of the organisation. Person processes the input with all previous knowledge of the system using her personal mental models and then she may perform some action as an output. All inputs do not trigger output, but they all affect person's mental models. Organisation related actions of a persons are considered as inputs of the organisation. The actions include all means how persons can affect the organisation.
According to systems thinking principles systems can further be refined as subsystems. Subsystems are elements, which work interconnected and they have shared purpose (Meadows 2008, p.11). We have refined the organisation into four subsystems and the environment. The person is divided into two parts. The body, which consists of sensory system required to deal with the input. Internal psychological factors consist of the mental models a person uses to handle the inputs from sensory system. Person produces behaviour, reactions and other actions as output. The refined interaction is showed in Figure 2.

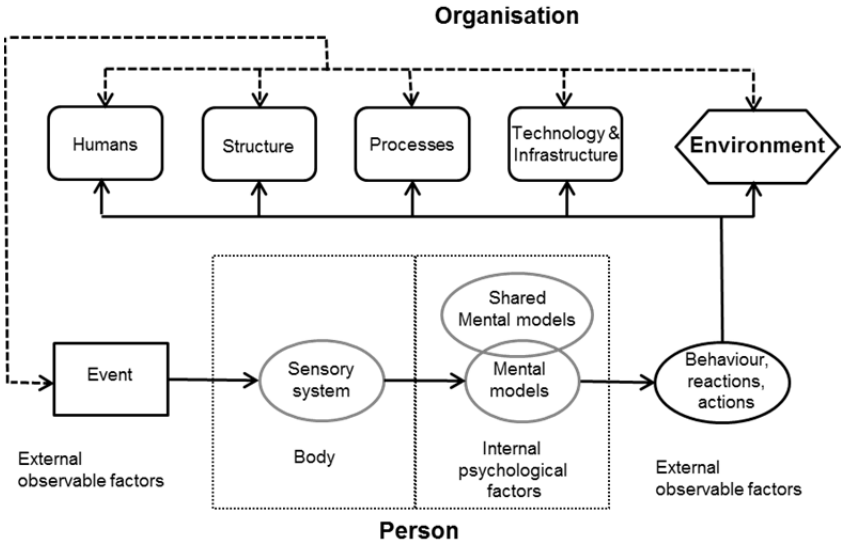

Figure 2: Refined interaction between person and system.

We have used very broad definition of an organization as an open sociotechnical system and it presents only one way of modelling an organisation. In our model the technical organisation is divided into three different subsystems. These subsystems are: 1) Structure, which includes both formal and informal structures, 2) Processes, both main and supporting processes and 3) Technology and infrastructure. We also include humans into a technological system and expand our system to sociotechnical system. Finally, including the environment makes the system to be defined as open. All three technical subsystems, humans and environment are interacting with each other. All these can also produce an event a person sensors.

We observe the world with our sensory system and all information we gain must go through senses. Then our mind interprets this sensory data. From these observation-based interpretations we make personal generalisations, which we use as guidelines when operating in the world. This way of making "rules of thumb" from the world and conducting our behaviour according to them is considered to be a fundamental way of human behaving (Nurius & Macy 2012, p.130).

There are several different psychological research approaches studying these kinds of personal cognition related ways of dealing with the world. These personal cognitions and corresponding behaviours are modelled as data structures in our minds. These structures may be called constructs (Kelly 1955), mental models (Senge 1990; Johnson-Laird 1996), mental rules (Rips 1994), cognitive maps (Tolman 1948), schemas, causal maps, frames or scripts. We use the term mental models, since there is also a term of shared mental models (Denzau & North 1994), which quite directly refer to culture and social part of the human behaviour.

If a group of employees acting in the same role, or have same education or otherwise share certain mental models, then they are said to form a subculture. Nowadays, the scholars are tending to give up the notion of an unitary organisational culture instead of organisational culture consisting of multiple subcultures (Schein 2013; Guldenmund 2010, p.195). This raises the questions "what is then organisational culture?" and "how to define who belongs to which culture?"

Figure 2 shows clear distinction between personal and organizational features. The shared mental models of a person may affect the technical subsystems of the organization only if the person is in a managerial role in the organization. The mental models of an ordinary worker about the technical subsystems are merely opinions, since the person is not in the role in which she can affect the formal structures. The questions stated in the previous paragraph can now be formulated as "Is the managerial subculture also organizational culture?" and if it is organizational culture "are the ordinary workers also part of it?" We finally return to the definition of organizational culture and remember that organizational culture was defined as shared mental models, which include values and beliefs. Definitely the ordinary workers do not share those mental models, which may affect technical subsystems. Also their values and beliefs have no effect whatsoever. Therefore they are not part of that culture and for other people, than those having the role of manager in the organisation, the technical subsystems are just structural issues, not cultural. And finally, if there is just a single manager responsible for that technical subsystem, then even the requirement of the culture of being shared, does not hold.

However, there is still ongoing discussion whether culture is something that organization **has** or organization **is** the culture. Culture itself is widely accepted to be socially constructed phenomenon (Antonsen 2009a). All manmade structures have been influenced by cultures of the individuals involved, so also all structures are socially constructed (Berger & Luckmann 1966). This has led to idea that since everything in the organization is socially constructed, everything is also artifact of some culture and therefore organization is culture.
This approach makes its own sense, but it also rises the same question stated above. Whose culture it actually is? According to Schein artifacts are the visible consequences from the underlying assumptions. If the visible consequences precede the underlying assumptions and not the vice versa, how can they be cultural artifacts? In the Schein's sense human behavior, which may have origins in the past, can be cultural artefact, since the shared values and models are the reason behind person's actions. However, structures, which are given and are mandatory are not cultural artefacts in the same sense. It is even possible that not a single person who was creating these artefacts is still alive. Structures can only be artefacts of the culture that has created them.

3. Other organisational and safety culture models

In this section we compare three different organisational and safety culture models. Schein's organisational levels of culture provides the core of all organisational and safety culture models share: underlying assumptions as the basis of culture and its visible manifestations are espoused beliefs and values and artefacts (2004). Johnson & al. show behavioural, physical and symbolic manifestations of a culture within an organisation with their cultural web (2008, p.198). Cooper has introduced a safety culture model (2000), which is based on Bandura reciprocal determinism model (1986). Cooper's model unites psychological, situational and behavioural factors. Figure 3 shows three different cultural models.

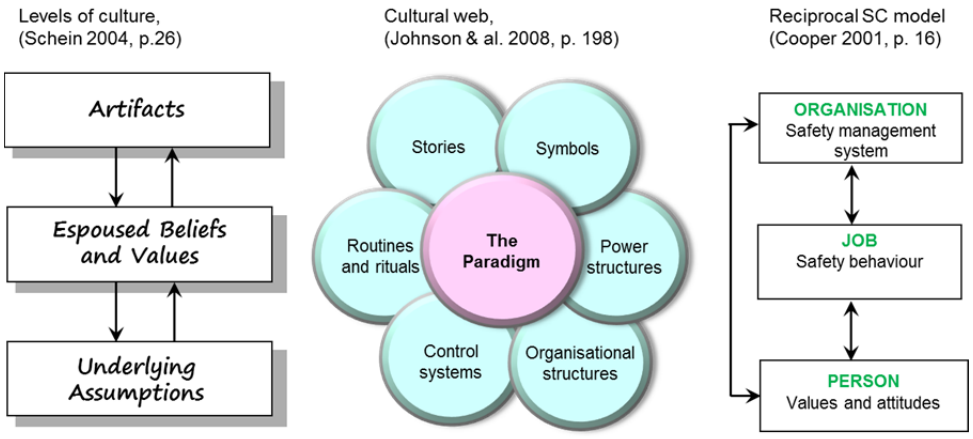

Figure 3: Three organisational and safety culture models.

These models offer different kinds of approaches to (safety) culture. Schein's levels of culture show the basis of the culture in quite abstract level. He does not specify in deeper level which espoused beliefs and values or artefacts belong the culture. He defines the external observable entities to be cultural if their basis is in the shared underlying assumptions.
Johnson & al. provide a deeper insight to organisational culture by defining in detail, which organisational entities are also cultural. The paradigm is defined as the set of assumptions held in common and taken for granted (Johnson et al. 2008, p.195). In that form it is quite equivalent to Schein's underlying assumptions, which were taken-for-granted beliefs, perceptions, thoughts and feelings (Schein 2004, p.26).
The most commonly used safety culture model in the safety culture research is the Cooper's reciprocal safety culture model (Cooper 2001, p.16). It states that an organisation's safety culture is combination of the dynamic inter-relationships between individuals' attitudes , their safety behaviour and organisation's safety systems support to goal-directed behaviour (Cooper 2001, p.15). This model explores safety culture through three different players: person's attitudes, person's safety behaviour and organisation's safety management system. When comparing organisation's role in Cooper's model (SMS only) to the systems model of organisation in Figure 2, it is quite obvious that Cooper's model reaches only small spectrum of the culture.

We are comparing theses three models in a table, which combines these different views into a one picture. Our table has three lines, which represent the Schein's model's view of internal psychological factors and external observable factors. The underlying assumptions are the psychological factors. Both espoused values and artefacts are visible observable factors. The third line presents other socially construed structures, which are not cultural artefacts.
Column headers in our table are from Cooper's model: person, job and organisation. However, we don't restrict the issues included into these entities only to those mentioned by Cooper. For example the organisation column may include also organisational entities and not just safety management system. Figure 4 we inserted the organisational entities from the model of Johnson & al. into the table.

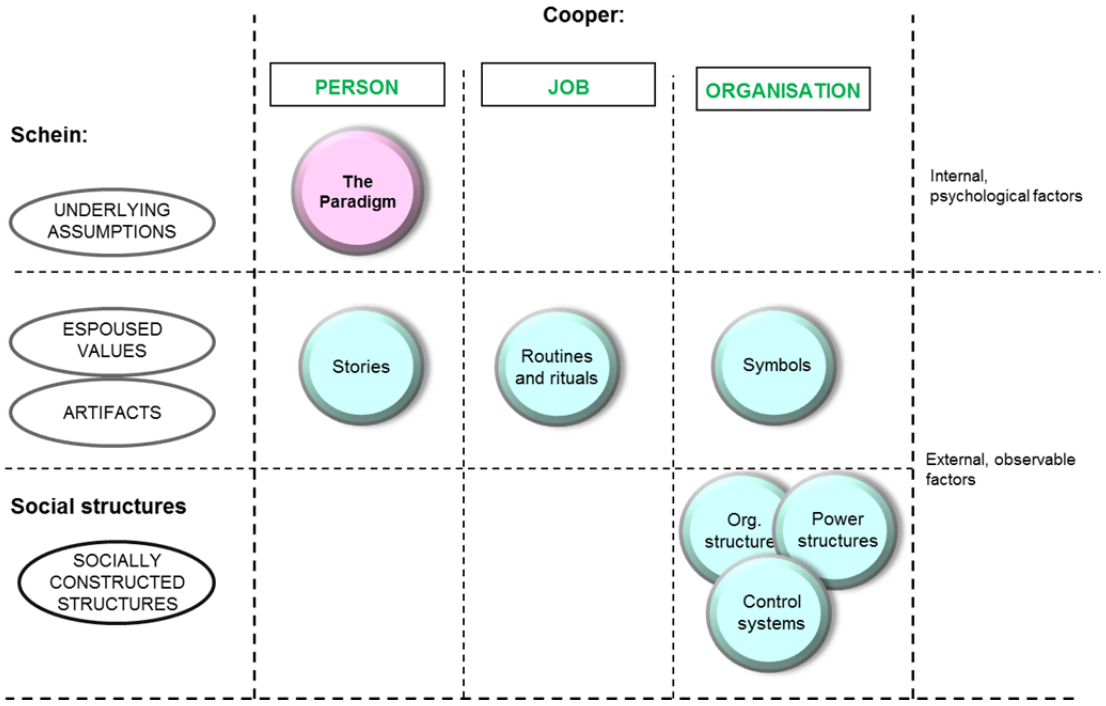

Figure 4: Combination of three organisational and safety culture models

In the first column, there are person related features. There exists internal psychological factors in all three models. Schein calls them underlying assumptions, Johnson & al. call it the paradigm and in Cooper's model there are perceptions and attitudes (2001, p.15). In Schein's model the observable signs of culture are espoused values and artifacts. They can be seen in all Cooper's triadic model's elements. In Johnson & al. the stories are person related espoused values and artefacts. In the job there are also espoused values and artefacts. From Johnson & al. the routines and rituals are in this category. Finally the symbols are organization related artefacts and espoused values.
The most interesting part in this categorization is the socially constructed structures, which are here considered to be not culture related features. Johnson & al. claim that organizational and power structures and control systems are part of the organizational culture. Following Antonsen (2009b), we consider them to be not cultural, but purely structural elements, for the reason explained earlier.

4. Discussion and conclusions

In chapter 2 we explained our view when socially constructed structures can be considered to be part of the organisation's culture and when they are just structural elements. Even human behaviour cannot always be considered to be cultural, even though it seems to be that way according to the common definition of organisational culture: "the way things are done around here" (Deal & Kennedy 1982). The distinction between cultural / non-cultural artefact (behaviour) cannot be done only by observation.
The role of power in organizations is an issue which is rarely addressed in safety culture research (Antonsen 2009a). This is an important issue when defining whether a feature is cultural or structural. It is too common in organisations that those with power are drawing up rules, but no not require following of them. From this point of view the behaviour in the job can be cultural or structural. If the manager level requires that the rules are

followed, then the behaviour of employees is structural based. If the rules are not mandatory and they are not followed, but employees have their own ways of doing the work, then the behaviour is cultural. In our opinion the free will to choose one's behaviour is essential precondition of culture.

References

Antonsen, S., 2009a. Safety culture and the issue of power. *Safety Science*, 47(2), pp.183–191.

Antonsen, S., 2009b. The relationship between culture and safety on offshore supply vessels. *Safety Science*, 47(8), pp.1118–1128. Bandura, A., 1986. *Social foundations of thought and action: A social cognitive theory*, Englewood Cliffs: Prentice Hall.

Berger, P.L. & Luckmann, T., 1966. *The Social Construction of Reality - A Treatise in the Sociology of Knowledge*, Penguin Books.

Von Bertalanffy, L., 1950. The theory of open systems in physics and biology. *Science (New York, N.Y.)*, 111(2872), pp.23–29.

Buckley, W., 1967. *Sociology and modern systems theory*, Englewood Cliffs: Prentice Hall.

Cooper, D., 2001. *Improving Safety Culture: A Practical Guide*, John Wiley & Sons Ltd.

Cooper, D., 2000. Towards a model of safety culture. *Safety Science*, 36(2), pp.111–136.

Deal, T. & Kennedy, A.A., 1982. *Corporate cultures : the rights and rituals of corporate life*, Addison-Wesley.

Deal, T.E. & Kennedy, A.A., 2000. *The new corporate cultures : revitalizing the workplace after downsizing, mergers and reengineering*, New York : Basic Books.

Denzau, A.T. & North, D.C., 1994. Shared Mental Models: Ideologies and Institutions. *Kyklos*, 47(1), pp.3–31.

Gherardi, S. & Nicolini, D., 2002. Learning the Trade: A Culture of Safety in Practice. *Organization*, 9(2), pp.191–223.

Guldenmund, F.W., 2010. *Understanding and Exploring Safety Culture*. Technical University of Delft.

Hollnagel, E., 2014. Is safety a subject for science? *Safety Science*, 67, pp.21–24.

Johnson, G., Scholes, K. & Whittington, R., 2008. *Exploring corporate strategy : text & cases* 8th editio., Prentice Hall Financial Times.

Johnson-Laird, P.N., 1996. Mental Models , Deductive Reasoning, and the Brain. In E. Bizzi et al., eds. *The Cognitive Neurosciences*. Cambridge: The MIT Press.

Kelly, G.A., 1955. *The Psychology of Personal Constructs: A Theory of Personality*, New York: Norton.

Laszlo, A. & Krippner, S., 1998. Systems Theories : Their Origins , Foundations , and Development. In J. S. Jordan, ed. *Systems Theories and A Priori Aspects of Perception*. Elsevier, pp. 47–74.

Meadows, D.H., 2008. *Thinking in Systems: A Primer* D. Wright, ed., Chelsea Green Publishing.

Nurius, P.S. & Macy, R.J., 2012. Cognitive-Behavioral Theory. In C. N. Dulmus, ed. *Human Behavior in the Social Environment: Theories for Social Work Practice*. John Wiley & Sons, p. 552.

Ravasi, D. & Schultz, M., 2006. Responding to Organizational Identity Threats : Exploring the Role of Organizational Culture. *Academy of Management Journal*, 49(3), pp.433–458.

Rips, L.J., 1994. *The Psychology of Proof: Deductive Reasoning in Human Thinking*, The MIT Press.

Sawyer, R.K., 2004. The Mechanisms of Emergence. *Philosophy of the Social Sciences*, 34(2), pp.260–282.

Schein, E.H., 2004. *Organizational culture and leadership*, San Francisco: Jossey-Bass.

Schein, E.H., 2013. The culture factor in safety culture. In G. Grote & J. S. Carroll, eds. *Safety management in context – Cross-industry learning for theory and practice 19–21 June 2013*. Swiss Re Centre for Global Dialogue, pp. 73–78.

Senge, P.M., 1990. *The fifth discipline : the art and practice of the learning organization*, New York: Doubleday/Currency.

Tolman, E.C., 1948. Cognitive maps in rats and men. *Psychological review*, 55(4), pp.189–208..