Understanding mindfulness as an analytical process.
An analysis of 9-1-1 responses on September 11, 2001

Paper submitted to the track on
Organization: Theory and Design
WOA 2015

M. Laura Frigotto, Università di Trento

Alessandro Narduzzo, Libera Università di Bolzano

Introduction and literature background

The study of organizations has traditionally focused on events and situations that organizations face more frequently, with the goal of improving successful performances and of refining and consolidating effective and efficient responses. More recently, the literature, building on contributions drawn from a stream on learning, has displayed a growing interest around unique low frequency events with disruptive consequences, with a dual motivation. First, some manifestations of this type of event represent cases which are no longer negligible in the eyes of the public opinion (Tierney, Lindell, & Perry, 2001) The attack on the Twin Towers is a prime example of such a phenomenon: it was unexpected and unprecedented event which provided extremely serious consequences. Second, those phenomena, despite their extreme peculiarities, can open to a deeper understanding of the dynamics of decision-making and learning of the broader set of cases, including high frequency events, and such lessons can be useful to enlighten the wider plethora of organizations.

Phenomena of this kind have been defined in various ways in the literature, emphasizing different aspects around their low frequency and the surprise effect associated with them: black swans (Taleb, 2007), rare events (Lampel & Shapira, 2001), surprises (Cunha, Clegg, & Kamoche, 2006), the unexpected (K. E. Weick & Sutcliffe, 2011), the unthinkable (Lagadec, 2007). The empirical context in which they were most studied is that of emergencies.

A tentative exploration of the issue of black swans has been done in terms of mindfulness, a concept which was born within the special set of organizations named High Reliability Organizations (La Porte, 1996; LaPorte & Consolini, 1991; Roberts, 1990; K. Weick & Sutcliffe, 2001), and which was tried to be extended to all organizations (Rerup, 2009). HRO are organizations such as air traffic control system, naval aircraft carriers, and nuclear power operations that face extremely threatening and uncertain environments (Perrow, 2011) and nevertheless they display safety, robustness and reliability. Organizational mindfulness is "the quality of collective attention that enables managers and employees to minimize errors, remain vigilant, and respond effectively to unexpected events" (Rerup & Levinthal, 2014). It includes the quality of attention, the consequence of attention, i.e. "what people do with what they notice" (K. Weick, Sutcliffe, & Obstfeld, 1999) and the conservation of attention. Mindfulness supports organizations to be continuously alert to and more receptive of early signals of trouble (Rerup, 2005), to track small failures, to resist oversimplification, to remain sensitive to the operations in practice, and to define responsibility of decisions on expertise rather than authority (K. Weick et al., 1999). As such, mindfulness is both a set of components and a process of continuous attention and problem definition. It is opposed to mindlessness where early and

simple assessments lead to a plan of responses that often consists of available routines, which are implemented until the plan runs its course or failure is evident (K. Weick & Sutcliffe, 2001).

Within this stream of literature, a lot of work remains in order to clarify the substance of mindfulness, and its deployment in terms of organizational design, processes and competencies. Actually, an operational definition of mindfulness clarifying components and properties is still a challenge to the existing literature (Lekka, 2011). Frigotto and Zamarian (2015) have offered a contribution in this line by generating an empirically grounded definition of mindfulness as the parallel activation of sensors and reactors with diverse degrees of specialization or generality. The operationalization of this definition lays in the concurrent identification of both well-defined routines and more general principles that direct perception and action.

Purpose of the paper

In this paper we aim at clarifying mindfulness as a process. More precisely, we aim at clarifying the process through which unexpected events are understood as new problems. We take the behavioral models on problem detection (the models of Cowan (Cowan, 1986)and Billings (Billings, Milburn, & Schaalman, 1980) in particular) as providing the basic components and dynamics of an analytical framework for understanding mindfulness as a process. Such baseline is amended and modified in the light of the evidence from an in-depth case study, so that the resulting model provides an empirically grounded operationalization of the concept of mindfulness as a process.

Models of problem detection and mindfulness

There are several models problem detection, which have been labeled in diverse ways: problem formulation (Lyles & Mitroff, 1980), problem recognition (Cowan, 1986; Mintzberg, Raisinghani, & Theoret, 1976), problem sensing (Billings et al., 1980; Kiesler & Sproull, 1982), problem detection (Klein, Pliske, Crandall, & Woods, 2005). Overall, empirical test of such models is very limited, however, their powerful and intuitive representations still build a reference on the issue.

For the purpose of this paper, we chose the models of Billings and others (1980) and of Cowan (1986). The first specifies the components of problem detection in terms of assessment of probability of loss, reliability of information and possible alternative solutions, both in terms of content and timing. As such, it provides a wide set of model components which can be tested

empirically. The second develops problem detection as a process that deploys over time and involves the stages of problem gestation, categorization, and diagnosis.

In Cowan's model, at first, signals indicating the existing state of reality are matched against expected states deriving from experience or assumptions within a sensing or gestation stage (stage 1). When the dissonance exceeds a defined threshold, a discrepancy is considered and the categorization stage starts. This phase ends with a discrepancy classification in terms of "problem" or "not a problem". Then, the diagnosis stage follows which provides a problem description, which may be either "certain" or "not certain".

Taking this process perspective further, some of Billings' components can be considered as building a problem assessment stage, which may be positioned as a stage 3, between the categorization stage (2) and the diagnosis stage (4).

In our view, along this process, the successful identification of a problem reveals mindfulness. However, also the lack of mindfulness, i.e. mindlessness can be represented through such process model, and it regards when individuals do not detect problems. This happens: a) when they ignore discrepancies (stage 1), b) when they notice them but they classify them as not revealing problems (stage 2), c) when they evaluate them as irrelevant or as hopeless cases (stage 3) or d) when they fail to- or are not able to- describe them (stage 4). This framework displays some assumptions that we make explicit and that are consistent with the literature. First, the process of mindfulness is the same of the process of mindlessness. This is in line with previous prominent contributions, e.g. Weick 1993 (K. E. Weick, 1993). Second, what differs between a situation when there is mindfulness or there is none is a mistake in fulfilling one of the process activities or in following their links, or an organizational definition of what activities consist of. For example, the way the "priority and importance of area" is assessed depends on what is considered to be relevant ad urgent within that organization.

Case selection

The case we selected for the study concerns the 9-1-1 operators response to the New York terrorist attack on September 11, 2001. This is a case of black swan, because: i) such an event had never been experienced before and was not present in the 9-1-1 codebook of possible events, ii) it was surprising both in terms of occurrence and of evolution of events. Among other black swans, it has become a reference for the extreme peculiarities and for the dreadful consequences it provided. The fact that it is both extraordinary and a reference make this be a unique case, which is interesting per se (Siggelkow, 2007). However, this case is also interesting because it is an extreme case of the category black swans, and as such it displays the essence

of the phenomenon in a similar extreme way (Flyvbjerg, 2006). For this reason it is an ideal set for an empirical study on that category. Moreover, availability of data is a further advantage of this case. September 11 attack was broadcasted real time from several perspectives and many data collections and analyses were conducted to understand the overall phenomenon. With respect to the mindfulness process, available data allow to investigate it at a micro-level through verbalized actions, perceptions, interactions and emotions and in real time.

Data

Our data set consists of 356 phone calls to the 9-1-1 emergency number, registered during the 102 minutes encompassed between the first attack to the WTC and the second collapse of the Towers (see Table 1 for some descriptive statistics on data). This original dataset was released between 2005 and 2006 by the New York Times (NYT) after years of legal wrangling for public availability. For privacy purposes, callers' words (if civilians) were removed from published data. Nevertheless, the impact of this fragmentation is limited as what civilians said can be inferred and double-checked because operators at 9-1-1 implement a procedure of redundancy to reduce communication misunderstanding. In fact, they are required to repeat what the caller says during the call, then they repeat it again when they transfer calls to colleagues, moreover, after the call operators comment on what the caller had just said and decide how to manage it within the information system.

Insert Table 1 about here

Method and Analysis

We analyzed 9-1-1 emergency number conversations on September 11 for inductive theory generation (Glaser & Strauss, 1967; Glaser, 1992; Siggelkow, 2007). We adopted an analytic strategy based on a single case (Yin, 1994). The authors chose grounded theory (Glaser & Strauss, 1967; Glaser, 1978) as a suitable method to found an empirically grounded model of mindfulness as a process (Le Coze, 2008; Suddaby, 2006; Vaughan, 2004).

Preliminarily, we organized the data within the NVivo software program, and attributed to each phone call seven identifying characteristics (see Table 2).

Insert Table 2 about here

As first stage, we created a codebook for the categorization of structure and general content of the interaction building on the Roter Interaction Analysis System (RIAS) developed by Roter (2002) and the Rogers and Farace codebook (Rogers & Farace, 1975). These allowed to structure of communication (e.g. assertion, question, talk-over, etc.) and the general meta-communicative message (e.g. support, information, order, etc.) (Table 2).

As a second stage, we refined codes in order to capture the peculiarity of the 9-1-1 conversations. Following Isabella (1990:14), we produced a second version of the codebook where previous codes were "enriched" (Glaser & Strauss, 1967) through open coding. The output was a list of 71 new codes that were problem specific. The authors discussed them extensively and finally agreed on the definition of 54 new codes (see Table 3). Two coders (one is the author of this paper) independently analyzed the phone conversations, discussed divergent codification choices and finally reached a consensus.

Insert Table 3 about here

The third phase of the analysis consisted of a "reconceptualization" (Isabella, 1990: 12) of the previously identified codes with the aim of defining a list of higher level concepts (Glaser & Strauss, 1967: 110) that built our advancement in the grounded understanding of the problem detection of black swans. Table 4 reports the list of produced constructs.

Insert Table 4 about here

Finally, theory generation emerged from the comparison between higher level concepts and components of theoretical models on problem detection (Table 5). This final step of the analysis resulted in an original and empirically grounded process model of mindfulness (Figure 1). Only theoretical components which found empirical support entered the final model. In addition, two new components were introduced which emerged from the case study analysis.

Insert Table 5 and Figure 1 about here

Main findings

Evidence along the model of mindfulness

Our analysis shows that unexpected and substantially unknown events like black swans appear through stimuli that are fragmented, contradictory and inconsistent (see Table 5: ID-1, ID-2). According to models of problem detection this implies the assessment about confidence in reliability and accuracy of the information (Table 5: a) as well as to check for different interpretations of the same information provided by colleagues and/or already recorded in the information system (Table 5: c). Then, they realize that the situation they are processing does not univocally converge towards the identification of a suitable alarm code (Table 5: ID-3). In fact, previous categorizations do not capture the main peculiarities of the situation, as a good category would do. They discuss about the possible impact that a standard categorization would have in terms of effectiveness of the response (Table 5: ID-13). In other terms, they assess the possible consequences that would derive from such situation if unaddressed (Table 5: f). They feel a high urgency to respond and a lack of time to search for alternative problem definitions and for ad hoc solutions (Table 5: g, i) which is revealed by the information system overload and by the high time pressure due to the high number of calls to answer.

While models of problem detection typically are centered on the individual and his cognitive processing, our model captures also the social dimension of problem detection within an organization. Operators discuss in order to find appropriate solutions to their issues (Table 5: ID 10 to 13), namely to confront with alternative explanations and categorizations (Table 5: b, d). Within the diagnosis phase they also confront on problem difficulty and response uncertainty (Table 5: ID 11). While they feel the inadequacy of their responses, they also need to persuade themselves that the lack of availability of more adequate responses allows them to provide standard directions to callers.

The evidence that responders have identified that the situation they face consists of an unprecedented problem, is given by the request of hierarchy intervention (Table 5: ID 8). They ask if they should open a new job for a caller asking to be saved or if this request was to be included in the overall job categorized as plane crash. The opening of new job would have shown that the standard categorization into one job would have not been enough to represent the situation, and that a set of categories could have been used to represent that peculiar case whose nature and responses would have been searched.

What happened is that the supervisor did not authorize this new job and claimed that the whole job consisted of rescuing people. Actually, while the mission of emergency management agencies is to rescue people, to keep them safe and wealthy, the identification of a job also

implies priorities within this mission. He played the role of the gatekeeper in the system which went on processing the emergency through the usual apparatus (Table 5: f). A plane crash job implies that the fire has to be extinguished while people are saved. A rescue job sets the priority on the people only. The result is that the 9-1-1 operators could not express the message on a new problem downstream in the process. However, along their processing, they experienced this situation as a discomfort which is traceable through emotions.

The role of emotions

The analysis of emotions over time (Figure 2) shows that emotions were mainly manifested when the first plane crashed (interval 1) and with a slight delay, when the second plane crashed (interval 5), while they decline after the collapse of the South Tower (interval 15). This is because callers became less and less.

Insert Figure 2 about here

Moreover, data display a different relevance of the various emotions in the intervals (Figure 3). An initial sense of certainty on the understanding of events (cfr. Figure 3: certainty on events) and a demonstration of annoyance with repetitive information on the causes of disaster (cfr. Figure 3: no news) which may be referred to a gestation phase when a substantial match between expected states and environmental signals is assessed, leaves the room for optimism and support (cfr. Figure 3: encouragement and optimism). At interval five, the most relevant emotions are incredulity, fear and a sense of uncertainty on events (see the corresponding emotions with the same names in Figure 3). After that, encouragement becomes again the most registered emotion.

Insert Figure 3 about here

We analyzed emotions also considering if they took place in conversations involving only 9-1-1 internal members, or an operator and an external caller. Among organizational members, people displayed more frequently their sense of uncertainty on what was happening and their fear and incredulity. On the other hand, when talking with external callers, operators showed their optimism and their control of the situation at most. Surprisingly enough, they displayed a sense of uncertainty on what to do when talking to externals. We interpret this evidence as a reaction to the extreme novelty and severity of the events. Towards the end of the

analyzed period, in fact, 9-1-1 operators realized that they could only limitedly help saving people, and they showed their powerlessness. These differences between the two groups appear to be statistically significant as shown in Table 6.

Insert Table 6 about here

The literature on problem recognition has only limitedly considered the issue in the context of general problems (Billings et al., 1980; Cowan, 1986) and the understanding of the role of the emotional dimension in this context is far from reaching completion. Our data analysis points out that 9-1-1 operators showed a multi-faceted emotional involvement when answering the calls: they felt uncomfortable with the uncertainty that characterizes the events (Table 5: ID-15) and the actions to be taken (Table 5: ID-14), and revealed fear (Table 5: ID-16) and concern (Table 5: ID-17) when they callers described the extreme situation they were experiencing.

Emotions reveal a sense of powerlessness became stronger over time and an inadequacy of the decision to stick with normal procedures in a situation that was clearly not standard. They also express the contradiction between the actual categorization and assessment of the problem provided by operators, and the denied authorization to proceed with the diagnosis phase where a new solution for the problem would be searched. Operators would proceed downwards along the process model as they understand the extreme negative consequences that may derive from the event and the substantial inadequateness of the response provided. However, the organizational stop to further search and diagnosis has produced a situation in which elements in favor of further search and diagnosis are continuously added but are kept “on hold”. This provokes a prominent sense of powerlessness of operators which is expressed through such emotions in particular when confronted with external callers’ needs.

Contributions

This paper provided an original, empirically grounded model of mindfulness. This represents an advancement for the literature on learning where this concept has been introduced. Moreover, this model allows to further understand the challenges the phenomenon of black swans raises in any kind of organizations, and in emergency organizations, in particular. Within models of problem detection, we offer an empirical validation which is still rare.

In terms of implication, we can derive from our analysis how organizations could organize their structure, their procedures as well as their expectations to support the mindfulness process.

Tables

TABLE 1

9-1-1 Phone Calls - Descriptive Statistics

Phone calls between the 1st and the 2nd attack	109
Phone calls between the 2nd attack and the 1st collapse	193
Phone calls between the 1st and the 2nd collapse	54
Average call length	0.00.51
Median call length	0.00.27
Shortest call	0.00.04
Longest call	0.24.45

TABLE 2

Attributes and values used for categorization of 9-1-1 calls

Attribute	**Values**
Number of people involved in the phone conversation with a distinctions of dyads composed of members of the 9-1-1 only	two people (caller and one responder) two members of the 9-1-1 three people more
Identification of the operator/CRO/dispatcher involved in the phone conversation	98 unique identification numbers of the responders not applicable
Phone call origin	inside the towers outside the towers not applicable
Tower identification for the phone calls that originated inside the towers	Tower 1 Tower 2 not applicable
Floor identification for the phone calls that originated inside the towers	22 of floors mentioned not applicable
Period of time	20 intervals of 5 minutes each
Phone call conclusion	call is dropped call is hanged up not applicable

TABLE 3

Codebook 1 and 2

Codebook 1		Codebook 2		
General categories derived from RIAS (Roter 2002)	Conversation specific codes adapted from Rogers and Farace (1975)	Final context specific codes	Sources	References
Task based exchange	Caller gives information	Caller gives information	77	165
		Immediate threat (smoke, people stuck, people jumped, damages, debris)		
		Main cause of disaster (crash, fire, explosion, etc)		
		Position of people-threat		
	Caller asks for instructions	Callers ask for instructions	5	5
	Responder asks questions	Responder asks for further info or ask other questions	141	340
		Closed questions		
		Open ended questions		
		Responder asks for further info more than once	25	38
		Responder asks for clarification	73	110
		Responder asks for clarification more than once	13	16
	Responder gives info	Responder gives info	162	306
		Fire, accident, people trapped, buidings collasped, explosion		
		Planes hit WTC1-2		
		Stair collapsed		
		We are on the way-somebody comes soon		
	Responder gives instructions	Responder gives instructions	115	330
		Medical instructions		
		Call 911		
		Check conditions		
		Do not break windows-open door		
		Do not use stairway-elevators		
		Get a towel		
		Get something clean-dry		
		Go on the floor-go out of the room-stay with other people		
		Look at fire		
		Open the windows		
		Stay and wait-keep calm-sit tight-keep in the ground		
		Use staircase and go upstairs-downstairs		
	Talk among 9-1-1	Talk among 9-1-1 operators	125	330
		Technical elaboration of the call		
		Code assignment		
		Dead times for the input of the information system		
		No news		
		Transfer and synthesis of call		
		Questioning hierarchy on causes of disaster		
		On what to do / how to answer caller's questions		
		Discussion on information given by a caller		
		On events		
		We are already there		
		Total recall	10	11
Socio-emotional exchange	Emotion	Certainty on facts	7	14
		Empaty statement	8	18
		Uncertainty on what to do	29	51
		Uncertainty on events	22	36
		Incredulity, shock, fear	26	54
		Reassures, encourages, shows optimism	93	178
		Concern or worry	20	31
		Lots of calls	21	25
		Overload of information	15	17

TABLE 4 Higher Level Concepts

Final context specific codes	Example	Higher level concepts	ID
main cause of disaster (crash, fire, explosion, etc)	we have it as an explosion. She just said there was a fire.	contradictory information	**1**
	There is a fire, or an explosion or something in the building	fragmented information	**2**
code assignment	-What job are you giving me? Do you want to make a new job? -This will be a new job, because this is a rescue -The whole thing is a rescue	stimuli do not univocally converge towards an alarm code	**3**
	ACD wants to send me a new job to say that the people are trapped. I told him everybody is trapped anyway.	lack of consensus for alarm code assignment	**7**
	Lieutenant Knight. Hold on one second. I'm going to see if the lieutenant wants me to set up an independent job.	search for consensus through the hierarchy intervention	**8**
	-The whole thing is a rescue. -The one before was put down as an explosion -Yeah, but it's a plane crash. Any time we get a call like that, automatic rescue.	search for consensus through peer discussion	**9**
	My job number on this one is 788, 788. You can cross-reference it in case they cross-reference it with the job number of the Trade Center. Trade Center number of the job is 727.	responders' discussion about what to input in the information system	**12**
	the reason that I did it is because a caller is stating that a person on a separate floor was -- wanted to know a question because they're having difficulty breathing. Instead of putting it on one job where it might or possibly could be overlooked, I used a separate job.	responders' discussion about the consequences of their action (code assignment)	**13**
lots of calls	No, I'm going to go. I have other calls to take.	time pressure due to high number of calls	**4**
slow information system	It's just that the computer is doing all kinds of crazy things. We have so many crazy things going on here.	information system overload	**5**
total recall	Yeah, dispatcher. Guys on recall, where do you want us to go?	lack of knowledge about the recall routine	**6**
on events	-Another plane. This is a whole new thing now. -They're saying it might be a terrorist attack. - It would have to be because what are the odds of two planes crashing into the same building; okay?	responders' discussion about the assessment of the situation	**10**
on what to do / how to answer caller's questions	I've got a guy on the 106th floor and he wants to know how to deal with a hundred people. He wants some directions. I don't know.	responders' discussion about the instructions given to the callers	**11**
uncertainty on what to do	We are in a state of confusion. I don't even know if we can handle all of this We don't want to give you wrong information I don't know what to tell you. I'm so sorry I don't know what to tell you to do. It's too hard to tell you what to do.	responders' emotional involvement (uncertainty on what to do)	**14**
uncertainty on events	All of these jobs printed out, but I need them to be put together. It's random.	responders' emotional involvement (uncertainty on the events)	**15**
incredulity, shock, fear	And it's an awful thing, it's an awful, awful, awful thing to call somebody and tell them you're going to die. That's an awful thing. God. Nobody is going home on this side It's crazy. Yeah, do you realize what's going on?	responders' emotional involvement (incredulity, shock, fear)	**16**
concern or worry	No, I feel so bad that we can't do more. You don't know. Oh, boy. God forbid.	responders' emotional involvement (concern, worry)	**17**

TABLE 5 Empirical Evidence vs. Theoretical Model Components

Empirical evidence about signal categorization and problem assessment phases

ID	Higher Level Concepts	a	b	c	d	e	f	g	h	i
1	Contradictory information			x						
2	Fragmented information	x								
3	Stimuli do not univocally converge towards an alarm code				x		x			
4	Time pressure due to high number of calls									x
5	Information system overload							x		
6	Lack of knowledge about the recall routine								x	
7	Lack of consensus for alarm code assignment				x					
8	Search for consensus through the hierarchy intervention					x				
9	Search for consensus through peer discussion				x					
10	Responders' discussion about the assessment of the situation		x							
11	Responders' discussion about the instructions given to the callers								x	
12	Responders' discussion about what to input in the information system				x					
13	Responders' discussion about the consequences of their action (code assignment)				x					

Empirical evidence about emotional involvement within signal categorization and problem assessment phases

ID	Higher Level Concepts	a	b	c	d	e	f	g	h	i
14	Responders' emotional involvement (uncertainty on what to do)								x	
15	Responders' emotional involvement (uncertainty on the events)	x								
16	Responders' emotional involvement (incredulity, shock, fear)						x			
17	Responders' emotional involvement (concern, worry)						x			

Theoretical model components grounded in case study	Drawn from: (reference)
a. Confidence in reliability and accuracy	Billings et al 1980
b. Alternative explanations	Billings et al 1980
c. Alternative perceptions	Billings et al 1980
d. Alternative/previous categorizations	New from case study
e. Organizational gatekeeper	New from case study
f. Possible negative consequences	Billings et al 1980
g. Urgency to respond	Billings et al 1980
h. Problem difficulty and response uncertainty	Billings et al 1980
i. Time to search for problem identification and solution	Billings et al 1980

TABLE 6 Socio-emotional exchange: 9-1-1 operators only versus operators with callers

	operators only		o. with callers					
Codes on socio-emotional exchange	n	%	n	%	Chi-square	Asymp. Sig. (2-tailed)	Mann-Whitney U	Asymp. Sig. (2-tailed)
Empaty	2	66,7	1	33,3	**		6838	,262
Certainty on events	3	75	1	25	**		6759	,100
Uncertainty on what to do	0	0	16	100	9,531	0,002	6248	,002
Uncertainty on the events	10	76,9	3	23,1	*		6294	,002
Incredulity, shock, fear	12	80	3	20	13,600	0,000	6136	,000
No news	3	13	20	87	5,705	0,017	6309	,017
Encouragement, optimism	2	3,8	51	96,2	30,106	0,000	4866	,000
Concern, worry	5	55,6	4	44,4	*		6733	,208

* 1 cell has an expected count less than 5

FIGURES

Figure 1. Grounded Model of Mindfulness

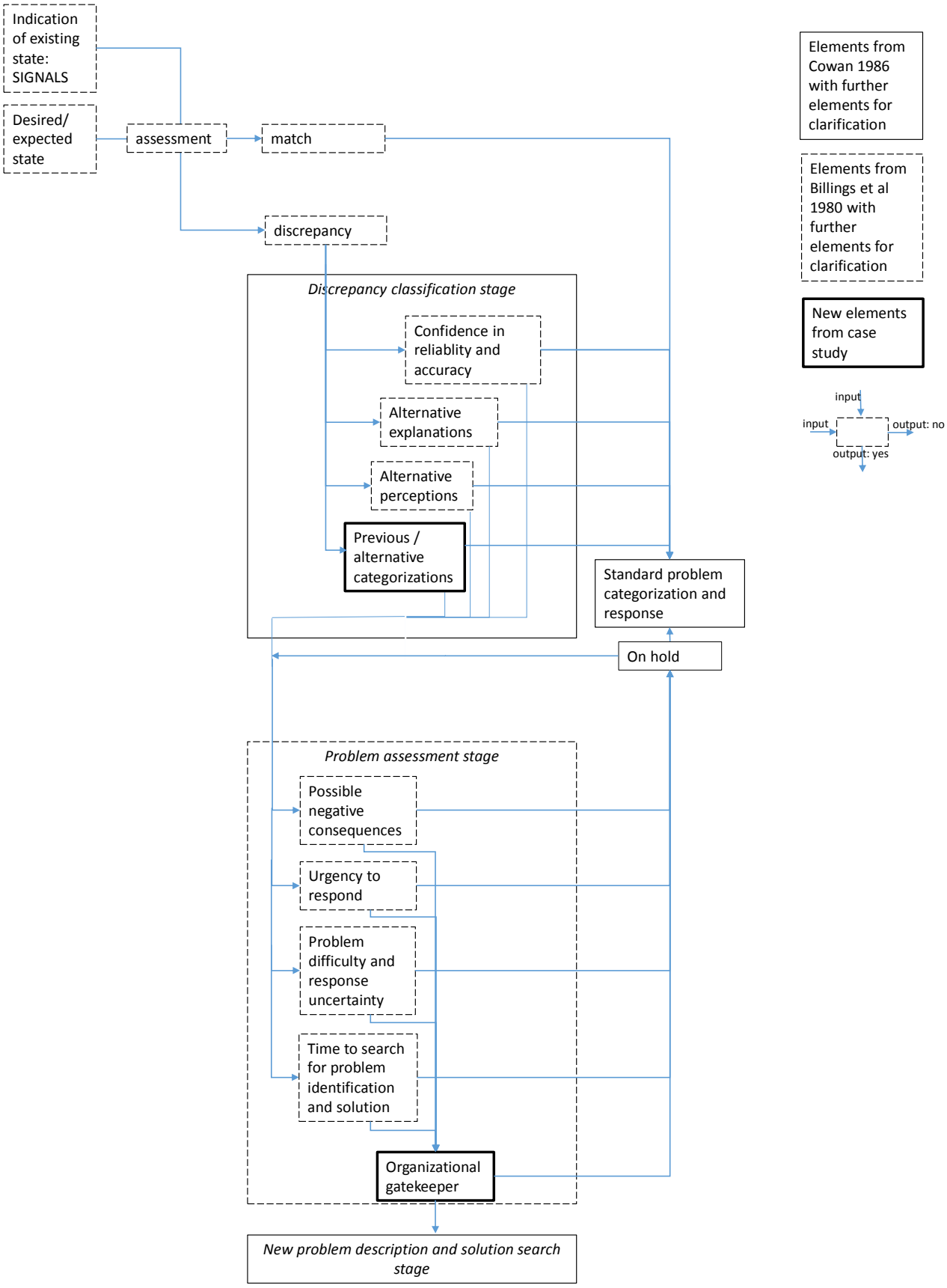


Figure 2. Socio-emotional exchange over time weighted for number of calls per interval

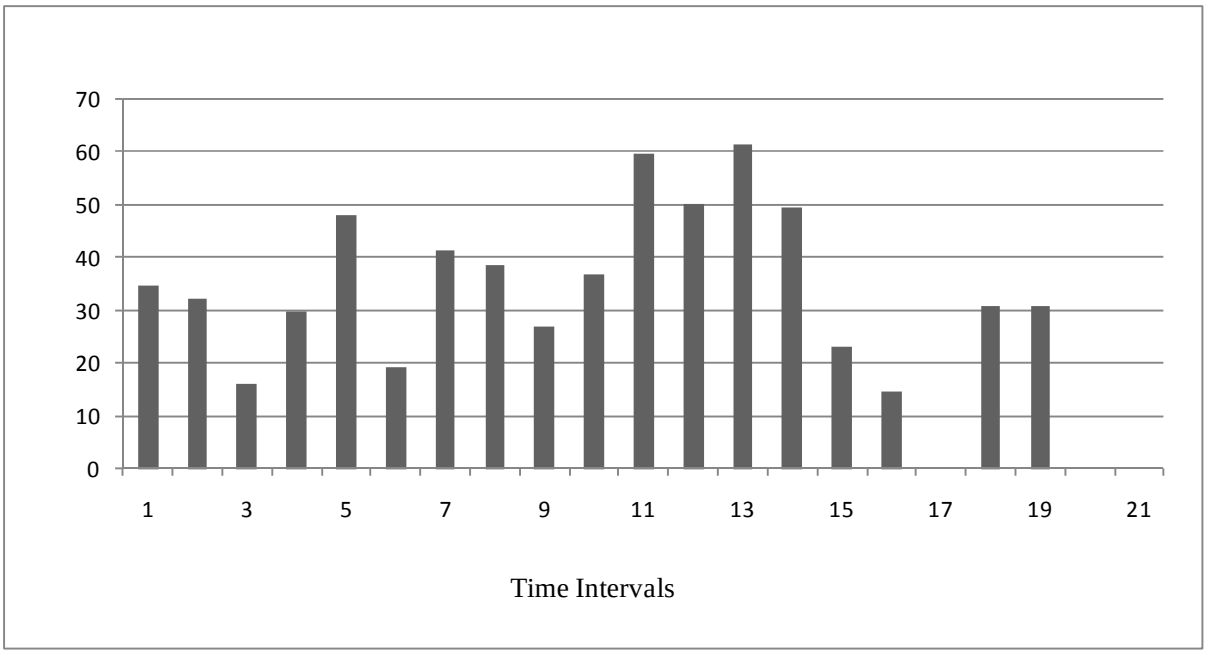
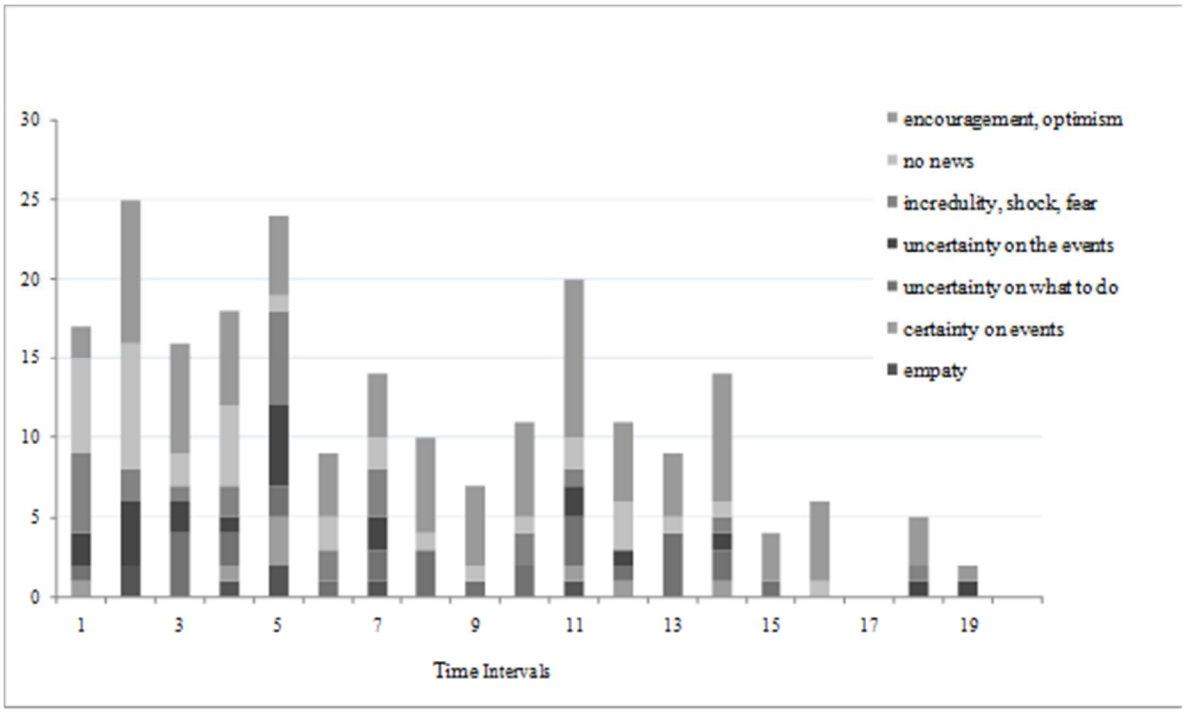


Figure 3. Distribution of types of emotions



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