"How can a horse be in two places at once?": Group sensemaking using diverse and ambiguous information

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Abstract. Sensemaking describes the activity of seeking to understand complex situations and extracting meaning from diverse, and sometimes conflicting, information. We report results from a study of groups attempting to construct narratives from diverse forms of fabricated incident information (reflective of the ever increasing diversity available on the internet) deliberately designed to be ambiguous. We found that groups demonstrated a rich range of convergent and divergent behaviours and manipulations of paper-based stimuli. We conclude by providing discussion of how these insights can be used in the design of web-based collaborative sensemaking tools.

Keywords., collaboration, decision making, group processes, sensemaking

1. Introduction

In the past individuals and organisations were limited in the amount of information that they could find out about events. However, today's 24/7 media and the world wide web afford access to vast and varied information from sources ranging from the official to citizen journalism, individual testimony and videos and photographs shared through social media. In the present work we were interested in how sensemaking, the process of coming to a plausible understanding of a complex situation, could be carried out by groups using diverse and often ambiguous/contradictory information (e.g., map mashups, tweets, videos, photographs, blogs etc.). We were aiming to capture concepts and requirements for the design of online platforms that would allow groups of citizens to interpret crisis events leveraging information sources from the web (for one prototype see Blum, Kefalidou, Houghton, Flintham, Arunchalam & Goulden, 2014). In particular, we sought to capture how when collocated participants worked with and developed different shared representations of meaning and narrative in order to provide appropriate support for reasoning and debate within a shared user interface for distributed working.

1.1 Group sensemaking and artefacts

Weick's (1995) seminal view on sensemaking was that it was a process that emphasises social processes, the extraction of cues and values consensus and plausibility over accuracy (to paraphrase: "telling a good story"). It is this discursive and open-ended social element that distinguishes it from concepts like Situation Awareness (SA) (Endsley, 1995) and Boyd's Observe-Orient-Decide-Act (OODA) loop (Boyd, 1995). Since this point, the sensemaking paradigm has evolved and become of interest to a range of stakeholders ranging from the military to the emergency services, medicine and even social policy. More recently, Busby and Hibberd (2004) identified the role of artefacts in crisis sensemaking in railways identifying accidents, their implicated artefacts and sensemaking modes (e.g. improvising, exonerating, dichotomising, regressing, permitting, sufficing, extrapolating, completing, categorising, conforming, gradating, normalising, rationalising, habituating and discharching). In a similar manner, Dyrks, Denef and Ramierz (2008) explored the role of artefacts within firefighting

sensemaking, providing support to the notion that ad hoc maps act as boundary objects but also that explicitly-expressed uncertainty and informed guesses regarding the crisis situation are common themes appearing within firefighters' sensemaking. Baber and colleagues followed an intelligence analysis approach to study sensemaking in a laboratory setting focusing on data, frames and narrative elements of sensemaking (Baber, Attfield, Wong & Rooney, 2013). They adopted a scenario and personas approach according to which the teams of participants had to account for in order to answer specific questions (e.g. "Why arrest the X person?") and found that perceptions of 'evidence' as well as perceptions of 'narrative' appear to interplay strongly in determining sensemaking frames. Different visualisations/representations also manifest depending on the task at hand (e.g. construction of timelines for log information vs. social network diagrams for phone logs).

2. Methods

The approach we took to examining this problem was to present groups of participants with a rich set of information in varied formats (tweets, maps, pictures, blogs, newspaper reports etc.) While formed around a central incident concerning a road accident, a number of side/co-occurring incidents were embedded within the reports and information provided. The intention was to create a situation reflective of the 'information overload' associated with the WWW and to provide a challenging situation for sensemaking to provoke controversy and group negotiation.

2.1 Participants

Twenty-six participants (M=31.06, SD=5.12; 15 Male and 11 Female) were recruited through opportunity sampling and were randomly assigned into groups of 2-3 people. We had 10 groups in total (including 2 pilot groups of x2 participants). From the remaining eight groups, six were of 3 participants each with the remaining groups having 2 participants each.

2.2 Materials

Twenty different paper-based stimuli were fabricated by the researcher to cover a storyline of minor crisis incidents. These incidents involved motorway car accidents, escaped horses, road works, robbery incidents, protest incidents, public events and bad weather. The fabricated stimuli consisted of newspaper articles, maps, social media entries, blogs and motorway condition feeds. Examples of the stimuli can be seen in Figure 1. The stimuli were presented to the participants in the format of a loose leaf portfolio the contents of which were shuffled for each group.



Figure 1. Examples of materials provided (clockwise: map, tweets, website, traffic update feed)

2.3 Procedure

Participants were briefed and asked to work collaboratively throughout the study session and they were told that they could produce a timeline of what had happened if they felt that would help them in any way. The task was introduced to them in nondirective manner in order to facilitate free and non-biased interpretations and interactions. Participants were given pens, colour markers, papers, pencils and post-it notes to use if they wished throughout the session and they were told that they could use the available whiteboard as well for making notes. They were also told that they could use the paper stimuli as they saw fit (annotating, folding, tearing etc.). Participants were asked to think aloud throughout the session in order to capture collaboration verbal elements and actions on-the-go. If participants remained silent for 1 minute, they were prompted to continue thinking aloud. The researcher sat opposite the participants and pictures, audio and video of the participants and their interactions were captured throughout. The study session was of 2-hours maximum duration and was audio, photo and video-recorded throughout. Each session observed only one group.

3. Results

Thematic analysis was applied to the field notes, video observations and transriptions of participant dialogue and 'thinking aloud' protocol analysis approach was also adopted to analyse participants' verbalisations.

3.1 Group behaviours

Theme	Description	Example
Clustering/	All participants in all groups exhibited	- P1 "What does it all have to
sorting	clustering behaviour as part of filtering the	do with the traffic
	different stimuli material that they have	report?() maybe all is
	been given.	fragmented"
	Groups physically re-sorted stimuli in	- P2 "it would make sense
	various ways; source-based, time-based,	if we try to arrange them by
	content-based (same incident?) or general	theme?"()

Table 1. Group behaviours and example dialogue

		D2 " Labin Labor mar all
	relevance to a point being argued.	-P3I think they are all
		grouped together
		- P1Welllet S look at the
		twitter jeeds nowcan we put
A		the articles chronologically?
Annotating	Participants exhibited different annotating	See Figure 2.
	styles: from making their own notes or	
	timelines on a separate paper, to	
	annotating (via notes and underlining) on	
	dimethy on using next it notes. These	
	anectry of using post-it notes. These	
	reflective notes on the evaluation of the	
	stimuli given to proliminary timolinos on	
	separate sheets to post it notes that	
	indicated potential links between the	
	stimuli	
Pocognising	Recognising behaviours appeared in	"When the Chesterfield
Recognising	groups' sensemaking in the form of either	accident happened?"
	realizations regarding misconcentions	- "2 days ago means the same
	information they haven't considered	dav - 7th Mav
	before or through a rhetorical and self-	- " is it the same horse? so
	directed queries that aimed at either	where is this Shell
	stirring discussions or prompting	garage?() " so there is
	interactions.	the horse story "[: starting
		making the paper timeline for
		the horse story]
		- " <i>this</i> [:referring to the
		badgers protest] is noiseit is
		irrelevant"
Making	Participants iteratively attempted to	- P4: "the horse may have
connections	connect incidents and information with	to do with the lorry ones"
	each other. However, this behaviour varied	- P5: "they must vaguely
	depending on the individuals. For	have to do with one
	example, some individuals appeared to be	another"
	more open to concatenating incidents	- P6: "there is the runaway
	while others exhibited a more reluctant	accident that does not seem to
	stance. This process of making	be connectedI wonder if
	connections was distinct from hypothesis	there is correlation between
	generation in that it was concerned with	expected (for example, road
	linkages between sets of information	works) versus unexpected
	rather than asserting facts based upon the	inclaents (for example, thefts
II	Content.	and accidents)
Hypotnesising	Participants generated concrete hypotheses	- P/: WellI inink ine
narrauves	hoth globally and locally and in relation to	the accident "
	the information presented to them. Group	ine ucciueni.
	dynamics frequently played a role in	
	determining the group's stones on lack of	
	confidence and lack of trust in the	
	confluence and luck of trust in the	
	levidence material More conservative	

	narratives by setting clear borders within	
	their group's sensemaking journey.	
Debating	All groups engaged into debating that	-P8: "what information
	varied in terms of intensity and content.	does this give us apart from
	Some of the debates involved more	being a map?"
	'technical' elements (e.g. validity of	-P9: "it is important to see
	stimuli materials) and other times involved	the overall picture it helps
	more 'qualitative' sensemaking elements	you understand which roads
	(e.g. plausibilities and potential scenarios).	are adjacent"
		- P10: "I agree but what I say
		is that is a quite different
		informationit does not tell
		you about the incident"
Negotiating	Negotiating was another sensemaking	- P11: " <i>I think ehmI think</i>
	behaviour that assumptions (drawn from	there are 3 different horse
	attempts to construct hypotheses and	accidents"
	narratives) and timelines (which is mainly	-P12: "are they?"
	drawn from the 'technical' aspects of the	- P11: "ehm[looking again
	sensemaking processes such as datestamps	at the stimuli] does that mean
	and timestamps) were reconciled in search	that a horse caused 3
	of group agreement.	accidents?very
		successful[being ironic]"

3.2 Timeline construction and physical interaction

All groups produced timelines that aimed to represent the flow and nature of incident(s) presented, discussed and/or implied within the stimuli material given. The timelines produced differed in terms of interactions, content and processes involved in their constructions. Some groups tended to create largescale timelines using all the available physical space to sort and categorise the stimuli. In other cases participants favoured constructing different timelines in parallel which were then merged into a negotiated and agreed overall timeline. We also observed a range of other interesting uses of the paper stimuli and the surrounding environment. These included: (sometimes multiple) numbering of stimuli to record and allow reconstruction of different orderings and categorisations, the use of positioning in personal space to allocate the work of reading and processing stimuli, the use of the table as either a topography (distance considered in terms of relevance, time, relatedness) or to represent actual map geography pertaining to the incident. In other cases the provided maps were annotated with markers or post-it notes corresponding with particular stimuli. Additionally, some participants also copied or tore up stimuli to generate additional more specific content. Generally speaking participants preferred to work with the original stimuli rather than transcribing content to post-it notes usually owing to concerns about loss of rich content while it remained "in play" as ambiguous in meaning and narrative possibility. However, specific exceptions were found in timeline construction late in the process when the content and its meaning were widely established within the group and could be summarised in an agreed manner.



Figure 2. Timeline construction and evolution.

3. Conclusion

Drawing on our results, there are certain aspects that emerge that appear to be facilitative of sensemaking and thus potentially valuable for incorporation into the design of appropriate web-based systems that support collaborative sensemaking (e.g. Blum et al., 2014) in a distributed or co-located manner:

- Facilitating collection and re-collection of material from different sources as demonstrated by our participants searching and cross-validation behaviour.
- Facilitating multiple linked clustering and categorising as we observed that our participants grouped and re-grouped information based on content, time/date and origin.
- Allowing for different levels and types of filtering of information (e.g. relevant vs. irrelevant information).
- Providing features for verification and reliability checks as we realised that our participants engaged heavily in debating reliability issues.
- Facilitating different ways to visualise and organise information (e.g. map annotations, network diagrams, timelines, lists) as we observed a variety of ways that people interacted and represented their sensemaking thought. The most flexible way to do this might be to provide different spaces in which items of information can be positioned and linked with user-defined topographies (e.g., positioned by relative recency, relevance, topic etc.).
- Accommodate social interactions that are potentially both synchronous and asynchronous in order to maximise interactions and sensemaking both on an adhoc and 'live' level. In that way, reflection and reviewing can also be accommodated.

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