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The Multifaceted Sensemaking Theory: A Systematic Literature Review and Content Analysis on Sensemaking

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Abstract: There are several key sensemaking models and theories that have attracted a lot of attention among researchers and practitioners in the last few decades. The adaptation and application of sensemaking has varied by field of study, organizational type, and industry. This study explored these sensemaking models and theories to better answer the following questions: what is sense-making/sensemaking? How is sensemaking practiced today compared to the original sensemaking frameworks, models, and theories? To answer these questions, the current study conducted a systematic literature review and content analysis of current research involving sensemaking methods, practices, and techniques. As a result, topic modeling and data analytic techniques were used to construct a multifaceted conceptual framework that has been contrasted and compared with previous sensemaking frameworks, models, and theories to show its coverage and coherence. The new multifaceted sensemaking (MSM) theory consists of nine stages with defining characteristics for each stage that were either derived from the data analysis or conceptualized by the researcher based on the literature review. The new theory presented demonstrates how previous sensemaking theories evolved and have influenced both practice and research today. The multifaceted sensemaking theory is influenced by previous sensemaking theories while also representing sensemaking in current practice. The multifaceted sensemaking theory contributes to the sensemaking field of study a new theory with nine stages and defining characteristics.

Keywords: sense-making; sensemaking; sensing; sensegiving; synthesis

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1. Introduction

Sensemaking has been acknowledged as the catalyst for shifting research focus from a system-centered to user-centered phenomena in the field of information sciences [1]. Sensemaking has also shifted the focus away from sender and receiver transactions in communications studies to constructions that are entangled with time, places, and perspectives [1]. Other shifts identified research as a practice in communication as found in Dervin's [2] term "verbings," the focus is on verbs rather than on nouns.

At the macro level, sensemaking as a methodology has been described as a "methodology between the cracks" [2]. Sensemaking has been portrayed as filling in the cracks between traditional academic disciplines (e.g., communication studies, information science, psychology, sociology). Filling in the cracks provides a more vivid picture of what is happening in circumstances where traditional theories and practices fail to shine a light.

At the micro level, sensemaking addresses the cracks or gaps in individual cognitions. These cognitive cracks describe one's ability to make sense of situations and structures, how these understandings differ from current knowledge structures, and one's ability to create new structures that frame the new situation around its constraints. This gap has been portrayed as the "Situation-Gap-Outcome Triangle," representing the recursive relationship between structure and agency when practicing sensemaking [2].

The conceptualization of Dervin's situation-gap-outcome triangle was described by Naumer, Fisher and Dervin [1]:

> "The sense-making moment is the point in time-space when a person experiences a gap while moving through time-space. The situation and outcome, as experienced, are informed by the nature of the situation, its history, its constraints, its relevant external power structures and other situational, contextual, and personal factors. The person bridges this gap by experiencing questions and muddles that lead them to construct bridges consisting of ideas, thoughts, emotions, feelings, hunches, and memories. Sometimes these 'bridges' are repetitions from the past; sometimes they are entirely new; sometimes they are deliberate and planned; sometimes capricious; sometimes unconscious at the time of action but brought to consciousness in interviewing talk; sometimes tactic and unarticulated but alluded to in examples and stories." (p. 3)

While the field of sensemaking has grown over the years, it is still a young multidisciplinary field of study. Researchers who have grown both study and practice have contributed greatly to make sensemaking or sense-making what it is today. However, as with any emerging field of study, there is still much to be discovered relating to sensemaking. This expansion of new frameworks and theories often leads to ill-defined constructs and propositions. Maitlis and Christianson [3] explained that "the last decade has seen something of a proliferation of sensemaking-related constructs, which are not always clearly defined" (p. 108). Because sensemaking has grown into a multidisciplinary field, it contains streams of research from several distinct disciplines. When this occurs, as with any new focus of research, it becomes important to synthesize scholarship to find commonalities and differences from all disciplines involved. Urquhart, et al. [4] highlighted this need in the following: "Reviews emphasize the need for meta-synthesis of research" (p. 1). In Dervin and Naumer's [5] review, they presented that there were "inconsistencies, even contradictions, between the various approaches" (p. 4121) to sensemaking.

Current research contains an overview of the field of sensemaking from the founders of the discipline. This study then reviews current research on sense-making and sensemaking and synthesizes this body of research into a new multifaceted theory of sensemaking. This multifaceted theory of sensemaking is contrasted with current frameworks, methods, and theories of sensemaking to show its growing breadth of coverage and level of coherence.

2. Literature Review

The first bibliographical entry in the "Oxford Bibliographies" on sense-making/sensemaking identified five main researchers, namely Dervin, Weick, Russell, Snowden, and Klein who have been instrumental in evolving the field of sensemaking [4]. This literature provides a review of the literature captured in the Oxford Bibliographies sensemaking/sensemaking entry with a snowball technique to capture additional sources from the reference sections of the articles from the five main researchers highlighted. A systematic review process was followed to collect literature for the topic modeling and data analytic techniques presented in the Methodology section in the current study.

As a field of practice, sensemaking aims to design practices and frameworks that are meaningful and contextual, rather than continued reliance on frameworks rooted in "expertise imposed on users" [1]. This design comes from agents utilizing sensemaking methods as they navigate their environment while balancing between structure and agency to develop relevant frameworks for their time and space. This practice is represented in the literature as "[humans] users as theorists and knowledge-makers in their worlds" [1,6]. Sensemaking provides the tools and methods that allow agents to be creative and innovative autonomous agents.

While there is no universally agreed upon definition for sensemaking in the literature [7]. Sensemaking assumes humans live in an ever-changing reality and necessitates a perpetual process of bridging information gaps while informing our actions. We create

sense by creating, seeking, using, and rejecting information and knowledge to guide and inform our actions and behaviors.

A general definition for sensemaking includes the following from Golob [7]: "sense-making allows humans to be in a constant process of learning and seeking knowledge when confronted with different kinds of challenges." (p. 1). For this study, the author provided the following definition of sensemaking: The process of interpreting ambiguous, complex, unknown, or unexpected events involving multiple processes and interactions resulting in representative actions.

Sensemaking has emerged through the work of five main major research streams:

(1) Dervin's sensemaking in user studies, human information behavior.

(2) Weick's sensemaking in organizational communication.

(3) Snowden's organizational sense-making in knowledge management.

(4) Russell's sensemaking in HCI.

(5) Klein's sensemaking in cognitive systems engineering [4,7–9].

A summary of sensemaking definitions is provided in Table 1. These definitions are listed by Discipline/Theory to represent sources outside of the five major research streams previously identified (e.g., Oxford Bibliographies, General).

Table 1. Sensemaking Definitions.

Discipline/Theory	Definition
Oxford Bibliographies	The process through which people interpret and give meaning to their experience [4].
The Learning Power of Listening (Sensemaker Guide)	The process of describing, summarizing, analyzing, making sense of, and communicating data and emerging knowledge to make decisions and act on the findings [10].
General (Individual)	Sensemaking is defined as meaning creation based on current and prior interpretations of thoughts generated from three sources: external stimuli, focused retrieval from internal memory, and seemingly random foci in working memory; such sense making is constructed on cultural pilings held unconsciously in long-term memory [11].
General	Sensemaking is related to acquisitions, interpretations, understandings, and actions, which are a result of processes on the cognitive level [7].
General (individual, group, societal)	A communicative process that occurs through social interaction and relies not only on interpretations but emerges in conversations and dialogues on different levels-internal and external as well as on individual, group, and societal level [7].
General	Sensemaking is the process through which people work to understand issues or events that are novel, ambiguous, confusing, or in some way violate expectations [3].
General	A process, prompted by violated expectations, that involves attending to and bracketing cues in the environment, creating intersubjective meaning through cycles of interpretation and action, and thereby enacting a more ordered environment from which further cues can be drawn [3].
General	Sensemaking refers to processes of meaning construction whereby people interpret events and issues within and outside of their organizations that are somehow surprising, complex, or confusing to them [3,12].
General	Sensemaking is a constant process of acquisition, reflection, and action. It is an action oriented cycle that people continually and fairly automatically go through in order to integrate experiences into their understanding of the world around them [9].
Dervin	Focuses on how messages are understood by receivers of information and communicated in their life contexts recognizing that there are differences in people's understandings, expertise, social positions, situations, and other factors that impact sense-making [1].
Dervin	Understand ambiguous and puzzling issues and events [7].
Dervin	Sense-making is related to the processes by which humans attempt to understand ambiguous and puzzling issues and events or to bridge the gaps of realities [7].
Dervin	To find a way of thinking about diversity, complexity and incompleteness that neither drowns us in a tower of babel nor composes homogeneity, simplicity and completeness [6].

Table 1. *Cont.*

Discipline/Theory	Definition
Klein	Sensemaking is motivated, continuous effort to understand connections (which can be among people, places, and event) in order to anticipate their trajectories and act effectively [8].
Klein	How people make sense out of their experience in the world [13].
Klein	A means of achieving a "state-of-knowledge, or, in other words, some kind of mental model representation of the state of affairs in the world [7].
Klein	Sense-making is both a backward-looking (forming mental models that explain past events) and forward -looking process (forming mental simulations on how the future event might unfold) [7].
Russell	Sensemaking is the process of searching for a representation and encoding data in that representation to answer task-specific questions [14].
Russell	Sense-making is about choosing, using, and shifting between different cognitive and external resources that are available and with which a sense-maker is able to reduce the costs of information processing [7].
Snowden	How we make sense of the world so we can act in it [8].
Snowden	Sensemaking or sense-making is the process by which people give meaning to their collective experiences. https://en.wikipedia.org/wiki/Sensemaking (accessed on 12 July 2022)
Weick	Sensemaking involves the ongoing retrospective development of plausible images that rationalize what people are doing [15].

2.1. Commonalities

These definitions of sensemaking have commonalities that include:

- Sensemaking can be labeled as a process.
- Sensemaking emerges when something that needs explanation occurs.
- Sensemaking is individual but can also be social because individuals are embedded in the social.
- Individuals' actions constitute their environment [7].

Sensemaking involves multiple processes (cognitive, emotional, feelings, intuition) [7] and involves multiple levels of analysis: individual, group, organizations, societal [7]; individual and intersubjective [16]; individual, collectivity, organizational micro and macro [17]; self, collective, organizational [18]. Sensemaking is also contextual and involves representational shifts. Representational shifts account for the various techniques that are required for different levels of analysis considering the context or environment [5,8].

2.2. Contrasts

While there are commonalities in these sensemaking definitions, there are also some contrasts between the different schools of thought. There are differences in the claims and approaches/methods that are practiced by each school of thought [2]. Snowden and Weick viewed sensemaking as an interpretive and collaborative process whereas Dervin viewed it as being interpretive and individually focused [7]. Some researchers and practitioners view sensemaking as an activity with a beginning and an end, while others view it as being a long-term iterative process [9].

In a review of the different sensemaking theories and practices, Kolko [9] summarized the similarities and differences in a table. This table is provided in Table 2.

Table 2. Sensemaking Methods Comparisons.

	Positions Sensemaking as	Style of Engagement	Effective for	Length of Engagement	Highly Dependent on
Hoffman, Klein, and Moon	A process of problem solving	Both personal and shared	Long-term socialization of complex problems	A long period of time	Participant's perspective and interpretation

Table 2. *Cont.*

	Positions Sensemaking as	Style of Engagement	Effective for	Length of Engagement	Highly Dependent on
Dervin	A process of education	Personal and contingent on experience	Learning	Continually and forever	Participant's perspective and interpretation
Russell	A process of modelling	Personal	Specific tasks	A finite period of time	Participant's perspective and interpretation
Snowden	A quality of an artifact	Highly collaborative	Early stages of problem solving	Formal and finite period of time	Participant's perspective and interpretation
Weick	A conversational process	Highly collaborative	Organizational growth and planning	Both short and long term	Participant's perspective and interpretation

Note: From [9]; available as open access through https://dl.designresearchsociety.org/cgi/viewcontent.cgi?article=1848&context=drs-conference-papers (accessed on 5 August 2022).

2.3. Why It Is Needed (When Faced with Uncertainty and Ambiguity)

Sensemaking is triggered when events or situations become ambiguous or uncertain, when the flow is disrupted, when our understanding is interrupted [3], and when our understanding of our world becomes challenged. In general:

We find that sensemaking begins when people experience a violation of their expectations, or when they encounter an ambiguous event or issue that is of some significance to them. Often this involves a threat to taken-for-granted roles and routines, causing those in organizations to question fundamental assumptions about how they should act [3].

2.4. Sensemaking Ontological Roots

Sensemaking has two essential ontological roots, individual and social. At the individual level, sensemaking is viewed as an individual process grounded in social cognition that examines various frameworks for making sense of environments/situations: schemes, representations, mental maps [3,7], schema, schemata, and interpretive schemes [3]. This distinction between individual and social ontological roots highlights each as being ontologically dependent entities where social cannot exist without the individual. These two entities are also created in that reality is socially created, requiring the social to inform the individual. The individual ontology is grounded in social cognition and can be represented by frameworks, schemes, representations and mental maps. The social ontology is translated through communicating via conversations, storytelling, and narrative [7].

2.5. Characteristics of Sensemaking

Depending on the school of thought, sensemaking has been described as consisting of several characteristics. The basic characteristics involve the cognitive processes of acquisition, interpretation, understanding, and acting [7]. Sensemaking is practiced through communication and through conversations, storytelling, and narratives [7].

Dervin and Naumer [8] identified characteristics for information-related behaviors, diverse behaviors, internal and external behaviors, and cognitive work. Klein introduced a set of characteristics for his cognitive task analysis (CTA) method and Weick introduced characteristics for organizational communication. Snowden provided a set of methods for practicing sensemaking and Dervin provided a set of characteristics for the Library and Information Sciences (LIS) [8].

The different characteristics from the literature are provided in Table 3.

Table 3. Sensemaking characteristics.

Classification	Characteristics
Cognitive Processes	Acquisitions, interpretations, understandings, actions [7].
Translated Through Communication	Inner and outer conversations, storytelling, narratives [7].

Table 3. *Cont.*

Classification	Characteristics
Distinct Aspects	Comprehending, understanding, explaining, attributing, extrapolating, predicting [3].
Information-related Behaviors	Processing, retrieving, searching, gathering, foraging, using, web-browsing, rejecting, collaborating, risk-facing [8].
Diverse Behaviors	Internal: cognitive, emotional, spiritual. External: seeking, finding, foraging, retrieving [8].
Cognitive Work	Thinking: knowing, understanding, planning, deciding, problem solving. Cognitive Work: interplay between perception, cognition, action [8].
Cognitive Task Analysis (Klein)	Understand what goes on inside their heads, how they think, what they know, how they organize and structure information, know what they seek to understand better [8].
Organizational Communication (Weick)	Comprehending, constructing meaning, searching for patterns and frameworks, redressing surprise, interacting with others, common understandings, narratives, storytelling, focus on failures and successes [8].
Snowden	Focus on narratives, analyze narratives, naturalized sense-making (humanistic approaches), action research, story circles, knowledge discourse points, connecting frameworks, contextualizations, narrative databases, convergences, alternative histories [8].
Library and Information Sciences (LIS; Dervin)	Attend to: context, time, space, movement, gap, horizon, energy, power, history, experience, constraint, change (flexibility, caprice, chaos), constancy (habit, inflexibility, rigidity) [8].
Dervin's Sensemaking Triangle	Changing as moving through time and space, navigating certainty and uncertainty, exploring gaps between certainty and uncertainty, confused, doubting, sure and unsure, struggling with structures, constraints, agency, being acted upon [8].
Individual Sensemaking	External stimuli, focused retrieval from internal memory, seemingly random foci in working memory [11].
Processes	Ongoing, social, retrospective, driven by plausibility (not accuracy), grounded in identity construction [8].
Frameworks	Frameworks, comprehending, redressing surprise, constructing meaning, interacting, mutual understanding, patterns [19].
7 Characteristics (Weick)	Grounded in identity construction, retrospective, enactive of sensible environments (socially constructed), social, ongoing, focuses on and accomplished by extracted cues, driven by plausibility rather than accuracy [7].
Verbings (Dervin)	Feel, experience, be aware, comprehend, grasp, ascribe meaning to, understand, interpret [5].
Experts and Decision Making (Klein)	Understanding the current situation, how it got there, where it is going [5].
SIR COPE (Weick)	Social, identity, retrospect, cues, ongoing, plausibility, enactment [17].
6 Themes (Weick)	Redoing, labeling, discarding, enacting, believing, substantiating [17].
Organizing Processes (Weick)	Organize flux, noticing and bracketing, labeling, retrospective, presumptions, social, systemic, action, communicative [17].
4 Conditions (Weick)	Stay in motion, have a direction, look closely and update often, converse candidly [17].
Key Principles (Snowden)	Describing, mapping, using new language, focusing, metaphor, perspective-taking, dynamic [20].
Sensemaking Learning Loops (Russell)	Search for representations, instantiate representation, shift representation, consume encodons [14].

2.6. Researching Sensemaking

According to Dervin [6], when researching sensemaking, one must be able to identify/represent the foundational concepts of time, space, movement, and the gap. Researching how sensemaking has been accomplished involves noticing or perceiving cues, creating interpretations, and taking action [3]. Communication and individual-level research studies have focused on cognitive, emotional, and physical processes that explain the sensemaking processes [7]. Other research studies concentrate on the bifurcation between structure and agency [2], while others focus on power, verbings, and utilize the situation-gap-outcome triangle [1]. Sensemaking also crosses the multi-level divide in that it can be viewed from the individual level of analysis, at the social level of analysis, or both.

Sensemaking is a process in theorizing where agents become theorists [1]. Methodologies for researching sensemaking, beyond theory building, include qualitative, quantitative, and mixed method research methods. Some of the more common methods identified include case studies, ethnographic techniques, conversation, discursive analysis, inter-

views, observations, narrative analysis, grounded theory, mathematical modeling, social network analysis, action research, and storytelling [7]. Naturalized sensemaking can involve action research, narratives, story circles, knowledge discourse points, the Cynefin framework, contextualizations, narrative databases, convergences, alternative histories, and Sensemaker [8].

Guijt, Gottret, Hanchar, Deprez and Muckenhirn [10] highlighted four processes for conducting research on sensemaking: primary analysis, collective interpretation, comprehensive analysis, and communication in use. Russell, Stfik, Pirolli and Card [14] identified learning loops for making sense of problems that included: searching for representations, instantiating representations, shifting representations, and consuming encodons (coded information that emerges from data).

Other sensemaking studies concentrated on events that trigger sensemaking. For example, Maitlis and Christianson [3] highlighted triggering events for sensemaking: "issues, events, or situations-for which the meaning is ambiguous and/or outcomes uncertain" (p. 70). Some triggers listed involved environmental change (unplanned change), organizational crises, threats to identity (individual and organizational), and planned change initiatives [3].

3. Methodology

The research methodology included topic modeling and data analytic techniques to construct a multifaceted theory that has been contrasted and compared with previous sensemaking frameworks, models, and theories to show its coverage and coherence. The following sections further describe the processes utilized in this study.

3.1. Research Design

Content analysis is a common research method concerned with identifying the presence of certain words, phrases, concepts, and relationships [21]. It enables researchers to employ reduction methods to exclude irrelevant information to build more coherent and manageable research data sets. Figure 1 shows the search process that started with data collection, data processing and preparation, data analysis, and topic identification.

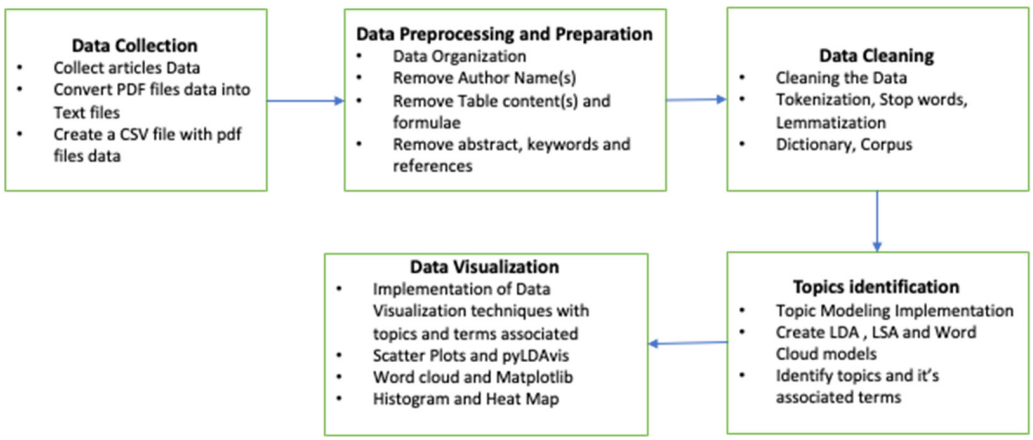

Figure 1. Research process.

Research articles were obtained from the Web of Science database using the keywords "sense-making" OR "sensemaking." The initial search looked for these keywords in the "title" of the database's articles. There was a total of 1583 articles from this initial search phase.

To reduce the number of articles, the researchers narrowed the search to five years (2018 to 2022). This resulted in 639 articles. Selecting articles in "English" reduced the number of articles to 625. Researchers then selected the following categories from the Web of Science database: "Business" to reflect Snowden and Weick's sensemaking theories; "Communication" to reflect Dervin's sensemaking theory; "Information Science Library Science"

to reflect Russell's theory; "Psychology Applied" to represent Klein's theory. Reducing the number of articles to 165. Finally, researchers selected the following research areas from the Web of Science database: "Communication" and "Information Science Library Science." This reduced the total number of articles to 68 articles. Eight articles could not be accessed or duplicated. The total number of articles used for the text analysis was 60.

3.2. Data Analysis and Topic Modeling

Different topic modeling techniques were utilized to generate various topics. Topic modeling techniques generate "themes" that are collections of related words. The following topic modelling techniques were used:

1. Latent dirichlet allocation (LDA): LDA expects that a variety of themes be used to create documents. After then, words are generated from those themes depending on their probability distribution. Given a dataset of documents, LDA goes back and tries to determine what subjects would have initially generated those documents.
2. Latent semantic analysis (LSA): LSA aims to minimize classification-related dimensions. LSA believes that words with similar meanings will appear in texts with a similar structure (the distributional hypothesis). Singular value decomposition (SVD), a mathematical method, is used to condense the number of rows in a matrix storing word counts per document while maintaining the similarity structure between the columns. This model was created using the "Gensim" and "LsiModel" inbuilt packages, libraries, and functions. This LSA model was created following the standard method, which involved creating a word matrix, reducing the matrix, and identifying the subjects and their terms.
3. K-Means: An unsupervised learning algorithm is K-means. It starts out with a specific number of clusters. To reduce the sum of squares within a cluster, each observation is given a cluster assignment. The new cluster centroid is then determined by taking the mean of the clustered observations. Then, in an iterative process, data are redistributed to clusters and centroids are recalculated until the algorithm reaches convergence.

To understand and have better insights into the identified data set from the systematic literature review, an exploratory data analysis (EDA) applies a variety of methodologies. EDA was used in this study to comprehend the dataset and clean the data by removing extraneous material [22]. The process used for the data analysis included the following steps:

1. Establishing and using stop words: Stop words are words that do not add anything to a sentence's meaning, such as articles and conjunctions. Providing a list of insignificant words allow researchers to exclude them from their analysis, thus concentrating more on relevant words and phrases [23]. These words were defined by using the capabilities provided by Python. The researchers were able to monitor and edit the list of stopwords to be checked for accuracy. For example, English words such as "me", "us", and "you" are often used in sentences but hold little to no meaning to the sentences' contextual purpose. By eliminating these insignificant words, the analyses using Python focus only on contextually relevant words. The stopwords used during analysis were those incorporated in Python from the Python library of the Natural Language Toolkit (NLTK).

2. Tokenization: Tokenization is a technique used to break up sentences into their component words. Each word is identified as an individual "token." Letter accents and punctuation are not used in this system, and the tokens are lowercase. As an example, the word "sense-making" would make up one token, "sensemaking." In this method, shorter tokens are ignored.

3. N-gram implementation: This technique is used to extract recurring "n" word sequences from the corpus 25. Only single words are extracted during tokenization. Bigrams and trigrams 26, which are two words and three words in order, respectively, were retrieved and used in this study. (For instance, the bigrams network theory and complex network theory are trigrams.) The bigrams and trigrams used in this study were constructed using Gensim's phrases model.

4. Lemmatization: Lemmatization is the process of stripping tokens of their inflectional endings and reverting to the word's base or dictionary form. For instance, lemmatization of the word "using" causes the word to change from "using" to "use," where use is the word's base form.

5. Making a corpus and dictionary: A word dictionary and corpus were generated using the pre-processed data after the data had undergone pre-processing. The pre-processed data's unique words were all included in the word dictionary. A corpus that provided details on word frequencies was created.

Topic modeling is an unsupervised machine learning technique that is capable of scanning a set of documents, detecting word and phrase patterns within them, and automatically cluster word groups and similar expressions that best characterize a set of documents. One technique for finding subjects across diverse texts is topic modeling. These subjects are abstract in nature; a topic is made up of words that are related to one another. A single document may have several themes. The exploration of massive amounts of text data using topic modeling enables the identification of abstract subjects, word clusters, and document similarities. Finding the themes and topic keywords in a document is performedusing the LDA topic modeling technique. The fundamental idea is that documents are viewed as haphazard mashups of hidden subjects, each of which is represented by a word distribution.

4. Results and Discussion

The Results section includes several tables that highlight the topic modeling stages that led to the synthesized multifaceted sensemaking theory presented in the current article. Table 4 provides a list of the common words from the literature, showing "sensemaking" as the most common word followed by "sense". Tables 5 and 6 show the top 20 topics from two types of analyses (mallet-wrapper topics, vectorizer topics). Each topic (20 per technique, 40 total) was analyzed by reviewing the definitions of each term. Table 7 provides an example for "Topic 1" from the Mallet-wrapper topics to show how this process was performed. This example shown in Table 7 was identified as "Interpretation (meaning making)."

A synthesis of the topics and analyses are provided in Tables 8 and 9. These two tables provide the top five topics from each of the two sets of topics with defining characteristics. Table 8 provides a synthesis of the top five topics and defining characteristics from the mallet-wrapper topics, and Table 9 from the vectorizer topics. These two sets of topics were then synthesized into one common set of topics shown in Table 10. Table 10 provides the nine components to the multifaceted sensemaking theory (sensing, meaning-making, sensegiving, becoming, agency, counterfactuals, future-scoping, movement, impact). Table 11 provides a comparative analysis of the components of the multifaceted sensemaking theory with other identified sensemaking frameworks and models.

4.1. Topics Modeling Results

4.1.1. Common Words

The initial text analysis produced the following list of common words from the sample (See Table 4). The most common word from the sample was "sensemaking" and the second "sense". This provided evidence that the sample was focuses on and around sensemaking.

Table 4. Common Words.

Word	Count	Word	Count	Word	Count	Word	Count
sensemaking	941	support	307	related	217	approach	174
sense	857	understanding	304	ways	215	public	172
information	742	narrative	303	findings	213	sexual	172
research	682	new	302	expatriates	213	theory	169
data	665	work	301	meaning	209	husbands	168

Table 4. *Cont.*

Word	Count	Word	Count	Word	Count	Word	Count
communication	654	experiences	299	understand	209	organizations	167
participants	642	use	290	positive	209	second	167
study	621	analysis	280	cultural	202	self	166
process	569	different	278	trust	200	local	166
miscarriage	539	example	275	organizational	198	roles	165
stories	455	knowledge	271	themes	194	state	161
family	433	important	268	messages	191	help	160
health	421	men	268	organization	190	metaphors	160
crisis	415	time	263	narratives	190	tongqi	156
members	371	way	263	current	188	families	153
experience	365	women	261	story	188	nurses	153
people	361	context	257	results	183	studies	150
social	358	digital	249	resilience	182	loss	149
news	352	users	234	processes	181	community	149
individuals	340	future	232	provide	177	systems	147
identity	321	need	229	negative	176	design	147
employees	318	relational	229	cognitive	176	researchers	145
based	318	individual	223	search	176	confidants	145
role	310	learning	220	focus	175	questions	144
media	308	group	219	know	175	development	142

4.1.2. Topics

The topic modelling analysis was conducted using two separate techniques. The first involved identifying common themes based on the mallet-wrapper technique. Table 5 provides a summary of the top five topics from the analysis along with the top 20 terms used to describe each topic. For example, the first topic "Topic 1" was defined by the terms of "analysis," "related," "sexual," "medical," "examples," "capacity," "artifacts," "interpreted," "mothers," "sessions," "crews," expertise," "acknowledging," "section," "school," "retrieval," "thematic," "evaluated," "intentions," and "sophisticated." The terms "sexual," "medical," and "mothers," were contextual to the research study and less so to sensemaking. These contextual terms were highlighted by the superscript [c] in Table 5 (i.e., medical[c]).

Table 5. Mallet-wrapper Topics.

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
Term 1	analysis	identified	belief	search	occurrence
Term 2	related	mentioned	hotshot	cheerleaders	developing
Term 3	sexual [c]	develop	ideologies	heterosexual [c]	ability
Term 4	medical [c]	end	consequence	consistency	embraced
Term 5	examples	demonstrated	age	heuristic	assigned
Term 6	capacity	reflecting	stress	cards	mediator
Term 7	artifacts	coworkers[c]	board	cation [c]	consciously
Term 8	interpreted	emerging	mode	facilitate	segment
Term 9	mothers [c]	consider	disorder	states	wake

Table 5. *Cont.*

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
Term 10	sessions	gave	crews	fit	hazard
Term 11	crews	childers [c]	qualtrics [c]	previously	market
Term 12	expertise	unlike	communicators	metrics	promoted
Term 13	acknowledging	refer	ida [c]	weick [c]	predicting
Term 14	section	interview	equality	extends	alexander [c]
Term 15	school	contaminated	indication	onset	normalization
Term 16	retrieval	meanings	controllability	topaasia [c]	ethnically
Term 17	thematic	respect	reinforced	asian [c]	attune
Term 18	evaluated	car [c]	appeal	nfl [c]	heartbeat
Term 19	intentions	points	placed	japanese [c]	aransas [c]
Term 20	sophisticated	race [c]	center	resource	collection

Note: [c] = Contextual, related to research sample, topic, name, etc.

The second topic modelling analysis involved identifying common themes based on the Vectorizer technique. Table 6 provides a summary of the top five topics found from the analysis along with the top 20 terms used to describe each topic. For example, the first topic "Topic 1" was defined by the terms of "sensemaking," "sense," "communication," "data," "information," "participants," "crisis," "miscarriage," "research," "employees," "study," "process," "health," "analysis," "stories," "family," "identity," "members," "experience," and "individuals." The terms "miscarriage," "employees," and "family," were contextual to the research study and less so to sensemaking. These contextual terms were highlighted by the superscript [c] in Table 6 (i.e., family [c]).

Table 6. Vectorizer Topics.

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
Term 1	sensemaking	employees [c]	data	communication	employees [c]
Term 2	sense	crisis	analysis	crisis	information
Term 3	communication	sensemaking	collection	employees [c]	expatriates [c]
Term 4	data	communication	health	miscarriage [c]	participants
Term 5	information	information	information	data	local
Term 6	participants	organization	sensemaking	internal	organization
Term 7	crisis	expatriates [c]	crisis	health	responsibilities
Term 8	miscarriage [c]	internal	communication	management	roles
Term 9	research	organizational	researchers	sense	know
Term 10	employees [c]	sensegiving	problem	identity	miscarriage [c]
Term 11	study	management	media	organization	data
Term 12	process	local	algorithms	behaviors	manager
Term 13	health	situation	users	narrative	need
Term 14	analysis	employee	coding	metaphor	search
Term 15	stories	roles	statements	analysis	help
Term 16	family [c]	behaviors	results	effective	veteran
Term 17	identity	flint	digital	family [c]	news
Term 18	members	effective	news	husbands [c]	negative
Term 19	experience	water [c]	mechanisms	stories	results
Term 20	individuals	situations	approach	strategic	think

Note: [c] = Contextual, related to research sample, topic, name, etc.

The top five topics from each of the two topic modeling analyses were further analyzed to determine what each topic should be termed. The definitions for each term were captured using the online Oxford English Dictionary (OED; www.oed.com, accessed on 12 November 2022). Table 7 provides an example of the definitions for each of the terms for "Topic 1" in the mallet-wrapper analysis.

Table 7. Topic 1 Definitions: Example.

Term #	Term	Definition(s)
1	analysis	The action or activity of telling stories, or a particular story; an instance of this (n).
2	related	Connected or having relation to something else (n).
3	sexual [c]	An organism which is capable of sexual reproduction (n). Relating to, tending towards, or involving sexual intercourse, or other forms of intimate physical contact (adj.). Relating to or affecting the genitals or reproductive organs (adj.).
4	medical [c]	A medical practitioner, medical officer, or medical student (n). Of, relating to, or designating the science or practice of medicine in general, or its practitioners (adj.).
5	examples	A person's conduct, practice, etc., regarded as an object of imitation or as an influence on the behaviour of others; the model afforded or set by this. Often with modifying adjective, as good, bad, etc., or with possessive (n).
6	capacity	Ability to receive or contain; holding power. Obsolete (in general sense) (n). The quality or condition of admitting or being open to action or treatment; capability, possibility (n). Position, condition, character, relation (n).
7	artifacts	An object made or modified by human workmanship, as opposed to one formed by natural processes (n). An excavated object that shows characteristic signs of human workmanship or use (n).
8	interpreted	(interpreted, adj.; interpret, v.) Interpret: to expound the meaning of (something abstruse or mysterious); to render (words, writings, an author, etc.) clear or explicit; to elucidate; to explain (v). To make out the meaning of, explain to oneself (v). To bring out the meaning of (a dramatic or musical composition, a landscape, etc.) by artistic representation or performance; to give one's own interpretation of; to render (v). To give a particular explanation of; to expound or take in a specified manner (v).
9	mothers [c]	N/A (contextual)
10	sessions	The action or an act of sitting; the state or posture of being seated; occupation of a seat in an assembly or the like; also a manner of sitting (n).
11	crews	A body of people assembled together, and related uses (n).
12	expertise	(a) Expert opinion or knowledge, often obtained through the action of submitting a matter to, and its consideration by, experts; an expert's appraisal, valuation, or report. (b) The quality or state of being expert; skill or expertness in a particular branch of study or sport (n).
13	acknowledging	Admitted or communicated knowledge; recognition, awareness, acknowledgement (n).
14	section	The action, or an act, of cutting or dividing (n). A part separated or divided off from the remainder; one of the portions into which a thing is cut or divided (n).
15	school	A band or company and related senses (n). A crowd; a group of people. Also: a large number; a mass of things (n). To educate or train (a person, the mind, etc.); (of experience, God, etc.) to make wise, skillful, or tractable by training or discipline; (more generally) to impart wisdom or understanding to (v). To bring oneself under control; to direct oneself to do something or into a particular state by a process of self-control; to bring into or out of a particular mood or state by self-discipline or determination. Also with hte mind, feelings, etc., as object (v). To be educated in a particular belief, habit, outlook, etc. With in, into, to, or infinitive (v).
16	retrieval	The action of retrieving something (in various senses of Retrieve v.); recovery; an instance of this (n). The action of recovering stored information, esp. information stored in a computer (n).
17	thematic	Of or pertaining to a theme or themes (adj.). The part of logic which deals with themes or subjects of thought (n). A body of subjects or topics of discussion or study (n).
18	evaluated	To work out the 'value' of (a quantitative expression); to find a numerical expression for (any quantitative fact or relation) (v). To 'reckon up', ascertain the amount of; to express in terms of something already known (v).
19	intentions	The action of straining or directing the mind or attention to something; mental application or effort; attention, intent observation or regard; endeavour (n). The action or faculty of understanding; way of understanding (something); the notion one has of anything. Also, the mind or mental faculties generally (n).
20	sophisticated	To mix (commodities) with some foreign or inferior substance; to render impure in this way; to adulterate (v). To render artificial, to deprive of simplicity, in respect of manners or ideas; to convert into something artificial (v). Of a person: free of variety, experienced, worldly-wise; subtle, discriminating, refined, cultured; aware of, versed in, the complexities of a subject or pursuit. Also transferred of a play, place, etc., that appeals to a sophisticated person (adj).

Table 7. *Cont.*

Interpretation (meaning-making)
The act of individuals, crews or a body of people evaluating and interpreting their environment and its artifacts.
Identifying, retrieving, and acknowledging information on associations, patterns, and themes.
Using storytelling to describe patterns using relevant examples and experiences.
Having the capacity to be open to intentional action and new possibilities.

Note: Definition from the online Oxford English Dictionary (OED; www.oed.com, accessed on 15 November 2022). [c] = contextual terms related to research.

The researchers analyzed the definitions of the terms for each topic to identify a representative term along with descriptions to describe the topic. In the example shown in Table 7, this topic was termed "Interpretation (meaning making)." This process was conducted for all 10 topics listed from the two topic modeling analyses. This initial naming and description process resulted in the following 10 topics: interpretation, development, centroid, facilitation, movement, sensing, sensegiving, agency, future-scoping, and impact. Next, the researchers synthesized these 10 topics into one comprehensive sensemaking model and finalized their names and descriptions. The following section presents the results from this synthesis.

4.2. Synthesis of Topics

The five topic names, short descriptions, and defining characteristics from the mallet-wrapper topics list were developed and are provided in Table 8.

Table 8. Mallet-Wrapper Topic Summary.

Topic #	Topic Name	Short Description	Defining Characteristics
Topic 1	Interpretation	Meaning-making	The act of individuals, crews, or a body of people evaluating and interpreting their environment and its artifacts.
			Identifying, retrieving, and acknowledging information on associations, patterns, and themes.
			Identifying, retrieving, and acknowledging information on associations, patterns, and themes.
			Having the capacity to be open to intentional action and new possibilities.
Topic 2	Development	Becoming	Examine or investigate attentively to reveal something unknown or hidden.
			Establish the underlying truth (axioms, generalized from experience), significance, and purpose of events/patterns through reasoning (induction, deduction, abductions) and reflection.
			Relinquish control.
			A becoming within a set of boundaries at a given moment in time.
Topic 3	Centroid	Counterfactuals	The mental action of inference making, drawing inferences through abstract speculation and visionary theorizing.
			Juxtaposing information, activities, events, and behaviors to challenge new threats and to achieve a level of controllability in one's time-space continuum.
			Identifying necessary, contingent, possible, and impossible propositions to guide activity as the center from which action originates.
Topic 4	Facilitation	Heuristic Making	To begin to take action to adapt to circumstances given capacity and resource.
			To champion action to find something that is hidden or unknown through empirically-proven methods, heuristics, and processes.
			To champion action to find something that is hidden or unknown through empirically-proven methods, heuristics, and processes.
Topic 5	Movement	Actions	Having the capacity to discover, take action, accept a course of action, and transfer to another when needed.
			An intermediary between perceiving and experiencing; utilization of the senses, feelings, and cognitions.

Table 8. *Cont.*

Topic #	Topic Name	Short Description	Defining Characteristics
			Provide a line of sight in an open environment to minimize risk and achieve harmony.
			The process of normalizing or making the environment more manageable.
			The act of inferring or deducing to make ethical and informed predictions about future events.

The five topic names, short descriptions, and defining characteristics from the Vectorizer topics list were developed and are provided in Table 9.

Table 9. Vectorizer Topic Summary.

Topic #	Topic Name	Short Description	Defining Characteristics
Topic 1	Sensing	Systematic Investigation	The action or process of making sense, giving meaning, and finding relevant associations.
			A systematic investigation or inquiry aimed at contributing and sharing new knowledge with others to fulfil practice.
			A systematic investigation or inquiry aimed at contributing and sharing new knowledge with others to fulfil practice.
			Identifying points of inflection (turning-points) and maintaining a sense of sameness during transitions.
Topic 2	Sensegiving	Normalizing and Legitimizing Realities	Systematically ordering or arranging knowledge for congruence during hard or unyielding events or situations.
			Situated in the now (contextual), acting as an inhabitant.
			Normalizing and legitimizing reality and delegitimizing false realities.
			Carrying into effect, executing, and accomplishing sustainable functions during internal turning-points.
Topic 3	Agency	Collecting and Processing Information	Examination of nature, structure, and features of the local environment.
			Agency to collect and process information relating to events and problems.
			Encode information for production, statement generation, and action.
			Evaluate the effects, consequences, or outcomes of actions, processes, or designs.
Topic 4	Future-scoping	(Metaphors, Narratives, and Strategies for Action)	Communicating information in a coherent manner relating to the affective, cognitive, social, and interactions surrounding the events and transitions in the environment.
			Developing metaphors relating to the events leading up to the turning point and those that follow.
			Utilizing carefully crafted narratives to document accounts of the environment and its conditions.
			Future-scoping, developing a strategy for positive action.
Topic 5	Impact	Positive Outcomes	As inhabitants of the environment, all action must be evaluated for positive change/impact.
			Everyone's roles and responsibilities must be directed toward positive change and impact.
			Action/change occurs through necessity caused by internal and external environmental forces (ambiguity, complexity, uncertainty) resulting in positive impact.
			Positive outcomes must be proper and fitting in relation to the action, design, and processes that caused them.

4.3. A Multifaceted Sensemaking Theory

The synthesis of topics from both the mallet-wrapper and vectorizor topic outputs were reviewed and compiled into one comprehensive sensemaking theory. The result, shown in Table 10, include nine total stages with the earlier stages of "Facilitation (heuristic making)" and "Future-scoping (metaphors, narratives, and strategies for action)" being

combined into one shared stage called "Future-scoping". The nine stages of sensemaking derived from current research and practice include: sensing, meaning-making, sensegiving, becoming, agency, counterfactuals, future-scoping, movement, and impact. The defining characteristics for each sensemaking stage are provide in Table 10.

Table 10. Multifaceted Sensemaking Theory: Stages and Defining Characteristics.

Sensemaking Stage	Defining Characteristics
1. Sensing	The action or process of making sense, giving meaning, and finding relevant associations.
	A systematic investigation or inquiry aimed at contributing and sharing new knowledge with others to fulfil practice.
	An examination of the nature, structure, and features of one's environment.
	Identifying points of inflection (turning-points) and maintaining a sense of sameness during transitions.
2. Meaning-making	The act of individuals, crews, or a body of people evaluating and interpreting their environment and its artifacts.
	Identifying, retrieving, and acknowledging information on associations, patterns, and themes.
	Using storytelling to describe patterns using relevant examples and experiences.
	Having the capacity to be open to intentional action and new possibilities.
3. Sensegiving	Systematically ordering or arranging knowledge for congruence during hard or unyielding events or situations.
	Situated in the now (contextual), acting as an inhabitant.
	Normalizing and legitimizing reality and delegitimizing false realities.
	Carrying into effect, executing, and accomplishing sustainable functions during internal turning-points.
4. Becoming	Examine or investigate attentively to reveal something unknown or hidden.
	Establish the underlying truth (axioms, generalized from experience), significance, and purpose of events/patterns through reasoning (induction, deduction, abduction) and reflection.
	Relinquish control.
	A becoming within a set of boundaries at a given moment in time.
5. Agency	Examination of nature, structure, and features of the local environment.
	Agency to collect and process information relating to events and problems.
	Encode information for production, statement generation, and action.
	Evaluate the effects, consequences, or outcomes of actions, processes, or designs.
6. Counterfactuals	The mental action of inference making, drawing inferences through abstract speculation and visionary theorizing.
	Juxtaposing information, activities, events, and behaviors to challenge new threats and to achieve a level of controllability in one's time-space continuum.
	Identifying necessary, contingent, possible, and impossible propositions to guide activity as the center from which action originates.
7. Future-scoping	Communicating information in a coherent manner relating to the affective, cognitive, social, and interactions surrounding the events and transitions in the environment.
	Developing metaphors relating to the events leading up to the turning point and those that follow.
	Identify and map conditions and constraints of the environment and its antecedent conditions to achieve coherence or harmony for requisite problem-solving and decision-making.
	Utilizing carefully crafted narratives and stories to document accounts of the environment and its conditions.
	Future-scoping, developing a strategy for positive action.

Table 10. *Cont.*

Sensemaking Stage	Defining Characteristics
8. Movement	Having the capacity to discover, take action, accept a course of action, and transfer to another when needed.
	An intermediary between perceiving and experiencing; utilization of the senses, feelings, and cognitions.
	Provide a line of sight in an open environment to minimize risk and achieve harmony.
	The process of normalizing or making the environment more manageable.
	The act of inferring or deducing to make ethical and informed predictions about future events.
9. Impact	As inhabitants of the environment, all action must be evaluated for positive change/impact.
	Everyone's roles and responsibilities must be directed toward positive change and impact.
	Action/change occurs through necessity caused by internal and external forces (ambiguity, complexity, uncertainty) resulting in positive impact.
	Positive outcomes must be proper and fitting in relation to the action, design, and processes that caused them.

Note: Facilitation (heuristic making) and future-scoping (metaphors, narratives, and strategies for action) were combined into one stage.

As with any new theory, the question of coherence and coverage is raised. Concerns regarding coherence may evaluate a model to see if its elements or propositions are "interpreted as true" [24]. Coherence is also concerned with how the elements are associated with one another and how the aggregate is representative of the whole [24]. In this case, coherence would be met if the elements (the nine stages of sensemaking) are related to one another and collectively representative of sensemaking. A question concerning coverage would look like the following: how does this model compare to existing models? Does this new model cover all previous components or characteristics of already established models?

As a multifaceted theory of sensemaking, the goal was to (a) compile already existing frameworks, models, and theories from the sensemaking field of study and practice, and (b) to compare or combine them with current research and practice from the literature.

The first part was conducted in the literature review that originated with Urquhart, Lam, Cheok and Dervin's [4] "Oxford Bibliographies" on sense-making/sensemaking. This review of the literature summarized literature from the five sensemaking theorists (Dervin, Klein, Russell, Snowden, Weick) as highlighted in the encyclopedia entry. This review provided several sensemaking definitions, comparisons between definitions and theories, an overview of sensemaking's ontological roots, and highlighted the characteristics of several sensemaking theories.

The second part was conducted by the text analysis of current research on "sense-making" and "sensemaking" from the Web of Science database. Topic modeling was conducted on the data which generated two groupings of topics (see Tables 8 and 9). These topics were analyzed, defined, and combined into the multifaceted sensemaking theory presented in Table 10.

At this stage the current article presents a review of literature from the five pioneers in sensemaking (Dervin, Klein, Russell, Snowden, Weick) and highlights current research and practice in the field of sensemaking through the topic model analyses. Data from the topic analysis have been synthesized into one comprehensive theory (model) of sensemaking as shown in Table 10. However, these two research projects have not been connected to show coherence.

The remainder of this "Results and Discussion" section will focus on showing how the multifaceted sensemaking theory does include the elements of previously published sensemaking frameworks, models, and theories, meeting the requirement of coverage. The author will also highlight how each of the components works as a comprehensive whole that contributes to the overall sensemaking practice, meeting the criteria of coherence.

4.4. Coverage and Coherence

The nine characteristics of the multifaceted sensemaking theory are contrasted with Dervin's Verbing's elements to show how the nine characteristics are associated with elements from previous sensemaking frameworks or models. The author discussed the associations between their model and Dervin's to show associations in the sections that follow. Associations for the other presented sensemaking frameworks or models are summarized in Table 11 by the superscript notation next to each element. These superscript notations are abbreviations for each of the nine characteristics in the composite sensemaking model (sensing, sn; meaning-making, mm; sensegiving, sg; becoming, be; agency, ag; counterfactuals, cf; future-scoping, fs; movement, mv; impact, ip). The authors analyzed each element of the presented sensemaking frameworks and models and identified the best representation from the nine characteristics in the composite sensemaking model. The results are presented in Table 11.

Table 11. Multifaceted Sensemaking Theory (MSM) Comparisons.

Multifaceted Sensemaking Theory	Dervin's Verbings [5]	Information-Related Behaviors [8]	Snowden [8]	Snowden's Key Principles [20]
Sensing (sn)	feel ^{ag}	processing ^{mm}	focus on narratives ^{fs}	describing ^{mm}
Meaning-making (mm)	experience $^{mm, be}$	retrieving ^{sn}	analyze narratives ^{ag}	mappings
Sensegiving (sg)	be aware ^{sn}	searching ^{sn}	naturalized sense-making (humanistic approaches) ^{ag}	using new language ^{ag}
Becoming (be)	comprehend $^{mm, mv}$	gathering ^{ag}	action research ^{be}	focusing ^{mm}
Agency (ag)	grasp ^{fs}	foraging ^{sn}	story circles ^{cf}	metaphor ^{fs}
Counterfactuals (cf)	ascribe meaning to ^{sg}	using ^{mv}	knowledge discourse points $^{cf, fs}$	perspective-taking ^{cf}
future-scoping (fs)	understand ^{cf}	Web-browsing ^{sg}	connecting frameworks ^{fs}	dynamic ^{mv}
Movement (mv)	interpret ^{mm}	rejecting ^{cf}	contextualizations ^{ag}	
Impact (ip)		collaborating ^{mm}	narrative databases ^{mm}	
		risk-facing ^{ip}	convergences ^{fs}	
			alternative histories $^{cf, fs}$	
Klein's Experts and Decision Making [5]	**Weick's Organizational Communications [8]**	**Weick's 7 Characteristics [7]**	**Weick's SIR-COPE [17]**	**Weick's 6 Themes [17]**
understanding the current situation ^{sn}	comprehending $^{mm, cf}$	grounded in identity construction ^{be}	social ^{mm}	redoing ^{mv}
how it got there ^{be}	constructing meaning ^{mm}	retrospective $^{cf, ip}$	identity ^{be}	labeling ^{mm}
where it is going ^{fs}	searching for patterns and frameworks ^{mm}	enactive of sensible environments (socially constructed) $^{mm, be}$	Retrospectives $^{cf, ip}$	discarding ^{sg}
	redressing surprise ^{cf}	social ^{mm}	Cues $^{mm, ag}$	Enacting $^{ag, mv}$
	interacting with others ^{mm}	ongoing ^{ip}	ongoing ^{ip}	Believing $^{be, ag}$
	common understanding ^{sn}	focuses on and accomplished by extracting cues $^{mm, ag}$	plausibility ^{fs}	substantiating ^{cf}
	Narratives $^{mm, fs}$	driven by plausibility rather than accuracy ^{fs}	enactment $^{ag, mv}$	
	storytelling $^{mm, fs}$			
	focus on failures and successes ^{cf}			

Table 11. *Cont.*

Weick's Frameworks [19]	Russell's Sensemaking Learning Loops [14]	Maitlis and Christianson [3]	Translation, Communication [7]	Cognitive Processes [7]
frameworks [sg]	Search for representation [mm]	Comprehending [mm, mv]	inner conversations [sn]	acquisitions [sg]
Comprehending [mm, mv]	Instantiate representation [sg]	understanding [cf]	outer conversations [mm]	Interpretations [be, cf]
redressing surprise [cf]	Shift representation [cf]	explaining [fs]	Storytelling [mm, fs]	understandings [cf]
constructing meaning [mm, cf]	Consume encodons (coded information emerging from data) [be, ag]	attributing [sg]	Narratives [mm, fs]	actions [mv]
interacting [mm]		extrapolating [be]		
mutual understanding [mm]		predicting [fs]		
patterns [mm]				

Notes: [sn] = sensing. [mm] = meaning-making. [sg] = sensegiving. [be] = becoming. [ag] = agency. [cf] = counterfactuals. [fs] = future-scoping. [mv] = movement. [ip] = impact.

4.4.1. Associating Dervin's Verbings with the Composite Sensemaking Model Characteristics

Dervin's verbings [2] element of "feel" could be represented by the characteristic of agency. Dervin [6] highlighted that the underlying goal of sensemaking was to uncover what users actually feel, want, and dream. To achieve this level of candor from users or agents, any power structures must first be overcome: "if we want users to tell us what they really think and feel, we must make it safe for users to attend to power issues" [6]. Agency is also highlighted in the sensemaking literature by Naumer, Fisher, and Dervin [1]: "Sense-making Methodology assumes that a person is a carrier of both structure and agency and that there is a perpetual and dynamic interaction between the two" (p. 3). It is the interactions between structure and agency that bridges the gap between perception and reality, and this gap cannot be crossed without agency that can function freely (agents expressing and acting on feelings).

Dervin's element of "experience" would be associated with either meaning-making or becoming. Meaning-making involves the use of storytelling to describe patterns from one's experiences. These stories and patterns are necessary to make sense of one's experiences as they are everchanging and emerging. As new knowledge and experiences are gained, these stories and patterns also change. Keeping up with these everchanging conditions is associated with the characteristics of meaning-making. Because our environments and knowledge are everchanging, we are in a constant state of becoming: "the human is always in a state of becoming" [25]. Our experiences include past, in situ, and possible representations (patterns, schemas, stories). Becoming includes finding the underlying truth that is often generalized from experiences.

The element "be aware" is best associated with the sensing characteristic. Sensing involves the components of making sense, giving meaning, and finding relevant associations that require one to be aware to perform each of these activities. Harun, et al. [26] highlighted a few of these components; making sense, giving meaning (size up), and be aware: "to rationalize, make sense of, or size up, be aware of and have some knowledge of the context with the other" (p. 155).

The next element, "comprehend," is associated with the characteristics of movement and meaning-making. Dervin [2] described verbings as approaches that "direct attention to how humans make sense and unmake sense as they move through a time-space that is always assumed to be gappy" (p. 65). The make sense and unmake sense is related to our meaning-making characteristic, and moving through a time-space continuum would be best associated with the characteristic of movement.

Dervin's element of "grasp" is best associated with the future-scoping characteristic. One practice to make sense of the unknown is to restate what had been experienced. This practice of restatement involves developing and repurposing metaphors, narratives,

and stories to come to a better understanding. Restatement as a practice is highlighted by Zhang and Soergel [27]: "Successful restatement with paraphrases not only helps sensemakers to grasp the meaning of the original, but also makes it more accessible, while lowering its level of complexity" (p. 166). As the characteristic of future-scoping involves communicating information in a coherent manner by developing metaphors relating to events, this characteristic is best associated with Dervin's element of grasp.

When we "ascribe meaning to," we often assign symbols to aid our sensemaking. Gioia, et al. [28] highlighted this in the following: "When we try to understand a new experience or concept, we do so by trying to ascribe meaning to it, and the meaning is often most effectively grasped through symbolic or metaphorical representation" (p. 365). Symbols could be a form of ordering and arranging knowledge for congruence, as described in the sensegiving characteristic. However, if one was to apply action to the element "ascribe meaning to" in a serendipitous manner; if the results are beneficial, then the actions will be associated with intentionality and accepted [29]. "Some things just 'are' by virtue of multiple interactions over time" [29], regardless of them being planned or not. The outcomes of these interactions, accidental or purposeful, result in a type of causality that aids in our understanding. Action, associated with ascribing meaning to, relates to the characteristic of sensegiving. Sensegiving was defined by Shaw [30] as the process of "influencing the sensemaking or meaning-making process so that an alternate or desired reality is embraced or enacted" (p. 8)(see also: [31]). Sensemaking and sensegiving interact with one another, it provides a constant interchange between understanding and influencing or action [31]. Both are necessary for making sense of one's environment. The element of ascribing meaning to, either through symbols or action for understanding, is best associated with the characteristic of sensegiving.

Dervin's element of "understanding" is best associated with the counterfactual characteristic. When one begins to "understand" their environment, they can begin to take action to change the environment to more favorable conditions. Unfortunately, individuals are mostly unable to capture their reality on their own, requiring multiple perspectives and interpretations to make sense of their experiences: "There is no one way to best represent reality; we must rely on multiple useful representations that exist for any situation" [7,19]. These multiple perspectives come from developing counterfactuals. Counterfactuals involve the endless pursuit of coherent pathways and the dismissal of incoherent pathways [32]. Counterfactuals are necessary for providing explanations of what is possible and what is not possible [33] and are the heart of the theory of causality [34], it has also been referred to as the "constructor theory of possible tasks" [35]. Counterfactuals aid our understanding as "understanding can only be achieved from capturing potential alternative explanations, counterfactuals, that are contextually dependent to the environment" [32].

Understanding involves agents theorizing and making inferences based on observations and experiments. Theorizing, to see, observe, or contemplate [36], involves agents having a good understanding of the phenomenon and the representations that make up the phenomenon [37]. Inference making begins with the evidence and ends with understanding: "Beginning with the evidence available to us, we infer what would, if true, provide the best explanation of that evidence" [38].

The goal is for this new understanding to "underpin new ways of organizing and encourage new, improved practices" [7]. The stage of counterfactuals transitions the making sense (understanding) stages of sensing, meaning-making, sensegiving, becoming, and agency to the action stages of future-scoping, movement, and evaluation.

Dervin's element of "interpret" is best associated with the meaning-making characteristic. Interpretation is activated when the perceived state of events differs from the state of actual events [17]. If all events occurred as expected then no interpretation would be required, this would equate to a state of free energy. The free energy principle is associated with the amount of energy utilized when interacting with the environment: "All the quantities that can change; i.e., that are part of the system, will change to minimize free-energy" [39]. In relation to interpret, the lower the energy that is required to understand

current events the less interpretation is required (lower cognitive load). As the energy levels to understand events increase, interpretation becomes more critical. An example showing this in practice can be found in Weick, Sutcliffe, and Obstfeld's [15] medical sensemaking research where nurses utilize what the researchers called "thinkingly". Thinkingly was defined as nurses "simultaneously interpret their knowledge with trusted frameworks, yet mistrust those very same frameworks by testing new frameworks and new interpretations" (p. 413). As our existing frameworks (knowledge and experiences) do not completely explain new events, we search for better explanations. This continuous interpreting between action and new possibilities captures the meaning-making characteristic in our multifaceted sensemaking theory.

Interpretation also occurs retroactively, after events occur unexpectedly, requiring information retrieval, stories or narratives, and pattern-identification to occur as a means of discovering what went wrong and why. Stories and narratives are called for in the literature as a "legitimate and useful way to interpret and understand human relations" [40]. This associates Dervin's element of interpret with the characteristic of meaning-making.

4.4.2. Impact

The only characteristic in our multifaceted sensemaking theory that wasn't associated to Dervin's verbings elements was impact. Dervin's model did not call out impact directly. Our theory utilized impact as a means of checking the results of all human actions, to be sure that we make a positive impact and improve systems and processes. Our participation in the actions has consequences, sensemaking looks to provide impactful outcomes while resulting in positive change.

Coherent and positive narratives have been associated with better mental health and fared better during difficult events [41]. Responding to unexpected events, such as a miscarriage, participants who scored higher on positive affect measures felt "more upbeat, hopeful, and optimistic" [42]. Snowden [43] utilized dispositional states to identify where potential changes can occur. Their premise is to look at the narrative landscape and ask: "*What can I (we) do tomorrow to create more stories like these and fewer like those?*" (p. para 4). Associating impact with stories highlights desired action. Evaluating which stories you want more of, and which stories you want less of, aids managers and practitioners in achieving positive change over time.

Research has looked at impact in relation to sensemaking. For example, Maitlis and Christianson [3] highlighted the growing research identifying the impact that sensemaking practices can have. These included impact on organizational processes (strategic change, decision-making) [18,44], creativity and innovation [45], and organizational learning [19,46,47], to name only a few.

Impact results in our actions and can have everlasting effects on those that are affected by any change. These changes must be evaluated for impact and any adjustments required must be made for the betterment of all impacted by the change. This point becomes especially necessary when dealing with ambiguity, complexity, and uncertainty. This sentiment is highlighted in the following from Guijt, Gottret, Hanchar, Deprez and Muckenhirn [10]:

> "Working with complex change processes requires an adaptive approach to change, with continual probing, making sense of evolving situations, adjusting actions, and learning. Accountability is not only about outcomes, which cannot be predicted or guaranteed: it is also about demonstrating how collaboration, learning, and adaptation have led to ever better practices and have contributed to impact. Adaptive responses require the ability to generate insights in real time about emerging conditions and about what works and what does not. Insights from the people whose lives are the focus of change efforts are essential for effective adaptation and improvement. People need to probe promising practices or respond to new options–and then observe, look for patterns, interpret, understand, and value the response to the actions that have been taken." (p. 13) see also [48]

Impact, in conclusion, models the emerging outcomes of sensemaking. Aligning outcomes with expected or desired outcomes for a given contextual situation is one goal of closing the gap. Evaluation is necessary for sensemaking to provide feedback and information relating to actions taken and changes in the environment. Evaluation informs agents of the outcomes of their actions and their impact. Impact involves evaluation but the focus is on impact, the emerging outcome. Identifying the outcomes before or when they emerge is necessary for navigating complexity. Acknowledging the impact of action continues the iterative and constant exploration of the unknown.

5. Conclusions

Sensemaking involves humans being social while they interact with their environment and apply their reasoning capabilities to take action and to change the conditions to more favorable ones. Early philosophers viewed the purpose of man as an either/or proposition, to reason or to take action [49]. The characteristic of counterfactuals in the multifaceted sensemaking theory transitions between these two dispositions, from reasoning (understanding) to action. Those siding with the reasoning philosophy viewed agents in the light of reason: "Philosophers consider man in the light of a reasonable rather than an active being, and endeavour to form his understanding more than cultivate his manners" [49]. Alternatively, those siding with the action philosophy viewed agent's as having the purpose of action: "Considers man chiefly as born for action; and as influenced in his measures by taste and sentiment; pursuing one object, and avoiding another, according to the value which these objects seem to possess, and according to the light in which they present themselves" [49]. However, as Hume had pointed out, it is not an either/or proposition, humans are composed of a mixture of dispositions: reason, social, and action [49]. The multifaceted sensemaking theory presented in the current study covers all three dispositions as sensemaking involves humans' ability to act and reason socially with their environment. This conceptualization is shown in Figure 2. The multifaceted sensemaking theory involves social activity at all levels; reasoning (sensing, meaning-making, sensegiving, becoming, agency), action (future-scoping, movement, evaluation), and transitioning during the stage of counterfactuals.

The characteristics of the multifaceted sensemaking theory are viewed as being nonlinear; they are entangled, as a multiplicity. A multiplicity is described as "something constantly entering into and breaking off combinations with other multiplicities" [50]. A multiplicity is viewed as having a middle with no beginning or end [51], as a blank slate that needs to be created as time counts forward and events unfold. There is no permanent memory or map of the landscape, sensemaking is to create one that is representative of the here and now, a becoming.

As with any sensemaking framework or multiplicity, application begins with knowing where you are at any given moment in time. This initial starting point is similar to Snowden's aporia/confused stage in the Cynefin framework [32,52]. Know where you are before you can act. Second, identify your staring point from the characteristics listed in the multifaceted sensemaking theory and work your way through the stages. Third, remember that the goal is to address action where positive change and impact can be realized and reduce activities and energy going to unfavorable one's that could result in negative outcomes. The goal of sensemaking is to find new ways of organizing (i.e., data, events, information, knowledge, observations), to produce new behaviors or practices that result in positive outcomes:

The sweetest and most inoffensive path of life leads through the avenues of science and learning; and whoever can either remove any obstructions in this way, or open any new prospect, ought so far to be esteemed a benefactor to mankind [49].

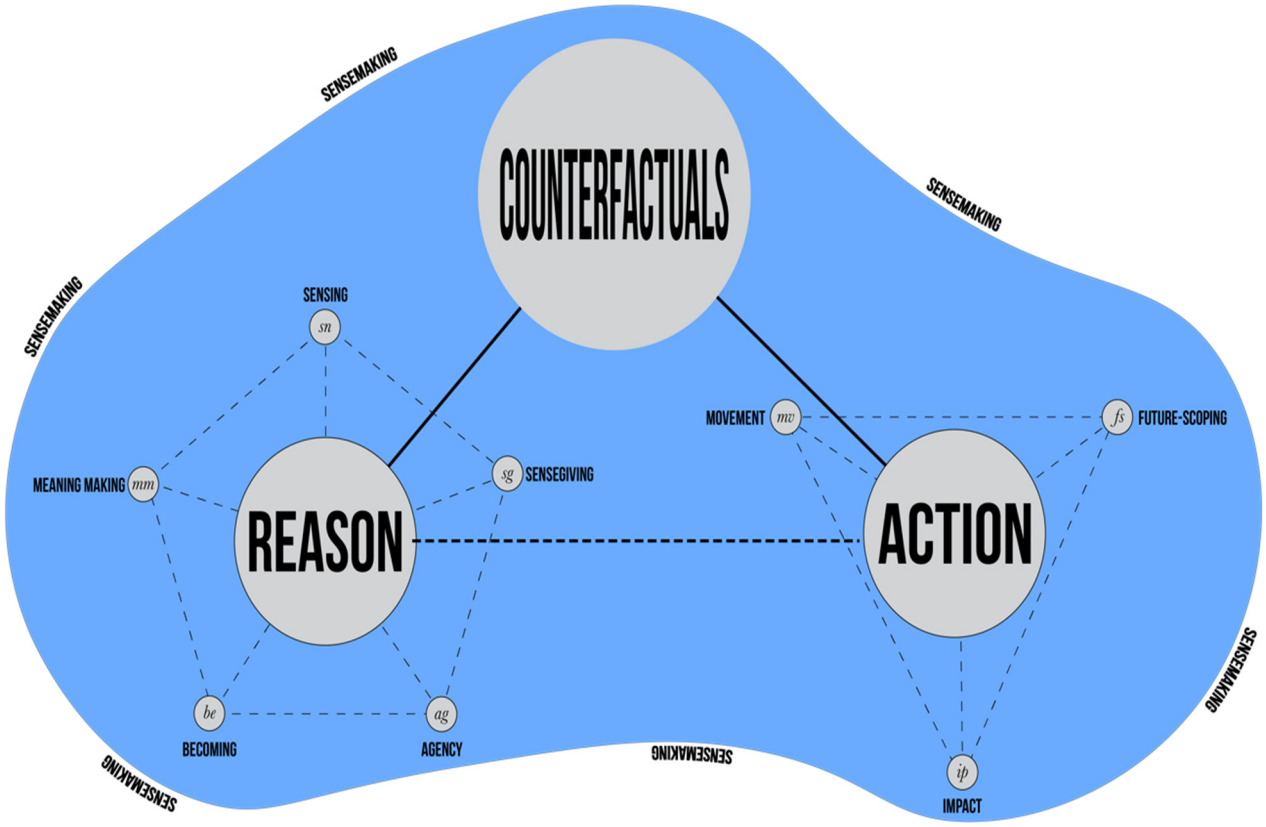

Figure 2. Conceptualization of the Multifaceted Sensemaking Theory.

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