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Sense-Making/Sensemaking

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Sense-Making/Sensemaking

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Introduction

Sense-making/sensemaking are terms commonly understood as the processes through which people interpret and give meaning to their experiences. The ~~two-three~~ different [spelling variation terms](#) (i.e., [sense-making](#), [sensemaking](#), [sense making](#)) are used deliberately by ~~the~~ authors [included here, with their spelling variations](#) in different academic discourse communities that share some common thrusts. The terms originally focused on the five senses but have expanded in meaning to cover physical, emotional, spiritual, and intuitional responses posited as involved in human sense-makings of their worlds, both internal and external. Since the 1970s, sense-making/sensemaking has been used by researchers from different disciplinary backgrounds, with significant applications in the fields of human-computer interaction (HCI), cognitive systems engineering, knowledge management, communication studies, and library/information science (human information behavior). At the highest level of abstraction, the differences in the underlying theories used by researchers can best be understood in tensions between cognitivist and constructivist strands and the focus on either a micro or macro framework. ~~However, as because~~ the different streams of attention differ in so many ways (e.g., context, informants, methods, intended audiences, etc.), comparisons are ~~not possible beyond those presented briefly here~~ [difficult](#). It is necessary to understand the historical origins, philosophical assumptions, and methodological roots of five major research approaches labeled as sense-making or sensemaking: Dervin's sense-making in user studies, human information behavior; Weick's sensemaking in organizational communication; Snowden's organizational sense-making in knowledge management; Russell's sensemaking in HCI; and Klein's

sensemaking in cognitive systems engineering. Applications of the approaches, emerging perspectives, and uses are reviewed. [Applications increasingly merge some sense-making/sensemaking ideas together or use sense-making/sensemaking with other theories \(e.g. *Brenda Dervin—Sense-Making Methodology: Methodology*, *Daniel Russell—Sensemaking and Searching: Philosophy and Methodology*, *Gary Klein—Sensemaking in Cognitive Systems Engineering: Application*\).](#)

General Overviews

Dervin and Naumer [2009](#) and Dervin and Naumer [2010](#) provide ~~an~~ overviews of these five sensemaking theories, and [Golob 2018](#) provides an update. [Kolko 2010](#) provides a theory-based comparison of the five sensemaking approaches in the context of system design. ~~—~~ [Lam 2014](#) systematically compares the theories of Dervin, Weick, and Snowden, [examining with a focus on](#) knowledge creation, sharing, and utilization. [Browning and Boudès 2005](#) focuses on narrative in comparing the ~~provides a closer look at the~~ models of Weick and Snowden. [Maitlis and Christenson 2014](#) reviews research on sensemaking as a process in organizations. [Reviews emphasize the need for meta-synthesis of research: Urquhart 2011](#) discusses the process of meta-synthesis for information behavior research and [Ward, et al. 2018](#) provides a critical interpretive synthesis of research on adaptation and skill that uses Klein's later models of sensemaking. ~~The authors focus on narrative as a sensemaking response to complexity.~~

[Browning, Larry L., and Thierry T. Boudès. 2005.](#) The use of narrative to understand and respond to complexity: A comparative analysis of the Cynefin and Weickian models. *Emergence: Complexity & Organization* 7.3–4: 32–39.

With the purpose of comparing how Weick and Snowden approach narrative and complexity, [Browning and Boudès](#) summarize their commonalities in eight statements after discussing the differences in their historical, cultural, and pedagogical approaches to complexity. The paper concludes with three essential features of narrative and complexity derived from the study.

[Dervin, Brenda, and Charles M. Naumer. 2009.](#) Sense-making. In *Encyclopedia of communication theory*. Vol. 2. Edited by [Stephen W. Littlejohn](#) and [Karen A. Foss](#), 877–881. Thousand Oaks, CA: SAGE.

Dervin and Naumer briefly review the five theories (Dervin, Weick, Snowden, Russell, and Klein), identifying implications for communication researchers.

[Dervin, Brenda, and Charles M. Naumer. 2010.](#) Sense-making. In *Encyclopedia of library and information sciences*. 3d ed. Edited by [Marcia J. Bates](#) and [Mary N. Maack](#), 4696–4707. Bora Raton, FL: CRC.

Studies sense-making from the perspective of user-oriented information behaviors and categorizes five sense-making theories into four fields: Dervin's in library and information science, Weick's and Snowden's in organizational communication, Russell's in HCI, and Klein's in cognitive systems engineering. Reviews historical and methodological roots and application contexts of these theories.

[Golob, Urša. 2018.](#) *Sense-Making [<https://onlinelibrary.wiley.com/doi/10.1002/9781119010722.iesc0159>]*. In *The*

[International Encyclopedia of Strategic Communication](#). Edited by Robert L. Heath and Winni Johansen. Hoboken, NJ: Wiley.

This encyclopedia review draws on five authors —Dervin, Klein, Russell, Snowden, Weick — regularly named as sources for conceptualizing and studying a phenomenon they variously term sensemaking, sense making, or sense-making. Golob emphasizes that the concept of sense-making is popular, often employed without clear definition, and she considers its complexity and ambiguity, both in ontological and epistemological terms. Focuses on extracting common features across perspectives.

Kolko, Jon. 2010. *Sensemaking and framing: A theoretical reflection on perspective in design synthesis[\[http://www.drs2010.umontreal.ca/data/PDF/067.pdf\]](http://www.drs2010.umontreal.ca/data/PDF/067.pdf)*. In *The 2010 Design Research Society conference proceedings, proceeding 067*.

Drawing on Dervin, Klein, Russell, Snowden, and Weick, Kolko provides a theoretical reflection on the relationship between design synthesis, sensemaking/sense-making and framing. The reflection is based on professional practice and design consultancy and attempts to bring to bear research from different disciplines to what many designers feel is the necessity of applying intuitive abilities to find meaning and solutions in complex situations. This approach begins to illustrate how design solutions are deeply embedded in the culture of the designers themselves.

Lam, Louisa Mei Chun. 2014. A micro-macro sense-making model for knowledge creation and utilization in healthcare organizations. PhD diss., Aberystwyth Univ.

Lam compares differences and commonalities of Dervin's, Weick's, and Snowden's theories in philosophical origins, views on knowledge creation situations, the nature of knowledge and knowing, verbing and a process approach toward knowledge creation, the importance of dialogue and narratives in knowledge creation, and approaches to individual and organizational sense-making.

Maitlis, Sally, and Marlys Christianson. 2014. Sensemaking in organizations: taking stock and moving forward. *Academy of Management Annals* 8.1: 57-125.

Examines research on sensemaking in organizations, how events become triggers for sensemaking, how intersubjective meaning is constructed and the role of action in sensemaking. Considers sensemaking as a process, compares definitions of sensemaking, sensebreaking and sensegiving, and discusses theoretical and methodological opportunities, e.g. embodiment and sociomateriality and collaborative sensemaking (see *Participatory Sensemaking and Social Cognition*).

Urquhart, Christine. 2011. *Meta-synthesis of research on information seeking behavior[\[http://www.informationr.net/ir/16-1/paper455.html\]](http://www.informationr.net/ir/16-1/paper455.html)*. *Information Research* 16.1: paper 455

Examines the theoretical research strategies commonly used in information behavior research and discusses the type of meta-synthesis methods that might therefore be appropriate. Concludes that meta-ethnography and critical interpretative synthesis would be applicable.

Ward, Paul, Julie Gore, Robert Hutton, Gareth E. Conway, and Robert R. Hoffman. 2018. Adaptive skills and the *Condition Sine Qua Non* of expertise. *Journal of Applied Research in Memory and Cognition* 7.1: 35-50.

[Considers an integrated data-frame and flexible execution model of adaptive skill that merges Klein's data-frame model of sensemaking and Klein's flexexecution model of adaptive re-planning \(See *Gary Klein—Sensemaking in Cognitive Systems Engineering: Philosophy and Methodology*\). Proposes six adaptive skill training principles \(project for UK Ministry of Defence\).](#)

Brenda Dervin—Sense-making/Making Methodology

Dervin has a background as a practitioner and researcher in communication. She is much cited for her turn to user-centered approaches for communicating with and studying users (e.g., audiences, patients, clients, patrons, students, customers, clients). She has not defined sense-making as such except for attempting to force attention to the “verbs” of making sense—the many communicating behaviors, internal and external, conscious and unconscious—that humans use to make and unmake their understandings as they move through the time-spaces of their lives in situations assumed to be at one and the same time both orderly and disorderly. Dervin's project evolved over time from a loosely presented set of assumptions and methods for attending to user behaviors in communicative ways (1970s); to presentation formally as the “sense-making approach” (1980s); to Dervin's Sense-Making Methodology (SMM; 1990s onward). From the outset, Dervin has focused on developing a methodology and set of methods for studying communication communicatively in any context—intrapersonal, interpersonal, group, organizational, societal, and directed or mediated. Thus, Dervin's project forsakes the dominant foci in communication studies on the transmission of “accurate” intent and meaning from senders to receivers and in its place uses an approach that mandates attention to both interpretive diversities as well as interpretive views of differences between diversities. Dervin has used the term “sense-making” as an axiomatic place-holder to rise above the attentions within communication studies (and the social sciences in general) to small artificially delimited and imposed by disciplinary discourses human activities encapsulated in static nouns (e.g., emotions, dreams, habits, inventions, cognitions, ideas, hunches, and/or attitudes). This has involved a break with traditional instrumental assumptions about the nature of human beings, reality, information, and communication.

Philosophical Origins and Assumptions

What is perhaps the most unique aspect of Dervin's approach has been the focus on developing a philosophically informed methodological approach designed to focus on communication as communication. Dervin's work has been much impacted by Carter who has argued strongly [in Carter 2003](#) that one must attend to communication as communication rather than transmission ([Carter 2003](#)). Dervin [1992](#) is one of Dervin's earlier and core works to elaborate her SMM. How this approach can be applied to knowledge management is reviewed in Dervin [1998](#). SMM assumes that the making and unmaking of sense involves sometimes uniquely situated and sometimes across time-space habitual human movements through time-space from past, to present, to future and is exemplified in its central organizing metaphor. The foundational constructs in this metaphor include attention to time-space; movement (force, power, energy); gaps (constraints, barriers); history; horizons (past, present, and future); flexibility (fluidity, change, chaos); and rigidity (constancy, stability, inertia). This metaphor is not intended as ontological mapping of sense-making but rather as a methodological tool. It was designed to guide, for example, interviewing, data analysis, and dialogic practice. [Agarwal 2012 reviews SMM papers over two decades](#). It is assumed that any given micro-moment of sense-making can

be more fully illuminated by attending to SMM's foundational constructs. As enumerated in many writings that can be found in Dervin, et al. [2003](#), a reader containing eighteen paper reprints from 1980 to 2001, Dervin's development of SMM has drawn heavily on a wide variety of philosopher sources sometimes positioned as incommensurate (e.g., critical and administrative, qualitative and quantitative, micro and macro). In this way, the approach has been positioned as "methodology between the cracks." Dervin [2010](#) discusses how this methodology can bridge contradictory polarities that have divided communication scholars in opposing camps. [Jones 2015](#) cites SMM as discipline, practice and theory based. [Tidline 2005](#) discusses sense-making theory in relation to other information behavior theories.

[Agarwal, Naresh Kumar. 2012. Making sense of sense-making: tracing the history and development of Dervin's Sense-Making Methodology. In *International perspectives on the history of information science & technology: Proceedings of the ASIS&T 2012 Pre-Conference on the History of ASIS&T and Information Science and Technology*. Edited by Tony Carbo and Trudi Bellardo Hahn, 61-73. Medford, NJ: Information Today.](#)
[Among the multiple approaches to the study of information behavior in general and sense-making/sense-making/sense making, the author posits value in making available a detailed review of one approach - Dervin's SMM. To this end, Agarwal reviews SMM papers across two decades focusing on influences, critiques of extant communication models, philosophical assumptions, the central metaphor used as organizing tool, research propositions, and methods for data collection and analysis.](#)

Carter, Richard F. 2003. Communication: A harder science. In *Communication: A different kind of horse race*. Edited by Brenda Dervin and Steven H. Chaffee, 369-376. Cresskill, NJ: Hampton.

Communication theorist Richard Carter has written for fifty years on how communication studies might attend to communication as communication rather than as transmission. He has developed both ~~theory~~ and methodological tools that have informed Dervin's works.

Dervin, Brenda. 1992. From the mind's eye of the user: The sense-making qualitative-quantitative methodology. In *Qualitative research in information management*. Edited by Jack D. Glazier and Ronald R. Powell, 61-84. Englewood, CO: Libraries Unlimited.

One of the earliest essays setting forth the methodology in development since 1972 as a programmatic research effort specifically focused on developing alternative approaches to the study of human information use. In this essay, Dervin presents an early version of methods proposed for studying sense-making.

Dervin, Brenda. 1998. Sense-making theory and practice: An overview of user interests in knowledge seeking and use. *Journal of Knowledge Management* 2.2 (December): 36-46.

Dervin reviews her approach to sense-making in terms of implications for knowledge management. Emphasis is placed on moving conceptualizations of users, information, and reality from noun-based knowledge-as-map to verb-based frameworks emphasizing diversity, complexity, and sense-making potentials. Sense-making is described as methodology disciplining the cacophony of diversity and complexity without homogenizing it.

Dervin, Brenda. 2010. Clear. . . unclear? Accurate. . . inaccurate? Objective. . . subjective? Research. . . practice? Why polarities impede the research, practice, and design of information systems and how sense-making methodology attempts to bridge the gaps. Part 1. *Journal of Evaluation in Clinical Practice* 16.5 (October): 994–1001.

Dervin discusses how her “methodology between the cracks” lays out how SMM attempts to bridge seemingly contradictory polarities including the oft-imposed critical versus administrative concepts that have divided communication scholars into opposing camps.

Dervin, Brenda, Lois Foreman-Wernet, and Eric Lauterbach, eds. 2003. *Sense-making methodology reader: Selected writings of Brenda Dervin*. Cresskill, NJ: Hampton.

This volume comprises eighteen paper reprints from 1980 to 2001 divided in two sections: Philosophical Foundations and Research Design and Practice. Some articles include reports of empirical investigations; most link philosophic premises to methodology-guided implementations. Foreman-Wernet contributes an original introductory essay on SMM as an approach to rethinking communication.

Jones, Peter Hayward. 2015. *Sensemaking Methodology: A liberation theory of communicative agency [<https://www.epicpeople.org/sensemaking-methodology/>]*. In *EPIC: Advancing the Value of Ethnography in Industry*.

Jones focuses on how researchers establish “methodological commitments.” He uses as exemplars major developments and types of sensemaking methodology. While he draws comparisons to the different perspectives of Klein, Russell, Snowden, and Weick, primary attention is given to Dervin’s SMM, the methodological approach Jones characterizes as “methodology as discipline, practice and theory based.” Looking at SMM from the vantage point of his expertise in participatory and design research and strategic innovation, Jones explicates how SMM advances methodological commitments.

Tidline, Tonya J. 2005. Dervin’s sense-making. In *Theories of information behavior*. Edited by Karen E. Fisher, Sanda Erdelez, and Lynne McKechnie, 113–117. Medford, NJ: Information Today.

This book comprises seventy-two brief descriptions of the varieties of theories that have informed those studying information behavior. Tidline’s review places particular emphasis on the verbs of sense-making and sense-unmaking, refocusing attention from the idea of information as discrete entity (i.e., noun) to the processes of being informed.

Methodology

Dervin’s SMM assumes that “theorizing” about human conditions and behaviors involves intertwined and tangled interconnections between philosophic assumptions and research implementations of (i.e., theorizing, research designing, data collecting, and conclusion drawing). SMM starts with a fundamental assumption about the ontological-epistemological paradox that it is assumed all communication faces—in the presence of diversities in interpretation even science does not offer any absolute way of navigating differences. This ever-present gap SMM assumes can be bridged (albeit only in part) by attending to communication communicatively – i.e. dialogically. – Dervin and Shields 2011 argues that the methodological tools provided by sense-making mandate attending to humans, not in terms of top-down imposed research constructs, but rather in terms of human universals that facilitate

understanding others within their own “maps of their worlds” rather than positioning them on our-imposed expert maps. Thus, SMM’s interviewing tools offer a variety of ways of addressing human movement through time-space in terms of universals. Examples include formats labeled as “time-line micro-moment” focusing on a single situational entry broken into micro-moments as seen by informants; in contrast to the “life-line” where informants name multiple situations that they interpreted as being similar across a life-line of experiences. Dervin 2015 presents these different interviewing practices comprehensively. Olsson 2005 shows the application of the “life-line” and “time-line” techniques. The queries that are addressed focus not on noun descriptors imposed on humans but rather on how interviewees see themselves as moving through time-space and how they define themselves. Example queries include: What happened? What did you see as leading to it? What were the outcomes—helpful and hindering? What questions did you have? What hunches and ideas did you come to? Methodological mandates such as these were first most systematically elaborated in Dervin 1999 and in a variety of chapters in Dervin, et al. 2003 (cited under [Brenda Dervin—Sense-Making: Philosophical Origins and Assumptions](#)). [In addition, Dervin and Clark 1999 provides 20 reports illustrating how the methodological tools of SMM can be applied in widely variant ways while being anchored in their own unique origin discourse communities.](#) [Dervin, et al. 2018 contains recent updates.](#) [Savolainen 1993 focuses on implementations in the field of library and information science.](#) [Dalrymple 2001 discusses how Dervin and Zweizig influenced user-centered methodologies in that discipline.](#) [and Lin 2010 discusses the dialogic principles of SMM.](#) [Cheuk and McKenzie 2018 similarly emphasizes SMM dialogue for online leadership development.](#) [Gaston 2017 discusses SMM for culturally diverse contexts.](#) [Olsson and Lloyd 2017 extends the information practices perspectives using SMM, emphasizing embodiment \(see also \[*Participatory Sensemaking and Social Cognition*\]\(#\)\).](#)

[Cheuk, Bonnie, and Jane McKenzie. 2018. Developing the practice of online leadership: lessons from the field. In *Online collaboration and communication in contemporary organizations*. Edited by Ditte Kolbaek, 235-255. Hershey, PA: IGI Global. McKenzie examines how sense-making has influenced the principles of leadership development practiced by Cheuk for online networked communication. Leaders are encouraged to host better conversations with their staff, both online and face-to-face. Better dialogue should be accompanied by better judgment about what is appropriate when, and how.](#)

[Dalrymple, Prudence W. 2001. A quarter century of user-centered study: The impact of Zweizig and Dervin on LIS research. *Library and Information Science Research* 23.2 \(Summer\): 155–165. Zweizig, an early doctoral student of Dervin, spearheaded user-centered approaches in library and information science. Dalrymple assesses the impact of Zweizig’s critique using searches for Zweizig citations and “user-centered” as keywords, describing characteristics of “user-centered” literature, and evaluating Zweizig’s initial call to incorporate social science methodologies into library and information science research.](#)

Dervin, Brenda. 1999. On studying information seeking methodologically: The implications of connecting meta-theory to method. *Information Processing and Management* 35.6 (November): 727–750.

Field Code Changed

This paper was the first to lay out how SMM has been defined methodologically. A later version appears in [the *Sense-Making Methodology Reader*](#) (Dervin, et al. 2003, cited under [Brenda Dervin—Sense-Making: Philosophical Origins and Assumptions](#)).

Dervin, Brenda. 2015. Dervin's sense-making theory. In *Information seeking behavior and technology adoption: Theories and trends*. Edited by Mohammed Nasser Al-Suqri and Ali Saif Al-Aufi, 59–80. Hershey, PA: IGI Global.

Dervin presents the most comprehensive explication of SMM's methodological mandates particularly as implemented in interviewing practice.

[Dervin, Brenda, and Kathleen D. Clark. 1999. Exemplars of the use of sense-making methodology \(meta-theory method\): In-depth introduction to the sensemaking issues of the electronic journal of communication. *The Electronic Journal of Communication* 9: 2–4. Twenty empirical reports focusing on how authors use SMM in their own discourse communities including applications to the study of communication in feminist groups, reflective nursing practice, communication campaign practice, community television, media use for social change, environmental experiences, assessing cancer information services, electronic discussion groups, and impacts of advertising.](#)

Dervin, Brenda, and Peter Shields. 2011. Disciplining communication: Invention, resistance, the dialectic struggle and its paradoxes. In *Against objections: Politics, communication, and philosophy*. Edited by Frank Deppe, Wolfgang Meixner, and Gunther Pallaver, 51–61. Innsbruck, Austria: Innsbruck Univ. Press.

The authors explain how Dervin's approach to sense-making is based on a core set of methodological assumptions about internal and external communicatings that frame the approach as a critical meta-theory. What this mandates is focusing on sense-makers not only as objective information receivers but as active constructors of new and revised sense and active resisters of ideological-constrained information.

[Dervin, Brenda, Bonnie Cheuk, Benny Cheung and Michael Allen. 2018. *Sense-Making Methodology Institute: Dervin's Sense-Making Methodology*](#)
<http://www.sense-making.org>

[This non-profit, educational site provides materials to learn about Dervin's Sense-Making Methodology and how it has been applied in different discourses. It includes papers by Dervin and her students, other papers that have used SMM, plus teaching and workshop materials.](#)

[Gaston, Nicole Marie. 2017. Contextualizing information behavior: a methodological approach. *Journal of Critical Library and Information Studies* 1.1: 1-33.](#)
[Using a deep conceptual review, the author explores the role of context and methodology in investigations of information behavior. The aim was to illustrate how a more contextually responsive method may provide more robust understandings of individuals in culturally diverse contexts. Two studies of informants in Laos and Samoa combined critical incident and SMM interviewing approaches with discourse analytic tools. A major finding was that Buddhist oriented informants reported Buddhist theory and spiritual practices as information behavior.](#)

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Lin, Chi-Shiou. 2010. Neutral questioning: A sense-making technique for the reference interview. *Journal of Librarianship and Information Studies* 2.1: 1–15.

Originally reported by B. Dervin and P. Dewdney. 1986. Neutral questioning: A Sense-Making technique for the reference interview *RO* 25.4: 506–513. Neutral questioning involves using what is now labeled “SMM questioning” in the reference library interview and other query exchanges between experts and clients. Lin reviews the strengths and limitations of the approach.

Olsson, Michael. 2005. *Meaning and authority: The social construction of an ‘author’ among information behavior researchers. *Information Research* 10.2: [paper 219](http://InformationR.net/ir/10-2/paper219.html) [<http://InformationR.net/ir/10-2/paper219.html>]*

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Explores the social processes that influence the construction by academic (information behavior) researchers of the significance of an author and her work prominent in their field’s literature. Olsson uses semi-structured qualitative interviews, based in part on the life-line and time-line techniques developed by Dervin and her collaborators.

Olsson, Michael, and Annemaree Lloyd. 2017. *Being in place: embodied information practices [<http://informationr.net/ir/22-1/colis/colis1601.html>]*. Proceedings of the ninth International Conceptions of Library and Information Science, Uppsala, Sweden, June 27-29, 2016. In *Information Research* 22.1.

The authors extend the information practices viewpoint by connecting it to a range of different approaches, including practice theory and Dervin’s Sense-Making. Drawing on constructionist empirical studies of fire fighters, renal nurses, patients with chronic illness, theatre professionals and archaeologists, the authors explore the dynamic, embodied and corporeal sense-making processes which are central to a holistic view of information practices. The aim was to highlight the importance of the corporeal.

Savolainen, Reijo. 1993. The sense-making theory: Reviewing the interests of a user-centered approach to information seeking and use. *Information Processing and Management* 29.1 (January–February): 13–28.

This oft-cited essay focuses on sense-making theory in relation to the interests of traditional intermediary-centered approaches. The theory is reviewed by analyzing its conceptions of information, information seeking and use, structure, and action. The theory’s assumptions are assessed in terms of recent developments of social science and methodology.

Applications

By far, most of the attention to Dervin’s works have involved reviews of its philosophic (sometimes labeled theoretic) underpinnings as well as numerous fleeting references to how the work has mandated a turn to user-oriented user studies. In addition, a robust set of applications to user studies cover an array of situations: everyday information needs; health, hospital, and workplace communication; telecommunication policy; development and social change; religion, spirituality, risk, and wilderness experiences; education and pedagogy; educational administration; community radio; online use; social media; audience interpretation of news; disability studies; public communication campaigns; and HIV/AIDS studies. Authors have applied the approach sometimes comprehensively but more often in adaptations that authors saw

as most useful to their unique missions. ~~lau: We do not support external links in the commentary paragraphs. If this source is important, please add a citation and annotation below.~~ SMM's most successfully tested proposition is that communicating behaviors internal and external show habitual patterns primarily when forces (e.g., external power, hegemonies) are interpreted by users as constraining. In contrast, situational and circumstantial interpretations play more of a role when users interpret themselves as moving free of constraints. Consistent with its meta-theory, SMM assumes that for communicating to be more effective we must find disciplined ways of allowing differences to speak and be understood. SMM has, for example, formalized plans for focus group research that involve rounds of individual journalings and open sharings, but without interruptions and disagreements aired capriciously. While this approach contradicts much of the communication field's emphasis on spontaneity, uses of the SMM approach to dialogue has been widely tested in conferences, workshops, conflict mediations, and classroom situations with considerable reports of utility. Examples of dialogic principles drawn from SMM are described in Cheuk 2013, ~~Lin 2010, and~~ Schaefer and Dervin 2009, ~~and Olsson 2005 (cited under *Brenda Dervin—Sense-Making: Methodology*).~~ ~~Savolainen 1992 focuses on implementations in the field of library and information science.~~ More recent examples ~~framed primarily within the same field~~ include Dalrymple-Genuis and Bronstein 2016, an information behavior study on normality for health that was guided in design by SMM, 2001, as was Naveh and Bronstein 2019, a study of sensemaking in virtual health communities. ~~aDow, et al. 2015 uses an SMM communication-as-procedure approach, review focusing on a user-centered study that spans twenty-five years; Tidline 2005, a review of Dervin's sensemaking Olsson 2015 uses SMM with other theoretical approaches, whereas interviews conducted in~~ den Haan, et al. 2019 were informed by SMM but cultural theory was used in analysis. Reinhard and Dervin 2012 uses SMM and a conceptualization of media reception situations. Stieglitz, et al. 2017 uses shortened versions of SMM interviews, ~~T, and Olsson 2005 (cited under Brenda Dervin—Sense-Making: Methodology).~~ The empirical reports discussed in ~~Dervin and Clark 1999 and~~ the two monographs Shields 2002 and ~~Pariyadath and Kline 2016 provide two comprehensive examples that apply SMM in widely variant ways while being anchored in their own unique origin discourse communities.~~ ~~Coeo 2014 provide two comprehensive examples that apply SMM in widely variant ways while being anchored in their own unique origin discourse communities.~~

Field Code Changed

Cheuk, Bonnie. 2013. *Social strategies in action: Driving business transformation*. London, UK: Ark Group.

Cheuk's application focuses on the design of knowledge management procedures, finding ways to improve knowledge sharing, communication, and collaboration. Cheuk is highly recognized for her strategic yet hands-on adoption of social approaches to organizational knowledge management. She has applied Dervin's approach since 1999 to inform her practice.

den Haan, Robert-Jan, Jan M. Fliervoet, Marcha C. van der Voort, V. Juliette Cortes Arevalo, and Suzanne J. M. H. Hulscher. 2019. Understanding actor perspectives regarding challenges for integrated river basin management. *International Journal of River Basin Management* 17.2: 229-242.

Finds that integrated river basin management increases technical as well as management complexity. In this multidisciplinary setting, actors from different organizational backgrounds, framed both issues and solutions differently. SMM-informed semi-structured interviews were conducted with 15 experienced Dutch river basin management actors and Cultural Theory was

[used to analyze responses. Analyses showed how actors used different rationalities in constructing perspectives. The authors conclude new tools are needed to facilitate exchanging actors' perspectives.](#)

[Coco, Angela. 2014. *Catholics, conflicts, and choices: An Exploration of power relations in the Catholic Church*. Durham, UK: Acumen.](#)

[Monograph reporting empirical application of SMM to the study of Catholics \(i.e., lay people, priests, nuns, brothers\) discussing their struggles with Catholic Church teachings and practices. Coco examines results through sociological, psychological, and feminist lenses and concludes by focusing on implications for change in Catholic institutional structures.](#)

[Dalrymple, Prudence W. 2001. A quarter century of user-centered study: The impact of Zweizig and Dervin on LIS research. *Library and Information Science Research* 23.2 \(Summer\): 155-165.](#)

[Zweizig, an early doctoral student of Dervin, spearheaded user-centered approaches in library and information science. Dalrymple assesses the impact of Zweizig's critique using searches for Zweizig citations and "user-centered" as keywords, describing characteristics of "user-centered" literature, and evaluating Zweizig's initial call to incorporate social science methodologies into library and information science research.](#)

[Dervin, Brenda, and Kathleen D. Clark. 1999. Exemplars of the use of sense-making methodology \(meta-theory method\): In-depth introduction to the sensemaking issues of the electronic journal of communication. *The Electronic Journal of Communication* 9:2-4.](#)

[Twenty empirical reports focusing on how authors use SMM in their own discourse communities including applications to the study of communication in feminist groups, reflective nursing practice, communication campaign practice, community television, media use for social change, environmental experiences, assessing cancer information services, electronic discussion groups, and impacts of advertising.](#)

[Dow, Mirah J, Carrie A, Boettcher, Juana F. Diego, E. Marziah, Ashley Todd-Diaz, and Kristine M. Woods. 2015. Case-based learning as pedagogy for teaching information ethics based on the Dervin Sense-Making Methodology. *Journal of Education for Library and Information Science* 56.2: 141-157.](#)

[The study's purpose was to determine the effectiveness of case-based pedagogy for teaching basic principles of information ethics and ethical decision making, and reports results of a pre- and post-assessment mixed methods study of 49 library and information science graduate students at a US university. The pedagogical approach developed was influenced by Dervin 'and colleagues' SMM communication-as-procedure model. The authors conclude that pedagogy using SMM holds promise for information ethics education.](#)

[Foreman-Wernet, Lois, and Brenda Dervin. 2017. Hidden depths and everyday secrets: how audience sense-making can inform arts policy and practice. *The Journal of Arts Management, Law, and Society* 47.1: 47-63.](#)

[The authors report on a large application of SMM audience research. They define SMM as an approach developed specifically for providing data useful to informing policies and practices of institutions mandated to serve publics. They review narrative themes that have emerged from](#)

[SMM informed studies and analyses of accounts of cultural experiences with the arts by several hundred student informants; and offer five potential applications for arts policy and practice.](#)

[Genuis, Shelagh K., and Jenny Bronstein. 2016. Looking for “normal”: Sense Making in the context of health disruption. *Journal of the Association for Information Science and Technology* 68.3: 750-761.](#)

[Focuses on how notions of normality were expressed by, and what these expressions meant for people engaged in information behaviors related to life disrupting health challenges. Reports on two studies of patients facing disruptions involving: a\) menopause transition; and b\) obsessive compulsive disorder. Neither study implemented SMM data collection methods but both were guided in design and analysis by SMM meta-theoretic premises. Findings demonstrate that sense-making of normality changes and develops experientially and socially over time.](#)

[Lin, Chi Shiou. 2010. Neutral questioning: A sense-making technique for the reference interview. *Journal of Librarianship and Information Studies* 2.1 \(February\): 1-15. Originally reported by D. Dervin and P. Dewdney, 1986. Neutral questioning: A Sense-Making technique for the reference interview *RQ* 25.4: 506-512. Neutral questioning involves using what is now labeled “SMM questioning” in the reference library interview and other query exchanges between experts and clients. Lin reviews the strengths and limitations of the approach.](#)

[Naveh, Sharon, and Jenny Bronstein. 2019. Sense making in complex health situations. *Aslib Journal of Information Management* 71.6: 789-805.](#)

[Drawing on Dervin’s SMM theoretic and methodological base, the authors examine the role virtual health communities play for pregnant women coping with diabetes. Data was 507 content analyzed online posts. This study highlights the significance of sense-making processes in managing complex health situations and the value of virtual communities as sources of information and social support.](#)

[Olsson, Michael. 2016. Making sense of the past: the embodied information practices of field archaeologists. *Journal of Information Science* 42.3: 410-419.](#)

[Informed in part by Dervin’s SMM theoretic and methodological base along with other social constructionist, critical and discourse analytics, Olsson studies the information practices of 10 field archeologists and students at two digs. Combining both ethnographic observation and in-depth interviews, findings showed that participant practices were both social and embodied in nature.](#)

[Pariyadath, Renu, and Susan L. Kline. 2016. Bridging difference: a sense-making study of the role of communication in stereotype change. In *Communicating Prejudice: An Appreciative Inquiry Approach*. Edited by Sakile K. Camara, and Darlene K. Drummond, 1-20. Hauppauge, New York: Nova Science Publishers.](#)

[Used Dervin’s Sense-Making Methodology \(SMM\) to study the types of intercultural contact that led to stereotype revision in cultural others. Interviews with participants who had revised stereotypes about cultural others overcame stereotypes by refocusing attention on the other and opening dialogue with them. The study suggests that both the content and the dialogic form of communication between cultural others influences stereotype review.](#)

[Reinhard, Carrie Lynn D., and Brenda Dervin. 2012. Comparing situated sense-making processes in virtual worlds: Application of Dervin's Sense-Making Methodology to media reception situations. *Convergence: The International Journal of Research into New Media Technologies* 18.1: 27-48.](#)

[Compares how novices made sense of engagements with four media technologies: film, console videogames, massively multiplayer online role-playing games, and social virtual worlds. Using Dervin's SMM and a conceptualization of media reception situations, authors made comparisons that did not presume a priori influences of characteristics of technologies and structures. Results indicated how the media reception situations converged and diverged and how they involved multiple influences. Details the methodology for data collection/production and analyses.](#)

~~[Savolainen, Reijo. 1993. The sense-making theory: Reviewing the interests of a user-centered approach to information seeking and use. *Information Processing and Management* 29.1 \(January-February\): 13-28.](#)~~

~~[This oft-cited essay focuses on sense-making theory in relation to the interests of traditional intermediary-centered approaches. The theory is reviewed by analyzing its conceptions of information, information seeking and use, structure, and action. The theory's assumptions are assessed in terms of recent developments of social science and methodology.](#)~~

[Schaefer, David, and Brenda Dervin. 2009. From the dialogic to the contemplative: A conceptual and empirical rethinking of online communication outcomes as verbing micro-practices. *Ethics and Information Technology* 11.4 \(December\): 265-278.](#)

[An investigation of impacts of SMM-derived procedures for online communicating. It is proposed that traditional approaches to studying communication draw upon outcome and consensus orientations that prevent theorizing about how communication behaviors either inhibit or facilitate dialogic processes. Authors conclude that effective dialogue needs emphasis on self-reflection as well as consensus.](#)

[Shields, Vickie Rutledge. 2002. *Measuring up: How advertising affects self-image*. Philadelphia: Univ. of Pennsylvania Press.](#)

[Monograph reporting empirical applications of sense-making interviewing to a study of advertising image reception and how advertising serves as vehicles for conveying larger views of a confining body-obsessed culture. This emphasis on ethnographic data \(rather than textual interpretations alone\) was an early addition to feminist cultural studies' focus on advertising.](#)

[Stieglitz, Stefan, Milad Mirbabaie, and Jennifer Fromm. 2017. Understanding sense-making on social media during crises: Categorization of sense-making barriers and strategies. *International Journal of Information Systems for Crisis Response and Management* 9.4: 46-69.](#)

[Little is known about how people utilize social media to gain understandings of crisis situations. Authors report on a study conducting shortened versions of Dervin's SMM interviews with 18 German social media users. Qualitative content analyses informed categorizations of sense-making barriers and strategies in the context of crisis situations and suggestions are made for how emergency agencies could more effectively utilize social media.](#)

Tidline, Tonyia J. 2005. Dervin's sense-making. In *Theories of information behavior*. Edited by Karen E. Fisher, Sansa Erdelez, and L. McKechnie, 113–117. Medford, NJ: Information Today. This book comprises seventy-two brief descriptions of the varieties of theories that have informed those studying information behavior. Tidline's review places particular emphasis on the verbs of sense-making and sense-unmaking, refocusing attention from the idea of information as discrete entity (i.e., noun) to the processes of being informed.

Karl Weick—Sensemaking in Organizations

Weick is a social psychologist but originally studied organizational psychology and graduated at Ohio University in 1962. He worked in different universities until he finally settled at the University of Michigan in 1988 as the Professor of Organizational Behavior and Psychology. At the same time, he began to turn his attention to social psychology and shifted his focus to sensemaking studies in the early 1970s. [He is the Rensis Likert Distinguished University Professor at the Ross School of Business at the University of Michigan.](#)

Philosophical Origins and Assumptions

[Weick's theory is rooted in interpretivism and constructivism, although it started with a cognitive stance, and a focus on how organizational members react to ambiguous events \(ecological changes\), to reduce equivocality through actions \(enactment\) to reconsider and reinterpret previous experiences. Gradually a plausible story emerges that is acceptable \(selection\) and added to organizational memory and narratives \(retention\). The focus is to impose order and to achieve a workable level of certainty. Weick 1995 takes a more social constructivist stance to define sensemaking as "a central activity in the construction of both the organization and the environments it confronts" \(p. 69\). It is "about such things as placement of items into frameworks, comprehending, redressing surprise, constructing meaning, interacting in pursuit of mutual understanding, and patterning" \(p. 6\). The emphasis is how people construct what they construct, why, and with what effects. There is no such thing as organization; there is only organizing, and organization is evolved in the processes underway. Weick 2001 puts forward seven properties of sensemaking process: "Sensemaking seems to follow roughly a sequence in which people concerned with *identity* in the *social* context of other actors engage ongoing events from which they *extract cues* and *make plausible sense retrospectively* while *enacting* more or less order into those *ongoing events*" \(p. 463\). Weick, et al. 2005 is a core theoretical work that further elaborates the possible future direction sensemaking in organizations may take, discussed further by Maitlis and Christianson 2014 \(cited under *General Overviews*\) and Brown, Colville and Pye 2015. Sandberg and Tsoukas 2015 critiques Weick's influence on organizational theory, discussing five main limitations. Lam 2014 \(cited under General Overviews\) suggests that the emphasis on the imposition of order and the establishment of certainty may be limiting. Thurlow and Mills 2015 critically examines what is considered plausible and why, and Schildt 2019 reviews power in sensemaking, distinguishing between systemic power and episodic power. Ogliastri and Zúñiga 2016 notes that Latin American management literature discusses Weick's ideas, but not using the same terms. Kataria, et al. 2018 emphasizes the role of emotion in sensemaking in an organization \(Anglican Communion\) facing worldwide changes. Helpap and Bekmeier-Feuerhahn 2016 tests an extended model of sensemaking that includes emotions. Weick's theory is rooted in interpretivism and constructivism. It started with a cognitive stance. Weick 1979 argues that the purpose of sensemaking is to remove equivocality in an enacted environment by means of four](#)

related processes of ecological change, enactment, selection, and retention. The equivocality brought about by environmental changes sparks off actions (enactment) by organizational members to reconfigure their environment through bracketing and labeling retrospectively portions of their lived experiences based on preconceptions of what worked best in the past. Appropriate assembly rules and communication cycles are identified to assign a new meaning or interpretation to their experiences, resulting in an enacted environment that is more orderly, and a plausible story that is able to stabilize the streaming experience begins to emerge. Organizational members agree to select this story as a reasonable interpretation of the new environment (selection) and retain it as organization memory and narratives in the form of a cognitive map (retention). The focus is to impose order and to achieve a workable level of certainty. On this basis, Weick 1995 takes a more social constructivist stance to define sensemaking as “a central activity in the construction of both the organization and the environments it confronts” (p. 69). It is “about such things as placement of items into frameworks, comprehending, redressing surprise, constructing meaning, interacting in pursuit of mutual understanding, and patterning” (p. 6). The emphasis is how people construct what they construct, why, and with what effects. There is no such thing as organization; there is only organizing, and organization is evolved in the processes underway. Weick 2001 puts forward seven properties of sensemaking process that further reveal the author’s constructivist stance, “Sensemaking seems to follow roughly a sequence in which people concerned with *identity* in the *social* context of other actors engage ongoing events from which they *extract cues* and *make plausible sense retrospectively* while *enacting* more or less order into those *ongoing events*” (p. 463). Weick, et al. 2005 is a core work that further elaborates the possible future direction sensemaking may take. Sandberg and Tsoukas 2015 critiques Weick’s influence on organizational theory, listing five main points. Lam 2014 (cited under [General Overviews](#)) suggests that the emphasis on the imposition of order and the establishment of certainty may be limiting. In contrast, Dervin’s SMM embraces but disciplines diversity and complexity. Weick’s writings also lack empirical and quantitative data for further testing and validation.

[Brown, Andrew D., Ian Colville, Ian , and Annie Pye. 2015. Making sense of sensemaking in *Organization Studies*. *Organization Studies* 36.2: 265-277.](#)

[Reviews sensemaking research published in the journal. The five themes discussed are: sense made through discourse; the politics and power associated with social forms of sensemaking; how institutions shape sensemaking, and how actions are judged culturally appropriate in the setting; how people’s identities affect their sensemaking; and how sensemaking processes contribute to decision making and change \(or not\).](#)

[Helpap, Sevda, and Sigrid Bekmeier-Feuerhahn. 2016. Employees’ emotions in change: advancing the sensemaking approach. *Journal of Organizational Change Management* 29.6: 903-916.](#)

[Uses Weick’s 1988 model of enacted sensemaking together with ideas from the Affect Infusion Model. The extended model of sensemaking should help understand how emotions affect the cognitive processing and judgments involved in sensemaking. The model was tested by employees in a vignette study of management restructuring with participatory or programmatic change strategies, and the results confirmed the role emotions play in change behavior or resistance to change.](#)

Kataria, Niyati, Glen Kreiner, Elaine Hollensbe, Mathew L. Sheep, and Jeff Stambaugh. 2018. The catalytic role of emotions in sensemaking: Evidence from the blogosphere. *Australian Journal of Management* 43.3: 456-475.

Analyzes, qualitatively, texts of blogs from members of the Anglican communion following a controversial decision. Identifies that emotions were used as catalysts in the sensemaking, sensegiving and sensebreaking processes. Emotions were targeted through language intended to influence the thoughts of others in the virtual community.

Ogliastri, Enrique, and Roy Zúñiga. 2016. An introduction to mindfulness and sensemaking by highly reliable organizations in Latin America. *Journal of Business Research* 69.10: 4429-4434. Discusses case studies of highly Latin American organizations that were revised and rewritten using the Weick perspective of collective mindfulness, that depends on individuals in an organization using sensemaking processes to understand problems or ambiguous, unexpected situations and to take appropriate actions – or “ponerse las pilas” in Spanish.

Sandberg, Jörgen, and Haridimos Tsoukas. 2015. Making sense of the sensemaking perspective: Its constituents, limitations, and opportunities for further development. *Journal of Organizational Behavior* 36: S6–S32.

Critically reviews the major constituents of Weick’s sensemaking and five characteristics of sensemaking process. Discusses the major criticisms of the theory: ~~its whether~~ retrospective sensemaking helps prospective sensemaking; ~~characteristic~~, the vague notion of process, insufficient elaboration of the concept of sense, ~~and the~~ neglect of the larger institutional context; ~~and reduction of reality to subjective understanding. in which sensemaking occurs.~~

Schildt, Henri, Saku Mantere, and Joep Cornelissen. 2019. Power in sensemaking processes. *Organization Studies* <https://doi.org/10.1177/0170840619847718>.

Discusses how systemic power works through knowledge structures and identities, to produce four ideal sensemaking processes (automatic, algorithmic, improvisational, and reflective). Episodic power may act to suppress these processes (by dismissing divergent views, for example) or empower those processes (by questioning initial explanations, for example).

Thurlow, Amy, and Jean Helms Mills. 2015. Telling tales out of school: Sensemaking and narratives of legitimacy in an organizational change process. *Scandinavian Journal of Management* 31.2: 246-254.

Critiques plausibility in sensemaking and proposes critical sensemaking. Analyzes the process of change in a Canadian community college using critical discourse analysis and identifies forms of legitimization (moralistic, rational, authoritative) that affect how plausibility is confirmed.

Weick, Karl E. 1979. *The social psychology of organizing*. 2d ed. Reading, MA: Addison-Wesley.

This second edition expands on the first 1969 edition to cover the process of organizing and to put forward the concept of a cause map to highlight the importance of group discussion in sensemaking. Also invokes the concept of loose coupling, setting the scene for later publications.

Weick, Karl E. 1995. *Sensemaking in organizations*. Thousand Oaks, CA: SAGE.

A core text that covers the nature of Weick's sensemaking and its seven properties: grounded in identity construction, retrospective, enactive of sensible environments, social, ongoing, focused on and by extracting cues, and driven by plausibility rather than accuracy. It also clarifies the processes of sensemaking driven by belief and action.

Weick, Karl E. 2001. *Making sense of the organization*. Oxford, and Malden, MA: Blackwell Business.

This is a compilation of the most significant literature on sensemaking in organizations. It details the four processes of sensemaking in organizations and its applications in addressing social problems, chaotic situations, and global changes.

Weick, Karl E., K. M. Sutcliffe, and D. Obstfeld. 2005. Organizing and the process of sensemaking. *Organization Science* 16.4: 409–421.

Elaborates central features of sensemaking conceptually and descriptively. Conceptually, sensemaking is instigated by situations seen as different from the past, gradually evolves within organizations, is rooted in identity construction, and is driven by plausibility, not accuracy. Descriptively, sensemaking retrospectively aims to organize flux communicatively, for example, by labeling, presumption, action, or organizing.

Application

Weick and Roberts 1993 is one of the most highly cited papers that applies Weick's theory. It uses the flight operation on aircraft carriers to exemplify the process for the formation of collective mind in heedful interrelating. Weick 1993 ([on the Mann Gulch fire disaster](#)) is another highly cited example of the collapse of sensemaking. ~~It examines the Mann Gulch fire disaster to demonstrate how the fire fighters failed to make sense of the situation.~~ Recently, Jensen 2009 presents methods to measure sensemaking performance in command forces. [Weick's sensemaking ideas have been applied in many different organizational settings such as: change agents working to alter supply chain practice in pig farming \(van der Heijden and Cramer 2017\); safety-critical situations \(Kilskar. et al. 2018\); China's system for responding to national emergencies \(Lu and Xue 2016\); and mediated sensemaking by family business advisers.](#) Weick's theory is also commonly applied in health care and health promotion. Jordan, et al. 2009 examined the critical role of conversations for effective sensemaking to occur in health-care teams, [Rhodes, et al. 2016 studies how patients in primary care experienced and enacted safety, and Vogelsmeier, et al. 2017 compares how different groups of nurses react to medication discrepancies.](#) Djaballah, et al. 2017 refers to prospective/strategic sensemaking (see also [*Situation Awareness*](#)).

[Djaballah, Mathieu, Christopher Hautbois, and Michel Desbordes. 2017. Sponsors' CSR strategies in sport: A sensemaking approach of corporations established in France. *Sport Management Review* 20.2: 211-225.](#)

[Adapts Weick's sensemaking to allow for prospective \(strategic\) sensemaking, and studied three key sensemaking activities of scanning, interpretation and action. Shows how internal and external determinants led to corporate social responsibility actions by sponsors, and distinguished between positive and negative sensemaking strategies.](#)

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Jensen, Eva. 2009. Sensemaking in military planning: A methodological study of command teams. *Cognition, Technology & Work* 11.2: 103–118.

Presents methods to measure sensemaking performance in command teams during military planning. Considers effects on sensemaking processes: amount of information and mode of communication. Weick's sensemaking is foundation. The author contrasts with usual military notions that sensemaking comprises situation awareness plus understanding.

Jordan, Michelle E., Holly J. Lanham, Benjamin F. Crabtree, Paul A. Nutting, William L. Miller, Kurt C. Stange, and Reuben R. McDaniel Jr. et al. 2009. The role of conversation in health care interventions: enabling sensemaking and learning. *Implementation Science* 4 (article 15): 1–13.

Uses ideas from sociolinguistics on conversation in general together with ideas from complex adaptive systems theory to examine the critical role of conversations for effective sensemaking and learning to occur in health-care interventions and to explain puzzling aspects of some implementations.

Kilskar, Stine Skaufel, Brit-Eli Danielsen, and Stig Ole Johnsen. 2018. Sensemaking and resilience in safety-critical situations: a literature review. Safety and Reliability–Safe Societies in a Changing World. Proceedings of ESREL 2018, June 17-21, 2018, Trondheim, Norway. Uses the Weick perspective on sensemaking to help identify the characteristics of sensemaking and resilience in safety-critical situations. Discusses how the 33 studies identified for the review defined sensemaking, and how they describe the relationship between sensemaking and resilience.

Lu, Xiaoli, and Lan Xue. 2016. Managing the unexpected: Sense-making in the Chinese emergency management system. Public Administration 94.2: 414-429. Describes the Chinese National Emergency Management system, that emerged after the SARS crisis and discusses whether effective sensemaking can take place in the new administrative structures. Joint sensemaking may be impeded by the lack of expertise among first responders to make sense of the situation, and the emergency plan system does not offer scripts for cue bracketing.

Rhodes, Penny, Ruth McDonald, Stephen Campbell, Gavin Daker-White, and Caroline Sanders. 2016. Sensemaking and the co-production of safety: a qualitative study of primary medical care patients. Sociology of Health & Illness 38.2: 270-285. Uses Weick's sensemaking framework to examine how individuals make sense of their experiences of primary medical care and how that sensemaking shapes and reshapes their conceptualization of safety. Notes how patients judged how to structure their interactions with doctors based on prior experience. The sensemaking framework helped to identify the psychosocial aspects of safety in primary care settings.

Senier, Laura, Leandra Smollin, Rachael Lee, Lauren Nicoll, Michael Shields, and Catherine Tan. 2018. Navigating the evidentiary turn in public health: Sensemaking strategies to integrate genomics into state-level chronic disease prevention programs. Social Science & Medicine 211 (August): 207-215.

[Uses Weick's organizational sensemaking concepts to understand the reciprocal processes of sensemaking and sensegiving as Michigan's state public health agency integrated genomics into their programs for chronic disease prevention.](#)

[van der Heijden, Angela, and Jacqueline M. Cramer. 2017. Change agents and sustainable supply chain collaboration: A longitudinal study in the Dutch pig farming sector from a sensemaking perspective. *Journal of Cleaner Production* 166 \(November\): 967-987. Uses Weick's organizational sensemaking ideas to clarify interactions for collaboration on sustainability, providing greater understanding of supply chain practice. The sensemaking perspective focuses on communicating \(discursively constructing accounts\), acting \(taking tentative action\), and building relationships. This perspective illuminates the activities of the change agents over a 17-year period.](#)

[Vogelsmeier, Amy, Ruth A. Anderson, Allison Anbari, Lawrence Ganong, Amany Farag, and MaryAnn Niemeier. 2017. A qualitative study describing nursing home nurses sensemaking to detect medication order discrepancies. *BMC Health Services Research* 17:1: 531. Examines differences between registered and licensed practical nurses in reconciling medication discrepancies in nursing homes. Analysis focuses on the differences in mental models of the two groups of nurses in extracting cues, interpreting events, making sense of events in relation to previous experience, and clarifying intentional changes from possible errors.](#)

Weick, Karl E. 1993. The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly* 38.4: 628–652.

Analyzes the death of thirteen men in the Mann Gulch fire disaster in Montana to illustrate the disintegration of sensemaking and discusses how an organization can be more resilient. Four potential sources of resilience were identified, namely, improvisation, virtual role systems, the attitude of wisdom, and norms of respectful interaction.

Weick, Karl E., and K. H. Roberts. 1993. Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly* 38.3: 357–381.

Collective mind is conceptualized as patterns of heedful interrelations of actions in social systems in which actors construct actions on understandings that systems consist of connected actions by themselves and others and interrelate their actions within the system, which is essential to organizations requiring error-free operations at nearly all times.

David Snowden—Sense-making, Making and Complexity

Coming from the management science background, Snowden developed his ideas on sense-making while working as the Director in IBM Institute for Knowledge Management in 1996. When he founded the Cognitive Edge in 2005, the aim was to equip organizations to deal with seemingly intractable problems in uncertain settings. His research reflects both his practitioner and academic perspectives. [The Cognitive Edge SenseMaker® tool is discussed in *Collaborative Sensemaking Tools*](#).

Philosophical Origins and the Cynefin Framework

Snowden's sense-making focuses on cognitive behavior in making decisions, in complex systems, an approach he termed "naturalizing sense-making". He defines sense-making as how

we make sense of the world so we can act in it. He is concerned with understanding the way people choose between multiple possible explanations of inputs to the organization and act responsively. This is best exemplified in the Cynefin Framework, the development of which, from Boisot's I-Space knowledge management model in 1999 to the current application in leadership, is charted in Snowden [2010](#). Snowden [2002](#) proposes that knowledge is both a thing and a flow and that the Framework is the sense-making model to examine how one can live with this diversity with different management styles in its five domains. Kurtz and Snowden [2003](#) incorporate complex adaptive systems and narrative into Cynefin to give decision makers new constructs to make sense of unspecified problems, to help people consider intractable problems in new ways, and to allow the emergence of shared understandings. Each of the five domains delineates different sets of causal and effect relationship that requires different analysis and management strategies. The simple/known domain, with a linear cause and effect relationship epitomizes the best practice of an organization (sense, categorize, respond). The complicated/knowable domain contains stable but unknown cause and effect relationships that need data analysis and application of expert knowledge (sense, analyze, respond). The complex domain contains complex cause and effect relationships that can only be understood in retrospect. "Safe to fail" experiments that allow probing, to sense and respond and to learn from planned failure, are needed (probe, sense, respond). The chaotic domain has no apparent cause and effect relationship, requiring quick action from the management to then sense possible responses that may be innovative (act, sense, respond). In the disordered domain, people revert to their preferred comfort zones for decision-making as they are uncertain about the cause and effect relationships. The Framework has been applied in many other areas of management consultancy. Snowden [2004](#) emphasizes the importance of narrative and storytelling as an alternative procedure for organizational dialogue and the response to accommodate diversity and complexity, [with indications of how to analyze micro-narratives in Snowden 2011](#).—Snowden [2005](#) identifies sixteen different types of dynamic knowledge flow patterns in which knowledge is transformed from one state to another at different times by deploying different techniques. Snowden and Boone [2007](#) explains how leaders can make use of Cynefin for leadership.

Kurtz, Cynthia- F., and David- J. Snowden. 2003. The new dynamics of strategy: Sense-making in a complex and complicated world. *IBM Systems Journal* 42.3: 462–483.
A core work to challenge the assumption of order, of rational choice, and of intent in organizational decision-making and argues that the Cynefin Framework can serve as a sense-making tool to help people make sense in the complex and complicated ontologies illustrated in the Framework.

Snowden, David- J. 2002. Complex acts of knowing: Paradox and descriptive self-awareness. *Journal of Knowledge Management* 6.2: 100–111.
The three generations of knowledge management are delineated. Snowden describes different types of knowledge in the four domains of the Cynefin Framework that requires different forms of management and leadership styles. The Framework also illustrates different flow patterns of knowledge within an organization and how these multiple contexts can coexist.

Snowden, David- J. 2004. Narrative patterns: The perils and possibilities of using story in organizations. In *Creating value with knowledge: Insights from the IBM Institute for business value*. Edited by Eric- Lesser and Laurence- Prusak, 201–215. Oxford: Oxford University- Press.

Reviews functions of stories: revealing patterns of culture, behavior, and understanding in more effective ways than other approaches; allowing organizational patterns to emerge in understanding stories of projects; delivering complex ideas in consistent, meaningful forms without loss of integrity; and considering successes and failures without requiring criticism or admission of responsibility.

Snowden, [David](#)-J. 2005. Strategy in the context of uncertainty. *Handbook of Business Strategy* 6.1: 47–54.

Illustrates with two examples from crisis management and innovation how organizational decision-making can be improved by not learning from the past as the past is not always perfect but by viewing the world in terms of various complexities as shown in the Cynefin Framework.

Snowden, [David](#)-J. 2010. [The origins of Cynefin](#). *Cognitive Edge*.

Describes the evolution from Boisot's I-Space model in several stages to the current mode whereby multiple strategies for decision making in different complex and complicated ontologies are mapped.

[Snowden, David J. 2011. Naturalizing sensemaking. In *Informed by knowledge: expert performance in complex situations*. Edited by Kathleen L. Mosier and Ute Fischer, 223-234. Psychology Press, Taylor and Francis e-library.](#)

[Extends Weick's sensemaking concepts for organizations by considering a type of prospective sensemaking, by setting up experiments to probe what happens when the system \(organization\) is perturbed slightly. What the experimenters want to observe, and encourage, are stable, self-organizing structures of behavior. Harmful behavior has to be dampened. Analysis of micro-narratives \(stories about what happens, or might happen\) that have been tagged by users in ways that both make sense to them and researchers can be analyzed to give an overall view of where there might be emergent stability or instability.\(see also *Collaborative Sensemaking Tools*\)](#)

Snowden, [David](#)-J., and Mary E. Boone. 2007. [A leader's framework for decision making: Wise executives tailor their approach to fit the complexity of the circumstances they face](#). *Harvard Business Review* 85.11(November): 69–76.

Describes the strategies leaders can take when they are situated in different contexts in the five domains of the Cynefin Framework.

Application

Snowden's sense-making theory has [mostly-frequently](#) been applied in health care. Sturmberg and Martin [2008](#) adopts Snowden's definition of knowledge and the Cynefin model to understand the generation of medical knowledge through sense-making. Sturmberg and Martin [2009](#) suggests that by bringing self-organized complexity systems into the health care scene, the Cynefin Framework works better than traditional "simplifying" scientific management, by allowing for options to accommodate complexity (Sturmberg and Martin [2013](#)). Van Beurden, et al. [2013](#) also introduces the Cynefin Framework and complex adaptive systems to handle the complexity in health promotion. [Burman and Alphane 2016 explains how the Cynefin framework helped guide evaluation of a pilot HIV/AIDS risk reduction intervention, and future management strategy.](#)

[Burman, Christopher J., and Marota A. Alphane. 2016. Leadership emergence: the application of the Cynefin framework during a bio-social HIV/AIDS risk-reduction pilot. *African Journal of AIDS Research* 15.3: 249-260.](#)

[Describes application of the Cynefin framework to help evaluate the first stages of a community-based intervention for reducing HIV/AIDS risks. Findings helped to delineate the decision making \(according to Cynefin domains\) that was required by different aspects of the intervention and how movement from one domain to another was, or could be, achieved.](#)

Sturmberg, [Joachim](#) P., and [Carmel](#) M. Martin. 2008. Knowing—in medicine. *Journal of Evaluation in Clinical Practice* 14.5: 767–770.

Arguing for the dynamic nature of knowledge, authors pioneer the adoption of the Cynefin Framework to help understand knowledge as a personal construct and how new knowledge can be created by moving knowledge from one domain to the other. Authors apply the model to understanding medical knowledge.

Sturmberg, [Joachim](#) P., and [Carmel](#) M. Martin. 2009. Complexity and health: Yesterday's traditions, tomorrow's future. *Journal of Evaluation in Clinical Practice* 15.3: 543–548.

Arguing that knowledge is complex and traditional scientific management that breaks down complex systems into constituent parts reduces medical problems to unrealistic simplicities, authors find it essential to bring in relevant concepts of complex adaptive systems and Cynefin to recognize the true nature of medical knowledge and examine different medical care options.

Sturmberg, [Joachim](#) P., and [Carmel](#) M. Martin, eds. 2013. *Handbook of systems and complexity in health*. New York: Springer.

Analyzing Dervin, Snowden and Weick, the authors use a clinical case to challenge protocol-based disease management. They demonstrate how sense-making can help achieve more desirable patient-perceived outcomes. Authors advocate identifying polarities and contradictions in health systems knowledge, appropriate patterns for creative problem-solving, and multiple ways of knowing.

Van Beurden, Erick K., Annie M. Kia, Avigdor Zask, Uta Dietrich, and Lauren Rose. 2013. Making sense in a complex landscape: how the Cynefin framework from complex adaptive system theory can inform health promotion practice. *Health Promotion International* 28.1 (March): 73–83.

Appreciates the usefulness of the Cynefin Framework and complex adaptive systems in the understanding of the complexity of health promotion issues and reviews the implications of complex approaches in the context of health promotion theory.

Daniel Russell—Sensemaking and Searching

Sensemaking in HCI ([Human Computer Interaction](#)) is based in cognitive psychology. Much research has aimed at a better understanding of how experts (e.g., military intelligence analysts) come to a decision, so that tools and interfaces can support a more effective and efficient sensemaking process. Other research has focused on the cognitive strategies used in searching and sensemaking (see also [Gary Klein—Sensemaking](#)). The Russell group (Russell, et al. 1993) defines sensemaking as the process of searching for a representation and encoding data in that

representation to answer task-specific questions. [Dan Russell's blog on his research details other work on information search and sensemaking.](#)

Philosophy and Methodology

The use of sensemaking as a term in HCI traces back to Russell, et al. [1993](#), a conference paper presented at a CHI ([Computer Human Interaction](#)) conference. This discussed the efficiency of searching (costs in time trade-offs), a theme that Russell and the co-authors have continued to pursue, although in different way ([Russell 2012](#)). Two of Russell's co-authors, Pirolli and Card, use cognitive task analysis to characterize processes in intelligence analysis and demonstrated two major loops, a foraging loop and a sensemaking loop (Pirolli and Card [2005](#)). Qu and Furnas [2008](#) adapts Russell's approach for evaluation of exploratory search (and its support). Sensemaking tools may support collaborative working, and Card, et al. [1999](#) describes how information visualization may reduce search time and encourage pattern recognition. [Zhang and Soergel 2020](#) integrates sensemaking principles, mainly from Russell and Klein (discussed in [*Gary Klein — Sensemaking in Cognitive Systems Engineering*](#)) with learning theories into a model of the sensemaking process (first proposed in Zhang and Soergel 2014) that should help in teaching thinking skills. Aselmaa, et al. [2017](#) uses the Zhang and Soergel model to develop a contextual sensemaking (C-SM) model for tumor contouring. Dan Russell's blog on his research, [**SearchReSearch**](#) and the [**Google home site**](#) detail recent work on information search and sensemaking. [Russell 2012](#) defines sensemaking as the process of understanding a large and complex set of data, typically using external representations to help memory and deduction.

[Aselmaa Anet, Marcel van Herk, Anne Laprie, Ursula Nestle, Irina Götz I, Nicole Wiedenmann, Tanja Schimek-Jasch, Francois Picaud, Charlotte Syrykh, Leonel V. Cagetti, Maria Jolnerovski, Yu Song, and Richard H. M. Goossens. 2017. Using a contextualized sensemaking model for interaction design: A case study of tumor contouring. *Journal of Biomedical Informatics* 65 \(January\): 145-158.](#)

[Develops a contextual sensemaking \(C-SM\) model for tumor contouring \(based on Zhang and Soergel's model\) based on the goal, the workflow and the context of the task. Prototype testing helped to identify the navigation interactions and interaction sequence patterns, and where design improvements might increase support for sensemaking.](#)

Card, Stuart K., Jock D. Mackinlay, and Ben Shneiderman. 1999. *Readings in information visualization: using vision to think*. San Francisco: Morgan Kaufmann.

Develops the idea of knowledge crystallization based on ideas of Russell and his coauthors. Information visualization can help search for data and use in a schema for a task. If the schema is satisfactory, information visualization may reduce to information retrieval. If the schema is not satisfactory, knowledge crystallization may help.

Pirolli, Peter, and Stuart Card. 2005. The sensemaking process and leverage points for analyst technology as identified through cognitive task analysis. *Proceedings of international conference on intelligence analysis* 5.2-4.

The authors extend the ideas of Russell, et al. [1993](#) with two major loops: foraging and sensemaking. Their research uses cognitive task analysis and "think aloud" protocols to characterize intelligence analysis processes. Information processing may be bottom-up from

data to theory or top–down. Relates the schematization to Klein’s work (see also [Gary Klein—Sensemaking](#)).

Qu, Yan, and George W. Furnas. 2008. Model-driven formative evaluation of exploratory search: A study under a sensemaking framework. *Information Processing & Management* 44.2 (March): 534–555.

Uses the (adapted) Russell model to examine representation and information seeking in exploratory search. Data analysis identifies the different ways users obtained inspiration for representation, when using an augmented ~~query-based~~[query-based](#) search system to make sense of an unfamiliar topic.

Russell, Dan M. [SearchReSearch](#).

This blog covers searching, teaching how to search, and learning how to do research. Information foraging and sensemaking are integral to the approach.

Russell, Dan M. 2012. [Sensemaking III: Searching-for and organizing information](#).

Sensemaking is defined as processes of coming to understand large/complex sets of data, characterized by use of external representations as memory and inference aids. Russell discusses examples of scientific searching/sensemaking, sensemaking in intelligence (and how it goes wrong), and other examples of collective sensemaking (see also [Other Perspectives on Sensemaking](#)).

[Russell, Dan. Dan Russell’s home page and site. https://sites.google.com/site/dmrussell](#)

[Provides educational materials on searching and how to make sense of search results, as well as news of recent activities associated with work with Google.](#)

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Russell, Daniel M., Mark J. Stefik, Peter Pirolli, and Stuart K. Card. 1993. The cost structure of sensemaking. In *Proceedings of the INTERACT’93 and CHI’93 conference on human factors in computing systems*. Edited by Stacey Ashlund, 269–276. Amsterdam: ACM.

Describes the learning loop complex: search for representations (generation loop), instantiate representations (data coverage loop), and shift representations. The shift loop is guided by discovery of residue (ill-fitting/missing data). This may require schema changes (called encodons) instantiated in the data coverage loop. Sensemaking iterates between top–down and bottom–up processes.

[Zhang, Pengyi, and Dagobert Soergel. 2014. Towards a comprehensive model of the cognitive process and mechanisms of individual sensemaking. *Journal of the Association for Information Science and Technology* 65.9: 1733–1756.](#)

[Reviews literature on various sensemaking models together with literature on learning theories, cognitive psychology and task-based information seeking. Proposes an integrated model that stresses the iterative nature of sensemaking, with hypotheses/instantiations with data, identification of gaps, data loops \(seeking data, seeking structure, fitting data into structure, building structure\) and updating knowledge through accretion, adaptation \(tuning\) and restructuring \(new structure\). Various cognitive mechanisms are identified, noting that some mechanisms may involve structure and/or logic, or neither structure nor logic.](#)

Zhang, Pengyi, and Dagobert Soergel. 2020. Cognitive mechanisms in sensemaking: a qualitative user study. *Journal of the Association for Information Science and Technology* 71.2: 158-171.

Uses the authors' modified model of individual sensemaking that incorporates cognitive mechanisms used in processing information and creating knowledge (data driven pattern recognition, with schema induction); structure/logic driven mechanisms such as elimination, inference; and other mechanisms such as classification, analogy, Socratic dialogue. The qualitative study with 15 students provided examples of each mechanism, singly or in combination.

Application

Pirolli and Russell guest edited a special issue of the journal *Human-Computer Interaction*, [Pirolli and Russell 2011](#), that examines examples of sensemaking in different domains (e.g., legal, educational) as well as the more recent emphasis on sensemaking tools. Sensemaking research by Russell and co-authors has contributed to research on how to make sense of large graph datasets, artificial intelligence, e.g. *IEEE Transactions on Visualization and Computer Graphics*. Some research has examined sensemaking from the neuroscience perspective, trying to relate the symbolic cognitive sensemaking models to neural frameworks ([Ascoli, et al. \(Computational Intelligence and Neuroscience 2013\)](#)). Zhang, et al. [2015](#) examines how humans detect and react to change in the environment.

Ascoli, Giorgio A., Rajan Bhattacharyya, and Matthew M. Botvinick, eds. 2013. *Special issue: Neurocognitive models of sense making. Computational Intelligence and Neuroscience*. 2013. Contributions by multiple authors use the cognitive model of core information-foraging and hypothesis-updating sensemaking processes and applies this to complex spatial probability estimation and decision-making tasks. Suggests that the model, although developed as a hybrid symbolic cognitive model, does correspond to neural frameworks.

IEEE Transactions on Visualization and Computer Graphics.1995-.

Deals with visualization techniques, methodologies, systems, and software.

Pirolli, Peter, and Daniel M. Russell, eds. 2011. *Special issue: Sensemaking. Human-Computer Interaction* 26.1-2.

Includes these articles: Peter Pirolli and Daniel M. Russell, "Introduction" (pp. 1-8); Simon Attfield and Ann Blandford, "Making Sense of Digital Footprints in Team-Based Legal Investigations: The Acquisition of Focus" (pp. 38-71); Kirsten R. Butcher and Tamara Sumner, "Self-Directed Learning and the Sensemaking Paradox" (pp. 123-159); Sharoda A. Paul, and Meredith Ringel Morris, "Sensemaking in Collaborative Web Search" (pp. 72-122); and Mikael Wahlström, Antti Salovaara, Leena Salo, and Antti Oulasvirta, "Resolving Safety-Critical Incidents in a Rally Control Center" (pp. 9-37).

Zhang, Yunfeng, Jaehyon Paik, and Peter Pirolli. 2015. Reinforcement learning and counterfactual reasoning explain adaptive behavior in a changing environment. *Topics in Cognitive Science* 7.2 (April): 368-381.

Counterfactual reasoning concerns how we think about potential or imaginary events and consequences that are alternatives to what has occurred.

Gary Klein—Sensemaking in Cognitive Systems Engineering

Cognitive systems engineering is a professional discipline that uses systematic methods of cognitive analysis and cognitive design to ensure that cognitive work is both efficient and robust. The aims are similar to HCI research, but the emphasis in cognitive systems engineering is the study of the socio-technical environment, and the term usually refers to an environment where human activity is information intensive, and social processes are important. Gary Klein is a leading proponent of the study of naturalistic decision-making in natural settings (the recognition-primed decision model) rather than the laboratory models favored by many cognitive psychologists. He founded Klein Associates Inc., which was acquired by Applied Research Associates in 2005. [Since 2009, Klein has been a Senior Scientist at MacroCognition LLC.](#) [Klein, et al. 2002 defines macrocognition as a level of description of cognitive functions in natural settings.](#) [His](#) research settings of interest are those where the consequences are severe should things go wrong—such as emergency rooms, intelligence work, and military command and control. Such settings may involve complex decision-making, data overload, time pressures, research participants who are experts (rather than undergraduate students), and goals that may be ill-defined and conflicting. [Klein, et al. 2006a and Klein, et al. 2006b set out the data/frame model of sensemaking, which stresses that the frame determines what counts as data but, equally, that the data also shape the frame.](#) [Klein, et al. 2010 examines team sensemaking, and Klein, et al. 2015 discusses the trust building sensemaking frame that enables some people in uniform to reduce aggression and build goodwill with civilians.](#) [The scope of his interests extends across naturalistic decision making, sensemaking, gaining insight and complex learning. \(both cited under Application\).](#)

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Philosophy and Methodology

[Klein, et al. 2003, an earlier paper, discusses macrocognition.](#) [Klein, et al. 2003 defines macrocognition as a level of description of cognitive functions in natural settings.](#) Sensemaking as a process is defined by Klein, et al. [2006a](#) and Klein, et al. [2006b](#), two highly cited papers that place Klein's approach in relation to other approaches that stress, for example, information processing or the heuristics and biases of decision-making. In Klein's data/frame model, the frame determines what counts as data and, equally, the data shape the frame. The sensemaking cycle may elaborate and preserve the frame, but questioning the data against the frame may lead to using a different frame (akin to Piaget's accommodation). Klein, et al. [2007](#) and Sieck, et al. [2007](#) set out the data/frame model, proposing six key sensemaking activities for handling frames in light of (anomalous) data: elaborating, questioning, comparing, preserving, re-framing, and seeking. [Sieck, et al. 2007](#) [The report](#) describes a range of cognitive task analysis, critical decision method and sensemaking interview methods for a report to the US Army that explores the differences in novice and expert sensemaking. Fragmentary mental models are called to mind to create a just-in-time mental model of a situation as the situation warrants. The report stresses that sensemaking is about what an expert is able to do in a situation, not merely awareness of what is going on in the situation. With experience, people develop larger repertoires of fragmentary mental models, know how to link these to current goals, and can develop (different) scripts for action. [Klein, et al. 2006a and Klein, et al. 2006b set out the data/frame model of sensemaking, which stresses that the frame determines what counts as data](#)

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but, equally, that the data also shape the frame. Klein 2011 reviews the author's research on sensemaking for adaptive decision making. Pontis and Blandford 2016 evaluates how the data/frame model worked in a searching task by academic staff. Attfield, et al. 2018 reviews various research studies and develop an elaborated data/frame model for distributed sensemaking.

Attfield, Simon, Bob Fields, and Chris Baber. 2018. A resources model for distributed sensemaking. *Cognition, Technology & Work* 20.4: 651-664. Reviews and reflects on various research studies by the authors, arguing that sensemaking is a quest for coherence. Elaborates the data frame model to allow for the role of resources as abstract information structures. The distributed resources model for sensemaking consists of the processes of the Klein data frame model connected to three resource domains of knowledge and belief, values and goals (terms of reference, ethical principles), and action (performance of a physical or cognitive task).

Klein, Gary, Brian Moon, and Robert R. Hoffman. 2006a. Making sense of sensemaking 1: Alternative perspectives. *IEEE Intelligent Systems* 21.4 (July–August): 70–73. Argues that sensemaking should not be conflated with creativity, curiosity, comprehension, mental modeling, or situation awareness. Sensemaking may involve these but is defined here as a motivated and continuous effort to understand connections (among people, places, and events) in order to predict likely series of events and act effectively.

Klein, Gary, Brian Moon, and Robert R. Hoffman. 2006b. Making sense of sensemaking 2: A macrocognitive model. *IEEE Intelligent Systems* 21.5 (September–October): 88–92. Proposes that the basic sensemaking act is symbiosis between data and frame. The data/frame theory involves a closed-loop transition sequence between (i) mental model formation (which is backward looking and explanatory) and (ii) mental simulation (which is forward looking and anticipatory).

Klein, Gary, Jennifer K. Phillips, Erica L. Rall, and Deborah A. Peluso. 2007. A data-frame theory of sensemaking. In *Expertise out of context: Proceedings of the sixth international conference on naturalistic decision making*. Edited by Robert R. Hoffman, 113–155. New York: Lawrence Erlbaum. Widely cited conference paper on data/frame sensemaking.

Klein, Gary, Karol G. Ross, Brian M. Moon, Devorah E. Klein, Robert R. Hoffman, and Erik Hollnagel. 2003. Macrocognition. *IEEE Intelligent Systems* 18.3 (May–June): 81–85. Identifies major macrocognitive functions as naturalistic decision-making; situation assessment and/or sensemaking; planning, adaptation, and/or replanning; and problem detection and coordination. These appear (for individuals, teams, and technologies) in processes such as managing common ground, developing mental models, uncertainty management, turning leverage points into action, attention management, and mental simulation and storyboarding.

Klein, Gary. 2011. *Streetlights & shadows: searching for the keys to adaptive decision making*. Cambridge, MA: MIT Press.

[Part II of the book is entitled “making sense of situations”. Discusses reactions to uncertainty, and discusses case studies that illustrate some of the problems of some commonly held assumptions about sensemaking concerned with collecting information, making inferences, giving feedback or using cues.](#)

[Pontis, Sheila, and Ann Blandford. 2016. Understanding “influence”: an empirical test of the data-frame theory of sensemaking. *Journal of the Association for Information Science and Technology* 67.4: 841-858.](#)

[Uses the data/frame theory of sensemaking \(Klein 2007\) to analyze academics’ searching and sensemaking when solving exploratory search tasks for which they lacked existing frames. The roles of specific and domain expertise were explored. Discusses different searching and sensemaking behaviors, and how reframing was accomplished.](#)

Sieck, Winston R., Gary Klein, Deborah A. Pelusa, Jennifer L. Smith, Danyele Harris-Thompson, and Paul A. Gade. 2007. *FOCUS: A model of sensemaking*. Technical report 1200, for the US Army Research Institute for the Behavioral and Social Sciences. Fairborn, OH: Klein Associates Inc.

Report on Klein’s data/frame approach [and](#) explains the methods used—cognitive task analyses, critical decision methods, and sensemaking interviews. Results suggest that fragmentary mental models are called to mind to create just-in-time models of situations. Sensemaking processes (questioning, comparing, preserving, reframing, seeking) are identified with different activities for each process.

Application

~~The more recent work~~ Klein, et al. 2010 examines team sensemaking as an aspect of macrocognition, and Klein, et al. 2015 identifies strategies for people in uniform to engage effectively with the public [using a trust building sensemaking frame.](#) More recently, [Ward, et al. 2018 \(cited in *General Overviews*\) discusses how Klein’s data/frame sensemaking model has been merged with a model of adaptive planning as a way of understanding how experts working in complex domains develop flexible thinking and adaptive skills. Landman, et al. 2017 and Rankin, et al. 2016 both use the data/frame model, but extend the model with other theories to deal with surprise situations in aircraft cockpits. Kodagoda, et al. 2017 uses the data/frame model in analysis of search logs, with the aim of developing a tool to infer how intelligence analysts are reasoning. Klein, et al. 2010 examines team sensemaking, and Klein, et al. 2015 discusses the trust building sensemaking frame that enables some people in uniform to reduce aggression and build goodwill with civilians](#)

Klein, Gary, Helen Altman Klein, Brian Lande, Joseph Borders, and James C. Whitacre. 2015. Police and military as good strangers. *Journal of Occupational and Organizational Psychology* 88.2 (June): 231–250.

Discusses research on why some police and military staff are seen as “good strangers” with civilians, able to defuse potentially difficult situations. Identified effective behavioral strategies and the five frames that comprised the mindset of “good strangers.”

Klein, Gary, Sterling Wiggins, and Cynthia O. Dominguez. 2010. Team sensemaking. *Theoretical Issues in Ergonomics Science* 11.4 (July–August): 304–320.

Discusses team cognition as a macrocognitive function and identifies processes of team sensemaking and the emergent requirements for team sensemaking.

[Kodagoda, Neesha, Sheila Pontis, Donal Simmie, Simon Attfield, B. L. William Wong, Ann Blandford, and Chris Hankin. 2017. Using machine learning to infer reasoning provenance from user interaction log data: based on the data/frame theory of sensemaking. *Journal of Cognitive Engineering and Decision Making* 11.1: 23-41.](#)

[Discusses two studies involving intelligence analysis tasks. Interaction logs were manually coded for cognitive actions \(using captured think-aloud protocols and post-task interviews\) based on the Klein 2007 data/frame model of sensemaking. The analysis was used to train an interaction frame mapper, which used multiple machine learning models to learn relationships. Results, though inconclusive, suggest that tools may be able to reconstruct reasoning provenance from interface actions.](#)

[Landman, Annemarie, Eric L. Groen, M. M. van Paassen, Adelbert W. Bronkhorst, and Max Mulder. 2017. Dealing with unexpected events on the flight deck: a conceptual model of startle and surprise. *Human Factors* 59.8: 1161-1172.](#)

[The model synthesizes elements of the cognitive-psychoevolutionary model of surprise \(Meyer\), the perceptual cycle model \(Neisser\), Klein's data/ frame theory of sensemaking and literature on startle and acute stress. Loss of a fitting frame in sensemaking relates to loss of level 1 situation awareness \(see *Situation Awareness*\).](#)

[Rankin, Amy, Rogier Woltjer, and Joris Field. 2016. Sensemaking following surprise in the cockpit: a reframing problem. *Cognition, Technology & Work* 18.4: 623-642.](#)

[Uses the Data/Frame model and the COCOM \(Contextual Control\) model to examine reframing processes of pilots in cockpit operations. Relates identified cases of surprise problems to the associated challenges and reframing activities. Develops a crew-aircraft contextual control loop model, that includes the sensemaking activities of questioning, preserving, elaborating, comparing, abandoning the search for a frame, and rapid frame switching.](#)

Other Perspectives on Sensemaking

There are other cognitive perspectives on sensemaking: Participatory sensemaking and social cognition; collaborative sensemaking [tools](#); [and situation awareness](#), ~~and the situation awareness debate~~.

Participatory Sensemaking and Social Cognition

Participatory sensemaking is part of the enactive (and embodied) approach to social cognition. This approach to cognition can be traced back to two Chilean biologists (and philosophers) Maturana and Varela, who were responsible for the concept of autopoiesis, a system capable of reproducing and maintaining itself (Maturana and Varela 1980). Varela, et al. 1991 presents a different, enactive approach to cognitive science. Research based in the University of Sussex, the Basque Foundation (Di Paolo), Mexico (Froese and Di Paolo 2011), Heidelberg (Fuchs and De Jaegher 2009), and Portsmouth are part of TESIS (Towards an Embodied Science of InterSubjectivity) research network. Gallagher 2000 and Gallagher 2014 examine the philosophical background to some of these developments in cognitive science such as Neisser 1993, and Stewart, et al. 2010 presents a collection of perspectives on enaction. Although narrative in sensemaking is usually related to Weick's sensemaking (See [Karl Weick](#)—

[Sensemaking, Philosophical Origins and Assumptions](#)), Brown and Jones [2000](#) and Cunliffe and Coupland [2012](#) are also interested in the notion of embodiment and how this affects sensemaking as narrative.

Brown, Andrew D., and Matthew Jones. 2000. Honorable members and dishonorable deeds: sensemaking, impression management and legitimation in the Arms to Iraq affair. *Human Relations* 53.5 (May): 655–689.

Examines a situation in which beliefs do not always seem to accord with actions. Responses to such discrepancies include self-deception, hypocrisy, and scapegoating; these allow people to make sense of events, at the same time presenting their actions to others (impression management).

Cunliffe, Ann, and Chris Coupland. 2012. From hero to villain to hero: Making experience sensible through embodied narrative sensemaking. *Human Relations* 65.1 (January): 63–88.

Extends sensemaking theory to include the notion of embodied narrative sensemaking. Embodiment is thus defined more broadly than emotion and is situated within the flow of experience. The authors argue (with reference to their research study) that embodiment is integral to sensemaking.

Froese, Tom, and Ezequiel A. Di Paolo. 2011. The enactive approach: theoretical sketches from cell to society. *Pragmatics & Cognition* 19.1: 1–36.

The five core ideas of the enactive paradigm are autonomy, sensemaking, embodiment, emergence, and experience (based on Varela's approach to cognitive science). Sensemaking thus involves intentional activity in interaction allowing new domains of social sensemaking to emerge. Suggests that participatory sensemaking is the general term and that there can be participatory sensemaking without social cognition. Proposes a definition of socio-cognitive interaction.

Fuchs, Thomas, and Hanne De Jaegher. 2009. Enactive intersubjectivity: Participatory sense-making and mutual incorporation. *Phenomenology and the Cognitive Sciences* 8.4: 465–486.

Presents a concept of social understanding as being a continuous, dynamic process of participatory sensemaking and a process of joined and joint understanding by participants. Intersubjectivity, the authors argue, means entering a process of embodied interaction and generating common meaning through that process.

Gallagher, Shaun. 2000. Philosophical conceptions of the self: implications for cognitive science. *Trends in Cognitive Sciences* 4.1 (January): 14–21.

Examines two important concepts of self: the “minimal self,” a self devoid of temporal extension, and the “narrative self,” which involves personal identity and continuity across time. Relates the minimal self to Neisser's ecological self and compares philosophical perspectives on the narrative self.

Gallagher, Shaun. 2014. Pragmatic interventions into enactive and extended conceptions of cognition. *Philosophical Issues* 24.1 (October): 110–126.

Suggests that pragmatism supports a more integrative view—an enactive conception of extended cognition—and that pragmatist views may help address the main objections to extended and enactive conceptions of cognition.

Maturana, Humberto, and Francisco J. Varela. 1980. *Autopoiesis and cognition: The realization of the living*. Dordrecht, The Netherlands: D. Reidel.

This is the main published reference on autopoiesis.

Neisser, Ulric, eds. 1993. *The perceived self: Ecological and interpersonal sources of self-knowledge*. Emory Symposia in Cognition. Cambridge, UK: Cambridge Univ. Press.

Neisser proposes various aspects of self—ecological, interpersonal, temporally extended, conceptual, and private. The book has contributors commenting on Neisser’s ideas.

Stewart, John Robert, Olivier Gapenne, and Ezequiel A. Di Paolo. eds. 2010. *Enaction: Toward a new paradigm for cognitive science*. Cambridge, MA: MIT.

Includes E. A. Di Paolo, M. Rohde, and H. De Jaegher, “Horizons for the Enactive Mind: Values, Social Interaction, and Play” (pp. 33–87). Also G. Colombetti, “Enaction, Sense-Making and Emotion” (pp. 145–164). Collection of multidisciplinary contributions discussing enaction.

Varela, Francisco, Evan Thompson, and Eleanor Rosch. 1991. *The embodied mind: cognitive science and human experience*. Cambridge, MA: MIT.

Suggests that common ground between mind in science and mind in experience is necessary. To reach this, the authors develop a dialogue between cognitive science and Buddhist meditative psychology, relating this to other traditions, such as phenomenology and psychoanalysis.

Collaborative Sensemaking Tools

Researchers who describe their interests as collaborative sensemaking frequently focus more on the sequence of events or how outcomes are viewed and collectively achieved. The aim is often to produce tools to support collaborative sensemaking, examples including [the work of Morris, et al. 2010](#); [Paul 2010](#); and [Paul and Morris 2011](#) for information searching and subsequent processing. The tools may include support for different explicit representations, sharing of representations and support for sharing, and exchange and interaction so that shared representations may be developed. [Other tools such as SenseMaker® by Cognitive Edge \(see *David Snowden – Sense-Making and Working with Complexity*\) aim to collect and analyse narratives in complex situations \(Van der Meerwe, et al. 2019\), such as adaptation to climate change \(Milne 2015, Lynam and Fletcher 2015\). Martins and Rodríguez Ortiz 2019 describes use of SenseCatcher in studying Brazilian communities of practice. SenseMap. Nguyen, et al. 2016 is concerned with HCI Tasks need to be organized by a team, and team members need to be aware what others are doing and thinking.](#) Cognitive psychologists may use the term “team cognition” (see also [Gary Klein—Sensemaking: Application and Salmon, et al. 2017 in *Situation Awareness*](#)).

[Lynam, Timothy, and Chris Fletcher. 2015. Milne, Kyla M. G. 2015. Can sense-making tools inform adaptation policy? A practitioner’s perspective. *Ecology and Society* 20.1: 65. Discusses possible use of Snowden’s SenseMaker® tool for developing and evaluating policy for adapting to climate change in Australia. The study included three different population groups](#)

[\(experts, government staff and members of the public\). Explains how the narratives were analyzed.](#)

[Milne, Kyla M. G. 2015. Can sense-making tools inform adaptation policy? A practitioner's perspective. *Ecology and Society* 20.1: 66.](#)
[Discusses use of Snowden's SenseMaker® tool in trying to capture the complexity of views on adaptation to climate change in Canada. Notes that survey responses tended to provide opinion rather than the desired narratives.](#)

[Martins, Rui D. S., and Laura D. Rodríguez Ortiz. 2019. Visual sense-making as an appropriate indicator for KM when dealing with complex environments: first stages of a longitudinal case study of a non-governmental organization, Brazil. *Knowledge Management Development Journal* 14.2](#)
[Discusses use of the SenseCatcher tool in a longitudinal study of communities of practice in a Brazilian NGO, the Caatinga Association. The tool aims to help sense-making in complex situations, where particular patterns of interaction may be observed.](#)

Morris, Meredith Ringel, Jarrod Lombardo, and Daniel Wigdor. 2010. WeSearch: supporting collaborative search and sensemaking on a tabletop display. In *Proceedings of the 2010 ACM conference on computer supported cooperative work*. Edited by Kori Inkpen, 401–410. Savannah, GA: ACM.

Describes and evaluates the design of WeSearch, a collaborative web search system with tabletop display that is designed for face-to-face collaboration and organization of tasks. The interactive tabletop display works better for sharing tasks and division of labor than PC-based tools.

[Nguyen, Phong H., Kai Xu, Andy Bardill, Betul Salman, Kate Herd, and B. L. William Wong. 2016. SenseMap: supporting browser-based online sensemaking through analytic provenance. In *Proceedings of the 2016 IEEE Conference on Visual Analytics Science and Technology*, Baltimore, MD.:-](#)
[The sensemaking model used is based on Pirolli and Card's model \(cited in *Daniel Russell – Sensemaking and Searching: Philosophy and Methodology*\). The aim of the tool is to assist users to curate and communicate their sensemaking findings.](#)

Paul, Sharoda A. 2010. Understanding together: Sensemaking in collaborative information seeking. PhD diss., Pennsylvania State Univ.

Examines why and how people collaborate to understand information and how tools help in sensemaking. People collaborate in sensemaking if information is ambiguous, there are roles for distributing information, and individuals lack expertise. Three important characteristics of collaborative sensemaking emerge: prioritization of relevant information, sensemaking trajectories, and activity awareness.

Paul, Sharoda A., and Meredith Ringel Morris. 2011. Sensemaking in collaborative web search. *Human-Computer Interaction*, 26.1–2 (January): 72–122.

The CoSense tool offers four views: the search strategies view, timeline view, chat-centric view, and workspace view. The evaluation examines how well CoSense helps the handoff of

sensemaking between group members as different views/features are used in synchronous and asynchronous collaboration. Handoffs can be search led or sensemaking led.

[Van der Merwe, Susara E., Reinette Biggs, Rike Preiser, Charmaine Cunningham, David J. Snowden, Karen O'Brien, Marcus Jenal, Marietjie Vosloo, Sonja Blignaut, and Zhen Goh. 2019. Making sense of complexity: using SenseMaker as a research tool. *Systems 7*: article number 25](#)
[Describes how the tool replaces in-depth interviews with ethnography essentially done by the participants who assign meaning to their own micro-narratives. It is a mixed method tool, using a signification framework to help assign relative strengths of views, concepts or outcomes. Various visualization and statistical analysis tools support analysis of patterns and anomalies.](#)

Situation Awareness

Mica Endsley has a background in industrial and systems engineering. Endsley [1995](#) develops a model of situation awareness for advanced systems that require decision-making and control. The original model emphasizes perception, comprehension, and projection as three levels of situation awareness, and the model is aimed at human factors researchers. The model links goals and mental models that drive the development or selection of plans and scripts for directing actions. The activated mental model directs attention to the environment to feed into the constantly updated situation model. Goal-driven and data-driven information processing alternate. [Salmon, et al. 2017 takes a systems perspective \(distributed situation awareness\) to consider the joint cognitive system of human and technological agents, with emphasis on military applications.](#) Klein [2015](#) compares aspects of the situation awareness model to Klein's data/frame sensemaking theory. In a special issue of the *Journal of Cognitive Engineering and Decision Making*, Endsley [2015a](#) and Endsley [2015b](#) critiques developments in the situation awareness model and responds to critiques of situation awareness that other researchers have contributed to the special issue. The debate epitomizes many of the difficulties in sense-making/sensemaking research and methodology, with different terms used to describe the same or very similar phenomena, with the same term meaning different things to people coming from different disciplines. [Rosness, et al. 2016 uses the term prospective sensemaking \(defined as sensemaking processes where the attention and concern of people is primarily directed as events that may occur in the future\), distinguishing between traditional situation awareness \(cognitive processes\) and sensemaking that is constructive, acknowledging that there are similarities with distributed situation awareness.](#)

Endsley, Mica R. 1995. Toward a theory of situation awareness in dynamic systems. *Human Factors: The Journal of the Human Factors and Ergonomics Society* 37.1: 32–64.

Emphasizes three levels of situation awareness: perception, comprehension, and projection. Discusses how goals and mental models relate to each other and how activated mental models direct attention to the environment for data that then feed into updated situation models that in turn update mental models.

Endsley, Mica R. 2015a. Situation awareness misconceptions and misunderstandings. Special Issue: *Journal of Cognitive Engineering and Decision Making* 9.1 (March): 4–32.

Introduction to the later development of the model and response to published critiques.

Endsley, Mica R. 2015b. Final reflections: situation awareness models and measures. *Journal of Cognitive Engineering and Decision Making* 9.1 (March): 101–111.

Response to current critiques including Klein's contention that situation awareness is a state and sensemaking is a process.

Klein, Gary. 2015. Whose fallacies? *Journal of Cognitive Engineering and Decision Making* 9.1 (March): 55–58.

Defends data/frame sensemaking as deliberate and therefore different from situation awareness, contrasting the disciplinary differences involved.

[Rosness, Ragnar, Tor Erik Evjemo, Torgeir Haavik, and Irene Wærø. 2016. Prospective sensemaking in the operating theatre. *Cognition, Technology & Work* 18.1: 53-69.](#)

[Discusses the relationships between prospective sensemaking and related terms such as mindfulness, situation awareness and anticipatory thinking, with reference to research on the way an operating team paid great attention to what might happen in the immediate future. This anticipation helped smooth collaboration and prepared team members for handling possible adverse events.](#)

[Salmon, Paul M., Neville A. Stanton, Guy P. Walker, and Daniel P. Jenkins. 2017. *Distributed situation awareness: theory, measurement and application to teamwork*. CRC Press.](#)

[Reviews existing situation awareness theory, and proposes a new model for complex collaborative systems, the distributed SA model with an associated modeling procedure, the propositional network approach. Discusses four case study applications in warfare and energy distribution, and provides guidelines for supporting distributed situation awareness. Originally published by Ashgate, 2009.](#)