Fuzziness and Miscellaneity:
Implications for Record Keeping by Organizations
Owen Ambur, March 15, 2010

In *Fuzzy Thinking: The New Science of Fuzzy Logic*, Bart Kosko says:

> We can put black-and-white labels on ... things. But the labels will pass from accurate to inaccurate as the things change. Language ties a string between a word and the thing is stands for. When the thing changes to nonthing, the string stretches or breaks or tangles with other strings... Science reveals a world of jagged edges and quantities that vary smoothly. More precision does not take the gray out of things – it pins down the gray... Yet in much of our science, math, logic, and culture we have assumed a world of blacks and whites that does not change. Every statement is true or false. (p. 5)

In *Everything Is Miscellaneous: The Power of the New Digital Disorder*, David Weinberger addresses the parameters of the "first order of order":

- *In physical space, some things are nearer than others.*
- *Physical objects can be in only one spot at any one time ...*
- *Physical space is shared*, so there can be only one layout, even though we all have different needs.
- *Human physical abilities are limited*, so the amount of information provided to us is constrained by our ability to see ...
- *The organization of the store needs to be orderly and neat*. If things are out of place, they can't be found. (p. 5)

Kosko asserts that math as a discipline does not fit the world it purports to describe. The former is artificial while the latter is real. Math is neat and reality is messy. He calls that the *mismatch problem*. (p. 8) Weinberger says we expend so much time trying to make our physical environment well-ordered because disorder is inefficient. (p. 12) However, he devotes a chapter of his book to the discussion of messiness as a virtue in the *digital* environment. (pp. 173 - 198)

Kosko notes that reality is so much simpler if we can routinely split issues into exactly two pieces. "Language," he says, and "especially the math language of science, creates artificial boundaries between black and white." On the other hand, "Reason or common sense smooths them out [and] works with grays." (pp. 14 & 15)

Similarly, Weinberger observes, "Lumping and splitting physical objects requires us to make binary decisions about where things go," but he argues ideas, information, and knowledge should not be bound by such constraints. (p. 83)

According to Kosko, the fuzzy principle means that everything is a matter of degree. In science he notes that fuzziness is formally known by the term multivalence and its opposite is bivalence or two-valuedness. In other words, fuzziness means that three or more options occur and perhaps an infinite number of them. The difference between truth and falsehood is defined on a

continuum, rather than as an either/or choice. (pp. 18 & 19)

In the discipline of records management, common wisdom dictates that records do not become records until they are "declared" as such. In the past, that meant by a human being. Increasingly, automated means are being used to evaluate records and assign them to disposition categories. However, for the most part, the artificial distinction between records and "nonrecord material" continues to prevail in most organizations, at least to the degree that they pay much attention to records management at all. Robyn Dawes defines irrationality as the failure to consider enough options, and the behavior of most organizations is certainly irrational by that measure.[1]

Kosko says adaptive fuzzy systems "suck the brains" of experts. Experts are not required to tell the system what makes them experts. The merely need to "act like experts." Doing so provides the data the neural nets need to "find and tune the rules." (pp. 39 & 40) In other words, in the digital world the activities of individuals create electronic records from which expert systems can divine meaning.[2]

Presumably, the meaning derived from the records created by "experts" will be of higher quality, value, and utility than those created by those who are less skillful in the discipline in question. James Surowiecki has argued that under certain conditions the wisdom of crowds exceeds that of the best experts. However, unless they are captivated by groupthink (which, unfortunately, is all too common) the wisdom of a crowd of experts should exceed that of the untrammeled masses.[3]

Kosko suggests that scientists are different than other professionals for at least two reasons: their product is reputation and they answer to no higher authority.[4] If their pursuits progress well, they build strong reputations and create the output of science – knowledge. More specifically, they create journal papers, textbooks, monographs, conference proceedings, software, and even new hardware devices. (p. 41) In other words, they establish records and

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[1] For more on Dawes' views regarding everyday irrationality, see
http://ambur.net/irrationality.pdf

[2] It is interesting to note that computers are able to operate incredibly efficiently because they break information down into a series of 1's and 0's, the ultimate abstraction of reality as a set of binary choices.

[3] For more on Surowiecki's views regarding the wisdom of crowds, see
http://ambur.net/crowdwisdom.pdf.

[4] One of the conditions Surowiecki specifies for crowd wisdom is independence, not only from groupthink but also influence from higher authorities.

develop the "things" that Donald Norman says "make us smart."[5]

Kosko says, "The more information we have about a fact the less we tend to blame the fact on probability or 'luck'" and he asserts, "Total information leaves little room for probability." (p. 45) Likewise, complete and accurate records vastly reduce, if not eliminate the probability of waste, fraud, and abuse.

As we experience events moving forward in time, we gain additional information, and as information increases, reliance on probabilities go down. Conversely, Kosko notes that fuzziness works the opposite way. As information increases so does fuzziness. Additional data help delineate the gray border between things and nonthingness. However, probability fades as additional data becomes known. (p. 52) In other words, the importance of chance diminishes as we become more cognizant not only of what we know but also that which we do not. What we know is documented in reliable records and what we don't know is not.

Evaluating alternatives can enable the transmittal of genes as the fittest survive over the generations of life. Kosko notes that we are able to weigh the odds before acting and thus improve the probability of relatively successful outcomes.   Indeed, he suggests that forward-looking mechanisms may be deeply embedded in the structure of mammalian and perhaps even reptilian brains. (p. 54)

On the other hand, Gary Klein asserts that considering options is not how our brains actually work in naturalistic settings. Instead, he says we simply evaluate the first option that comes to mind, and if it seems likely to succeed, we act upon it regardless of whether it may be the "best" option or not.[6] Such behavior may only be "natural" and, as noted by Donald Norman, may result in perfectly acceptable results for individuals, since the costs and benefits of less than optimal outcomes may be relatively low.[7] However, the larger the organization and the greater the risks associated with its activities, the more important that it not only choose the best options but also that it fully document its intents and actions as well as the results.

Kosko observes that Aristotle apparently lectured and worked in Greek social and military life less than Socrates and Plato did. Instead, Aristotle wrote more than he preached. (p. 75) Indeed, one wonders whether we would even know about Socrates and Plato if not for the records that Aristotle created. Certainly, their "stories" are now as much *his* story as they are their own. In fact, history is merely what someone has documented in records that have persisted over time. To the degree that such "stories" are second- and third- and even more "second-handed" than

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[5] For more on Norman's views regarding things that make us smart, see http://ambur.net/smart.pdf

[6] For more on Klein's views regarding what he calls "recognition-primed decision-making," see http://ambur.net/rpd.pdf.

[7] For more on Norman's views regarding things that make us smart, see http://ambur.net/smart.pdf

that, the extent to which they may be true and accurate reflections of the realities that existed at the time is highly questionable. Lacking records accurately created and faithfully preserved at the time of occurrence, history is more likely to reflect the wishes and emotions of those who "authored" it after-the-fact than what actually occurred at any point in time.[8]

Kosko points out that fuzzy logic treats truth as accuracy and accuracy clearly as a matter of degree. (p. 85) Statements of fact are relatively accurate and, at the same time, relatively inaccurate. "Ironic as it sounds," Kosko notes, "inaccuracy is the central assumption of science... The goal of science is to remove as much inaccuracy of description as possible ..." Further, he explains, "Scientific claims or statements are inexact and provisional. They depend upon dozens of *simplifying* assumptions and on a particular choice of words and symbols ..."[9] When we speak, we simplify, and when we simplify, Kosko asserts that we lie.[10] (p. 86) The same is true when we decide which records to "declare" and manage as "official" records and which to try to ignore as if they did not exist.[11]

In the context of the limitations of physical space as well as the "sins" of human memory outlined by Schacter, we may have no practical choice but to make such foolhardy distinctions. However, in "alternative universe" of the digital world, Weinberger points out:

> Instead of having to be the same way for all people, [reality] can instantly rearrange itself for each person and each person's current task... now, for the first time in history, we are able to arrange our concepts without the silent limitations of the physical... As we invent new principles of organization that make sense in a world of knowledge freed from physical constraints, information doesn't just want to be free, it wants to be *miscellaneous*. (pp. 6 & 7)

Kosko notes that rounding off is central to working with information represented in symbols and speech. Doing so condenses information, simplifies it, and renders complexity manageable. He

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[8] Daniel Schacter observes: "we bias our memories of the past by attributing to them emotions or knowledge we acquired after the event." For more on his views regarding the "sins" of memory, see http://ambur.net/memorysins.pdf,

[9] William Kent says, "People in the data processing community have gotten used to viewing things in a highly simplistic way, dictated by the kind of tools they have at their disposal." For more on his views of the distinctions between data and reality, see http://ambur.net/datareality.pdf.

[10] Charles Ford notes that we all lie; the differences among us is merely a matter of degree. For more on his views on the psychology of deceit, see http://ambur.net/lies.pdf.

[11] The Federal Rules of Civil Procedure have sidestepped this issue by making clear that all "electronically stored information" (ESI) is potentially discoverable in litigation, regardless of whether is has been "declared" to be an official record or not. http://en.wikipedia.org/wiki/Electronically_Stored_Information

says, "We round off to get by and to get a quick handle on ideas and the pieces of our changing world view." Indeed, "We have to simplify to get things going, at least at first." However, any action has a cost, and bivalence and rounding off sacrifices accuracy for simplicity. When we round off, we pay in truth and accuracy and honesty for what we gain in simplicity and precision and conformity. (p. 91) Using Kosko's words, we "round off" records by implicitly trying bivalently to declare some of them not to be records.

Kosko says, "The truth is strange" and notes that Heisenberg's uncertainty principle sums up the strangeness: "You disturb what you measure." (p. 104) However, would it not be a good thing to "disturb" the behavior of those who would otherwise perform misdeeds not only by requiring them to create records removing any uncertainty as to their intents and actions but also by maintaining those records apart from their control? Why should we care that we cannot be certain what they might have done if they thought they might be able to get away with it due to the lack of good records? Isn't it rather strange that we continue to allow, if not enable, such behavior? Might it be that we allow others to do so in order to give ourselves the same opportunity? That wouldn't be unusual (strange) at all, would it?

Kosko observes:

> A nonlinear theory does not give you the whole from the parts. The parts do not add up to the whole... Groups do not behave as their members behave... System complexity exceeds subsystem complexity. (p. 108)

> Words stand for sets... We all speak and write the same words but we do not think the same words. Words are public but the sets we learn are private. And we think in sets. (p. 122)

> Our brains are full of fuzzy sets... We group things into loose fuzzy sets and then play with the groups and look for connections. *Thought is set play.* That is just what fuzzy logic is – reasoning with fuzzy sets. Fuzzy logic makes our computers think in fuzzy sets. And that's the advance – getting computers to reason with fuzzy sets. Not words or symbol lists or "language strings" ... (p. 123)

What are the implications of those observations with respect to the management of records? That the entire set of records must be available in order to fully understand any of them? That the words we use do not accurately reflect our learning and thoughts? That computers can somehow make sense of it all even if we can't?

Kosko continues by noting that rules associate ideas by relating things or events or processes to each other. (p. 158) He goes on to define system as anything that maps inputs to outputs. (p. 168)[12] He also highlights and emphasizes Professor Ebrahim Mamdani's suggestion that a

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[12] By that definition Part 2 of AIIM's Strategy Markup Language (StratML) will be a component of a "system" since it will enable inputs and processes to be mapped to outputs and

primary advantage of fuzzy systems is that they don't require a model of the process. (p. 169) In other words, reality can be allowed to speak for itself, in reliable records, rather than being forced to conform to any constraints we may wish to try to impose upon it in advance.

Kosko says good math models occur only in textbooks and classrooms, as "toy answers to toy problems" to which the real world pays no attention. (p.169) Similarly, many, perhaps most, if not all of us may prefer the fuzzy comfort of our own mental models versus the cold, harsh realities as best they can be reflected in myriad, miscellaneous albeit reliable records.

Kosko asserts that the application of fuzzy systems need not be limited to the control of robots, household gadgets, and car parts. Since they approximate systems more generally, they can be used in other disciplines, such as physics, communications, and neuroscience. (p. 170)

With respect to the question of which rule "fires" at which time, he says all fire at all times, in parallel and to some degree. They fire partially and most of them to zero degree. That, he says, is the way *associative* memory operates, with the result being a fuzzy weighted average. (p. 171) Analogously, all electronically stored information (ESI) is potentially available for discovery and use at any point in time, when the metadata associated with it is relevant to the issue at hand. Most of it is irrelevant and useless most of the time but nonetheless is part of the essence of reality and may become important at any particular point in time.

Kosko notes that the concept of the letter versus the spirit of the law is based on the distinction between rules and principles. He asserts: "Rules are precise, black and white, all or none. They have no exceptions..." whereas, by contrast, "Principles are vague and abstract and full of exceptions. They change slowly with time as culture evolves." (p. 178) However, the adjective "enduring" is commonly applied to principles. An alternative view is that rules and laws are relatively arbitrary, volatile, vague, full of exceptions, and subject to interpretation, by highly paid and specialized lawyers as well as the courts, whereas basic principles are generally simple, fair, enduring, and clear to anyone with an average degree of intelligence.

On the other hand, Kosko quotes Dworkin as noting that principles "have a dimension that rules do not – the dimension of weight or importance." (p. 179) Again, however, that distinction is itself a bit fuzzy, at least in social systems, since the risks of being caught as well as the penalties for violating laws and rules vary greatly based upon the actual importance ascribed by the bureaucracies charged with enforcement. By contrast, enduring principles may be deemed to be highly important, and quite well enforced by society at large, through ongoing and effective social pressure.

Finally, Kosko observes:

> The Fuzzy Approximation Theorem (FAT) tells us that *in theory* we can always find fuzzy rules to simulate or approximate any type of control or computer processing. But

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outputs to outcomes. For more information on StratML, see .

in practice we may have no idea where to begin... We seek a system that learns fuzzy rules from experience. That means it learns from the data... We seek a learning system that turns expert *behavior* into fuzzy rules. The experts leave footprints in the data. They leave a number trail that the adaptive system converts into fuzzy rules... The adaptive system sucks the brain of the expert or the computer or whatever came up with the data. The more data, the better the brain suck. (pp. 202 & 203)

In other words, the more current and complete the records, the better equipped expert, adaptive systems will be to use them to guide actions in the future.

Kosko concludes:

The universe is information... The more we look at nature the more information we see in the structure. The structure is information. Our DNA is just genetic information made flesh. The neural nets in our brain and spine and muscle code and store and decode information. Our culture and economies are just stores and flows of information. (p. 279)

In short, everything that exists is in some sense a record of that which came before it, and in that regard, Weinberger asserts:

Whether we're doing it on purpose or simply leaving tracks behind us, the public construction of meaning is the most important project of the next hundred years... The world won't ever stay miscellaneous because we are together making it ours. (pp. 222 & 230)

The question is whether we will indeed let reality speak for itself in current, complete, and accurate records or whether we will continue to insist upon making it whatever miscellaneous ball of fuzz we choose it to be, individually or collectively, at any particular point in time.