Methodology for managing linguistic uncertainty

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Abstract

This paper proposes a methodology for managing linguistic uncertainty in shared text. The methodology applies standard risk management practice and is illustrated in a scenario with stakeholders who make use of a shared reference text to make a decision that meets specified objectives. Methodology such as this is important in risk management practice because of stakeholders' inherent intolerance of uncertainty. An ontology that could be useful in artificial intelligence applications is also proposed.

Keywords

ontology, risk management, uncertainty, ambiguity, linguistic uncertainty, explainability, fairness, ISO

1. Introduction

Uncertainty is recognized as a source of risk, and one type is linguistic uncertainty. The objective of this paper is to propose a methodology that applies standardized risk management practices to address linguistic uncertainty. Methodology such as this is important in risk management practice because uncertainty will otherwise likely go improperly addressed (and largely unaddressed). It has long been known that people's intolerance to uncertainty results in avoidance [1] and denial of uncertainty [1, 2] and these can lead to unacknowledged bias in decision-making.

This paper begins by proposing a typology of linguistic uncertainty that is subsequently used in a proposed methodology for managing linguistic uncertainty. Linguistic uncertainty is acknowledged in established standards for risk management (e.g., ISO 31010 [3]) and yet techniques specific to the management of subjective uncertainty such as linguistic uncertainty are currently underdeveloped [4]. As such, this work contributes to risk management by providing a methodology for managing linguistic uncertainty.

The use of this methodology is illustrated in a simple fictional scenario where service providers rely on their interpretation of shared text (i.e., their shared meaning) to choose among service offerings for each of their clients, and they must explain their choice. This illustration demonstrates how managing linguistic uncertainty could improve the consistency and explainability of choice of service offerings in such a scenario.

Further, a conceptual model and components of an ontology of Managing Linguistic Uncertainty in shared Text (or, MLUT ontology) is proposed, and a distinction between the concepts of risk and uncertainty is made evident. Components of this ontology are operationalized with reference to two frameworks: (1) the Descriptive Ontology for Linguistic and Cognitive Engineering (DOLCE) detailed in ISO/IEC 21838-3 standard [5], a top-level ontology that promotes coordination of domain-neutral ontology development, and (2) the AI Risk Ontology (AIRO), developed from concepts extracted from the EU AI Act and ISO 31000 regarding risk [6] and intended for use in AI applications.

The proposed topology of uncertainty is described next.

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2. A comprehensive typology of uncertainty

Hillen, Han and their colleagues analyzed a broad range of eighteen adopted measures of tolerance to uncertainty in order to identify and categorize sources of uncertainty [7] [1]. Some fourteen (14) distinct sources emerged, and these are described in the first column of Table 1.

Some of these fourteen sources are identified by other impactful uncertainty researchers, including those who have specifically studied linguistic uncertainty. For example, Divergence is described as "conflict" by Benjamin and Budescu [8]. Indefinitiveness is termed "imprecision" by Benjamin and Budescu [8] and labelled "vagueness" by Regan and colleagues [9]. Rounsevell and colleagues [10] continue to use Regan and colleagues' labels, including "context dependence" in a way similar to Complexity, "underspecificity" for Incompleteness, and "ambiguity" for Polysmousness (equivocality). To this author's knowledge, no combination of scholarly work has covered the breadth of the fourteen types identified by Hillel, Han and their colleagues. As such, this might be the most comprehensive set of sources.

Hillen, Han and their colleagues describe their categorization as an integrative and flexible model that could be utilized in multiple domains and disciplines. While some of the sources of uncertainty seem similar, their distinction will become clear in the next section, where they are contextualized.

3. A typology of linguistic uncertainty in shared text

The fourteen (14) distinct sources of uncertainty identified in the last section are contextualized for linguistic uncertainty in shared meaning and described in the second column of Table 1.

Unpredictability, Impermanence, and Tentativeness all have a temporal dimension. However, while Impermanence acknowledges the mutable nature of conceptual definitions, and the fact that the shared text today might be interpreted somehow differently in future, Unpredictability makes it challenging or not possible to predict how the shared meaning (i.e., interpretation) of the text will change, or vary, with time across Stakeholders. Regan and colleagues [9] identified a similar source of uncertainty and describe it as "indeterminacy of theoretical terms". One way of treating this uncertainty is by neither assuming the shared meaning to be static nor assuming to know how it might change across Stakeholders with time. Both Unpredictability and Impermanence might be resolved by revisiting the shared meaning of the text frequently enough for stakeholders to remain aligned on their interpretation[2].

Tentativeness arises because of indecision in coming up with shared meaning. One feasible treatment to Tentativeness might be to revisit the shared meaning of the text to identify those aspects that remain undecided and to decide on them, and to document the remaining undecided aspects, reasons for them, and their potential impact to outcomes, which in this case are consistency and explainability of choice of service offerings.

Some sources of uncertainty may contribute to another source of uncertainty. For instance, equivocality (Polysmousness) in the shared text may create vagueness (Indefinitiveness). In such a case, addressing equivocality could improve vagueness. In contrast, while an obscurity (Non-Transparency) may also create vagueness, other obscurities may be present that do not. For this reason, addressing uncertainties should be done both separately and in combination.

The next section describes a methodology for managing linguistic uncertainty and illustrates this in a scenario with stakeholders (service providers) who make use of a shared text (a definition of homelessness) to make a decision (a choice of client service offerings) that must meet their objectives (consistency and explainability of their choice of service offerings).

[1] Hillen et al. (2017) uses the term uncertainty to refer to both uncertainty and ambiguity, and describes how this parsimony does not compromise the analysis.

[2] Note the distinction between Unpredictability of interpretation of the shared text *homelessness* and Unpredictability of the *nature of homelessness of a client over time*, which could also impact a service provider's choice of the client's service offerings. Additional uncertainty could arise from applying the interpretation of homelessness to predict the nature of homelessness of a client over time. This additional uncertainty would warrant additional management of uncertainty during the decision-making process.

Table 1
Details of risk sources and risk treatment.

Sources of risk		Sample risk treatment (b) (c)
Uncertainty	**Linguistic uncertainty (a)**	
Complexity (multi-dimensionality)	that which causes the shared meaning to depend multiple factors, including context	•Revising the shared text to explicitly add known dependencies •Calling on human judgement to address tacit dependencies •Document to describe known dependencies and how tacit dependencies are addressed
Disorder (lack of order)	arising from the shared meaning to be lacking in organizational structure	•Revising the shared text to add as much organizational structure as possible
Divergence (inconsistency)	arising from having a dissimilarity of multiple shared meanings	•Revising the shared text to get to a single shared meaning or a multitude of shared meanings that do not diverge (see Variety) •Training for stakeholders to consistently interpret the shared text
Impermanence (changeability)	arising from the shared meaning's potential to change with time	•Repeating risk assessment and treatment so stakeholders remain aligned on the shared meaning
Incompleteness (insufficiency of information)	arising from the shared meaning to be lacking sufficient available detail	•Revising the shared text to add sufficient detail
Incomprehensibility (resistance to being understood)	that which causes the shared meaning to not be understood by all	•Revising the shared text to make it understood by all stakeholders
Indefinitiveness (vagueness)	that which keeps from reaching a single, precise, invariant shared meaning	•Revising the shared text to remove as much vagueness as possible
Insolubility (resistance to being worked out)	that which causes it to be challenging or not possible to work out the shared meaning	•Document to describe beliefs, values, principles, policies and such that are applied in arriving at the shared meaning
Non-transparency (obscurity)	arising from obscurity of the shared meaning	•Revising the shared text to remove as much obscurity as possible
Polyesmousness (equivocality)	arising from having different meanings of words contained in the shared meaning	•Revising the shared text to remove as much equivocality as possible •Training to reduce variation across stakeholders
Tentativeness (undecidedness)	that which causes the shared meaning to remain undecided	•Revising the shared text to decide on as many aspects as possible of shared meaning
Unfamilarity (unaquaintedness)	arising from lack of familiarity with the shared meaning	•Revising the shared text to reduce as much unfamiliarity as possible •Training examples to increase familiarity across stakeholders
Unpredictability (indeterminancy)	that which causes it to be challenging or not possible to determine how the shared meaning will change with time	•Repeating risk assessment and treatment so stakeholders remain aligned on the shared meaning
Variety (diversity)	arising from having multiple shared meanings	•Revising the shared text to get to a single shared meaning or a multitude of shared meanings that do not diverge (see Divergence)

(a) The interpretation of the shared text is referred to as 'shared meaning'.
(b) These risk treatments mitigate the risk of not achieving objectives, which in the sample scenario are consistency and explainability of choice of client service offerings.
(c) Risk treatment always includes documenting to describe any remaining sources of risk, reasons for them, and to explain their potential impact on outcomes.

4. Illustrated methodology

4.1. A fictional scenario in social service

This section will illustrate a methodology for managing linguistic uncertainty with a fictional scenario. In this scenario, service providers for clients experiencing homelessness make choices of service offerings for each of their clients based on a client's needs, and providers must explain each choice.

In making their choice of service offering, service providers rely on a shared reference document that includes a definition of *homelessness*. Providers may have different interpretations of homelessness in this shared text. This could lead to inadequacy of explaining a choice or to inconsistency in choice of a client's service offerings across time or across service providers. Such inconsistency in choice or explanation would go counter to the ethical practice standards with which this social service organization remains compliant. For instance, linguistic Divergence leading to a consistently inconsistent choice of service offerings across service providers would be considered a source of unwanted bias, and the choices made would be unfair.

The following definition is given to the service providers to help them determine the choice of service offering. This fictional definition is purposely inadequate to allow for illustration of the methodology:

Homelessness: A situation in which an individual or family does not have stable, permanent, and appropriate housing, or the means and ability of acquiring it.

4.2. Addressing clients' basic needs

In our scenario, service providers for clients experiencing homelessness make choices based on a client's needs. Literature differentiates between "instrumental" needs of an organism that are associated with instrumental goals (or, ends) and means of achieving those goals (or, agents) and "basic" (or, absolute) needs of an organism that are inseparable from the organism itself, such as a human's need for food, without which a human would not exist [11, 12]. For example, helping a client secure housing will address an instrumental need. Helping a client secure housing at the expense of food would not meet a client's basic needs. By following the organization's policies related to clients' basic needs, which are conformant to the organization's legal obligations (such as those under human rights legislation) and its standards of ethical practice, a service provider will address basic needs when making their choice of how to help a client.

In this risk-based approach, basic needs are addressed in the first step of the methodology. Specifically, an additional objective is added to the risk criteria. All four steps of the methodology are described next.

4.3. A methodology for managing linguistic uncertainty in shared text

Uncertainty is a source of risk; therefore, sources of uncertainty are also sources of risk. To manage linguistic uncertainty in shared text, each of the fourteen sources of linguistic uncertainty are addressed following a methodology that includes steps of risk management described in the international standards ISO 31000 [13] and IEC 31010 [3]. These steps are the following:

1. Define risk criteria: Describe the objectives and context against which the significance of linguistic uncertainty are evaluated. In our scenario, the objectives of interest are both consistency and explainability of a decision in a context of a social service organization choosing client service offerings.

To address clients' basic needs described in Section 4.2, an additional objective is added. Specifically, this objective is compliance with the organization's legal obligations and its standards of ethical practice. In our scenario, this additional objective is met by the service providers' adherence to the organization's policies related to clients' basic needs.

2. Identify risk sources: Describe the sources of linguistic uncertainty that could impact the objectives defined in step 1. These are the fourteen sources of linguistic uncertainty identified in Section 2 and described in the second column of Table 1.

3. Perform risk assessment: Assess to what extent each identified source of linguistic uncertainty could lead to not meeting objectives, which in this scenario are consistency and explainability of choice of client service offerings, and adherence to the organization's policies related to clients' basic needs.

Risk assessment is accomplished in two steps. The first step involves estimating the impact of each of the sources of risk by posing questions to stakeholders. These questions estimate the linguistic uncertainty from each of the sources of risk (low, medium, or high) and describe the risk (i.e., the uncertainty of not achieving the desired outcome due to that source of risk).

To perform risk assessment for Complexity, the questions to stakeholders include: *To what extent does applying this definition to a specific situation depend on factors not included in the definition? In other words, to what extent does this definition provide insufficient context to be able to apply it in any given situation (low, medium, or high)?* In our scenario, the service providers rate this definition as having high uncertainty due to Complexity, and describe how a client's ability to acquire housing has many dependencies such as financial ability or whether they are a dependent child. Additionally, there likely are factors about a client's situation that are unknown to the service provider. Without acknowledging the factors taken into account in making a choice, explainability of choice of service offering would be

Table 2
Sample of risk assessment questions for each source of risk applied to a definition of *homelessness*.

Sources of risk	Sample risk assessment
Complexity (multi-dimensionality)	•To what extent does applying this definition to a specific situation depend on factors not included in the definition, or provide insufficient context to apply to any given situation? (low, medium, high)? •There are many known dependencies on a client's *ability to acquire housing* such as financial ability or whether they are a dependent child. Also, likely there are factors about a client's situation that are unknown to the service provider. Without acknowledging the factors taken into account, explainability of choice of service offering would be lacking. Additionally, new factors may only become apparent after service provision has occurred.
Disorder (lack of order)	•To what extent can this definition be methodically interpreted (low, medium, high)? •If this definition were difficult to locate in the reference text when it was needed to make a choice, it would make it difficult to apply consistently.
Divergence (inconsistency)	•To what extent is there variability across stakeholders in how the definition is applied (low, medium, high)? •Do stakeholders consistently interpret the definition in ways that would lead (consistently) to different choices?
Impermanence (changeability)	•How frequently might the definition need to change (low, medium, high)? •Are there foreseeable changes to policy that would require the definition to be revisited?
Incompleteness (insufficiency of information)	•Is something missing from the definition (yes:high; no:low)? •If the definition were missing the word *stable*, it would be difficult to explain how a choice could resolve homelessness.
Incomprehensibility (resistance to being understood)	•To what extent is it difficult to understand this definition (low, medium, high)? •For instance, do some parts of the definition translate poorly, making it difficult to understand in other languages?
Indefinitiveness (vagueness)	•To what extent might the definition be vague about something important (low, medium, high)? •If the definition did not allow the interpreter to pin down the meaning, then how to explain their choice? For instance, this definition is vague about whether permanent, affordable housing that lacks security would be considered *appropriate*.
Insolubility (resistance to being worked out)	•To what extent must one rely on pure guesswork to interpret the meaning (low, medium, high)? •A client might require easy access to resources unknown to the client service provider such as work, school, church, or family caregivers.
Non-transparency (obscurity)	•To what extent might the definition obscure something important (low, medium, high)? •This definition is obscure about whether living with non-family members is a situation of homelessness, making a choice in this situation hard to explain.
Polyesmousness (equivocality)	•Is there more than one meaning (yes:high; no:low)? •If the phrase *stable housing* from the definition were interpreted to mean *fixed location* versus *reliable*, this could affect the consistency of the choice. For a temporary worker, *stable* might best be interpreted to mean a reliable housing solution that will allow them to move as required in order to remain close to their temporary work locations.
Tentativeness (undecidedness)	•With what frequency should the shared meaning be re-visited for a larger stakeholder audience (low, medium, high)? •Is this definition intended to be used by a new group of service providers who might interpret the meaning of the definition differently?
Unfamilarity (unaquaintedness)	•To what extent are all concepts in the definition familiar enough to every stakeholder (low, medium, high)? •Not every service provider is familiar with calculating the financial *means* of a client, making consistency of choice across providers difficult.
Unpredictability (indeterminancy)	•To what extent is it difficult to predict how the meaning of the definition might change over time (low, medium, high)? •The meaning of *appropriate housing* may change in ways that cannot be easily predicted. New types of housing might be built to better accommodate temporary workers, and digital connectivity requirements for remote workers might evolve. This could affect the consistency of choices between service providers who are aware of these changes and those who are not.
Variety (diversity)	•Is there more than one definition that is valid (yes:high; no:low)? •In addressing the risks identified above, more than one valid definition might be warranted. For instance, different definitions may be helpful to making a choice depending on whether a client is unsheltered, emergency sheltered, provisionally accommodated, or at-risk.

lacking.

To perform risk assessment for Unpredictability, stakeholders are asked: *To what extent is it difficult to predict how the meaning of the definition might change over time (low, medium, or high)?* In our scenario, the service providers consider the definition's Unpredictability to be medium because the meaning of *appropriate housing* may change in ways that cannot be easily predicted. New types of housing might be built to better accommodate temporary workers, and digital connectivity requirements for remote workers might evolve. This could affect the consistency of choices between service providers who are aware of these changes and those who are not.

For Unfamiliarity, one question is, *to what extent are all the concepts in the definition familiar enough to every stakeholder (low, medium, or high)?* In our scenario, the service providers rate the definition's

risk from Unfamiliarity as high and explain that not every service provider is familiar with calculating *means* of a client, specifically financial means. This could affect the consistency of choices between service providers who are familiar with making this calculation and those who are not.

This line of questioning continues for the remaining sources of risk. A detailed list of sample questions and notes for the scenario's risk assessment is found in Table 2.

The second step in risk assessment is to prioritize these risks according to their likelihood of impact, and addressing those that are deemed high enough priority. Highest priority is given to any risk that could result in non-adherence to legal obligations or standards of ethical practice related to basic needs. In our fictional scenario, the service organization wants to minimize any inconsistency in choice or challenge to explainability and will address all risks, making prioritization unnecessary.

4. Prescribe risk treatment: Those sources of risk that could be eliminated should be, and those remaining should be reduced as much as is feasible. There will be cases where nothing can be done about an uncertainty, and these should be identified in documentation about the decision.

In our fictional scenario, brainstorming with service providers arrives at the (sample) actions described in the third column of Table 1. These fall into 5 categories of risk treatment actions. The first four eliminate or reduce the risk to consistency of choice of service offerings:

- Revising the shared text: Some uncertainties are eliminated by revisiting and improving the shared text. For example, Incomprehensibility would be entirely addressed by making the shared meaning entirely comprehensible, or understood by all Stakeholders. In our scenario, risk treatment for Complexity would include explicitly adding known dependencies, such as how the meaning of the definition should be different for clients who are children.

- Training: Some uncertainties might require not only revising the shared text, but also providing training to the service providers on how to interpret the revised shared text. For example, Unfamiliarity could be addressed by providing training examples to help make the shared meaning more familiar to service providers. In our scenario, risk treatment for Unfamiliarity includes improved text and training on how to calculate a client's financial means.

- Calling on human judgement: Expert judgement could address tacit knowledge issues such as tacit dependencies. Human judgement reliably takes into account human attitudes that can make a decision more humane, more ethical. In our scenario, risk treatment for Complexity includes asking a client whether other considerations should be taken into account and checking in with a client after service provision to see if any new factors become apparent.

- Repeating risk assessment and treatment: As previously mentioned, both Unpredictability and Impermanence might be resolved by revisiting the shared meaning of the text frequently enough for stakeholders to remain aligned on their interpretation, or, in other words, repeating steps 3 and 4 of this methodology frequently enough. In our fictional scenario, risk treatment for Unpredictability includes revisiting the shared meaning of *appropriate housing* frequently enough for the choices to remain consistent across service providers.

The fifth action addresses explainability of choice of service offerings:

- Documenting: Some aspects of uncertainties cannot be eliminated or reduced, and must be accepted. Such cases should be addressed by documenting the aspects of the shared meaning for which the uncertainty cannot be addressed, reasons for them, and potential impact to outcomes.

  For example, Insolubility may not be entirely resolvable. There may be shared beliefs, values, principles, policies and such that need to be applied to arrive at a shared meaning. Sufficient details of this should be documented, as should aspects of the shared text that remain insoluble, reasons for this, and the potential impact to outcomes, which in our fictional case are consistency and explainability of choice of service offerings. Documenting interpretation allows an explanation to be more complete,

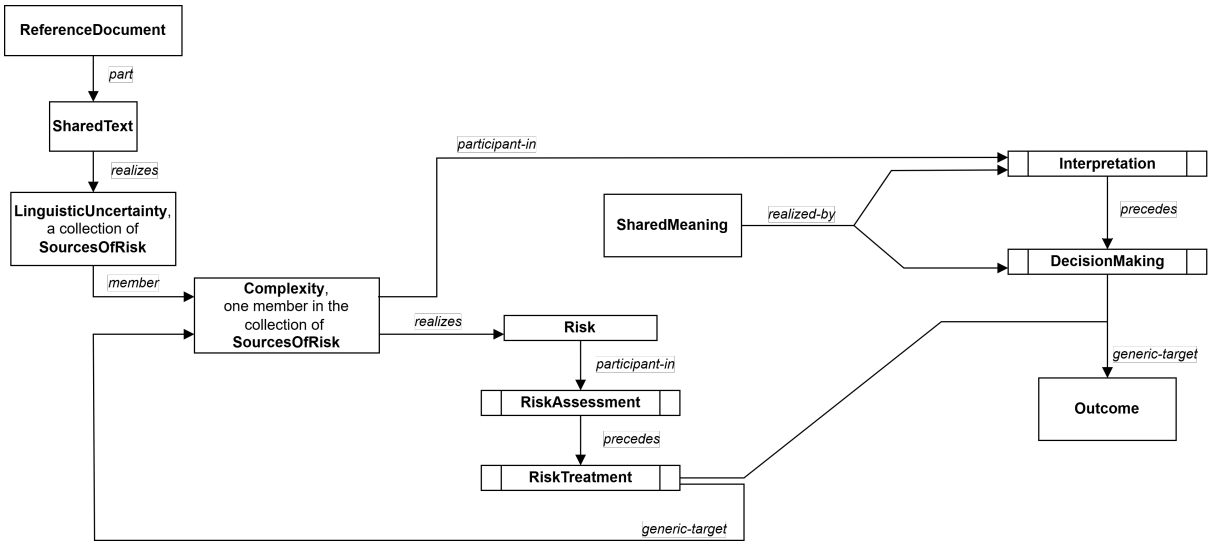

Figure 1: Conceptual model of the MLUT ontology. The interpretation of SharedText is referred to as SharedMeaning. For simplicity, only one of the sources of risk is illustrated, that of Complexity.

and subsequent service providers could refer to this documentation to help make more consistent choices. A second example are instances where interpretation of the shared text (shared meaning) is based on tacit knowledge, which cannot be codified and requires human judgement. The details of any human judgement should be documented to describe this risk treatment. In our scenario, risk treatment for Complexity includes explicitly documenting both known factors and other factors that the client makes known.

Care should be taken so that the risk treatment for one source of uncertainty (source of risk) does not unduly add to another. One example is allowing for more than one shared meaning (adding diversity, or Variety) while not adding unwanted inconsistency, or Divergence. For example, an interpretation may be dependent on logistics of a client experiencing homelessness. Adding this dependency to the definition of homelessness would add Variety (by allowing there to be more than one valid shared meaning based on an explicit dependency). However, this diversity should be added without diverging in a way that could compromise desired outcomes, which in this scenario are the ability to consistently determine and be able to explain the choice of client service offerings, and adherence to the organization's policies related to clients' basic needs.

Many concepts mentioned in this section are further developed in the next, where they are referenced in an ontology of managing linguistic uncertainty in shared text.

4.4. An ontology of managing linguistic uncertainty in shared text

A simplified conceptual model for a proposed Ontology of Managing Linguistic Uncertainty in shared Text (or, MLUT ontology) is illustrated in Figure 1, which highlights in bold the MLUT components and in italics the DOLCE taxonomy proposed to operationalize these components [5, 14]. The DOLCE framework is chosen because it provides a form of expressing relevant MLUT ontological axioms for both subjective entities such as individual and societal interpretations of meaning and human cognitive decision-making.

SharedText is construed as a *non-agentive-physical-object (NAPO)* that is *part* of a **ReferenceDocument**, which is artifact originating from a process (out of scope for this paper) of authoring the **ReferenceDocument**. A *NAPO* does not have agency; it requires an agent to become relevant within an ontology. In our fictional scenario, the agent (not illustrated in Figure 1)—an *agentive-physical-object*—is a *natural person* who *plays* the role of service provider or human expert—an *agentic-social-object*—and is *participant-in* a process of **Interpretation**.

SharedMeaning is a *social-object*, specifically an *information-object* that *expresses* a *description* (not illustrated) of the meaning of the **SharedText**. **SharedMeaning** is *realized-by* the process of **Interpretation** mentioned above and during the **DecisionMaking** process, which comes after an **Interpretation**, which *precedes* it.

LinguisticUncertainty is realized by **SharedText** (which *realizes* it) during the process of **Interpretation**. It is a collection of **SourcesOfRisk**. For simplicity, only one in the collection is illustrated in Figure 1, specifically **Complexity**. Each of the **SourcesOfRisk** *realizes* **Risk**. Also, each one of the **SourcesOfRisk** is a *non-agentive-social-object*, specifically a *role* (not illustrated in Figure 1) that is *participant-in* an activity of "cognitive force" occurring during the process of **Interpretation**. The role of the source of risk might be *played-by* the cognitive material of a *natural-person*, such as a human service provider, impacting the person's interpretation of **SharedText**. More work could be done to elaborate on this concept of cognitive force. Each one of the **SourcesOfRisk** *has-quality*. In our scenario, these qualities are estimated quantitatively (as either low, medium, or high) by questions posed during risk assessment step 3 of Section 4.3.

Risk is a *mental-object* that is *participant-in* the process of **RiskAssessment**. **Risk** is imagined by agents (not illustrated) also *participant-in* **RiskAssessment**. A widely accepted definition of risk is as an effect of uncertainty on outcome; in other words, a possible effect on outcomes. This requires imagining a possible—as yet unrealized and potentially never realised—effect on outcome. More work could be done to elaborate on Risk as an imagined entity. Each **Risk** *has-quality*. In our scenario, these qualities are estimated qualitatively (in the form of a description) by questions posed during risk assessment step 3 of Section 4.3.

RiskAssessment for each of the **SourcesOfRisk** is a *process*. In this conceptualization, the **RiskAssessment** process includes (in a way not illustrated here) the process of **Interpretation**. As described above, each of the **SourcesOfRisk** and each **Risk** have qualities, and these are estimated during the **RiskAssessment**.

RiskTreatment for each of the **SoucesOfRisk** is a *process* that follows **RiskAssessment** (which *precedes* it). It includes more than one *activity* (not illustrated) that impact both (*generic-target*) **Outcome** and (*generic-target*) **SourcesOfRisk**. In our fictional scenario, there are five types of risk treatment processes: Revising the shared text, training, calling on human judgement, repeating risk assessment and treatment, and documenting. Risk treatments can both directly affect client service outcomes (e.g., documenting) and indirectly affect outcomes by modifying the risk sources (e.g., revising the shared text).

Outcome is a *non-physical-endurant* that *has-quality* that *inheres-in* the result (not illustrated) of the **DecisionMaking** and **RiskTreatment** processes. In our fictional scenario, risk treatments can lead to more desirable quality of outcomes, specifically improvement to consistency and explainability of choice of service offerings while adhering to the organization's policies regarding clients' basic needs.

5. Conclusion

This work relies on a comprehensive typology of uncertainty contextualized for linguistic uncertainty, and an approach is proposed for managing linguistic uncertainty in a fictional social services scenario where service providers must rely on a shared definition of *homelessness* to help them make a choice of service offerings for a client. One can imagine how it would be possible to adapt the method to other text with other groups of stakeholders making other types of decisions with other objectives. For instance, while in this illustrative scenario the shared text is a definition of homelessness, this methodology could be applied to other shared text, such as *accountability* found in organizational policies and procedures for AI governance.

By consciously addressing uncertainty, this methodology helps address an endogenous problem in uncertainty management, namely intolerance to uncertainty that can lead to unacknowledged bias in outcomes. Future work could be done to validate this methodology in a real-world scenario.

Future work could also explore the concept of a cognitive force of uncertainty and the risk it realizes

in various scenarios. Research in uncertainty management is informed by multiple domains including risk management, behavioural decision making, ontology engineering, and others. It is hoped that this paper inspires more such collaboration.

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Declaration on generative AI

The author has not employed any Generative AI tools.

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