SWAHILI CONDITIONAL CONSTRUCTIONS IN EMBODIED FRAMES OF REFERENCE: MODELING SEMANTICS, PRAGMATICS, AND CONTEXT-SENSITIVITY IN UML MENTAL SPACES

by

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Abstract

Studies of several languages, including Swahili [swa],[1] suggest that *realis* (actual, realizable) and *irrealis* (unlikely, counterfactual) meanings vary along a scale (e.g., 0.0–1.0). T-values (True, False) and P-values (probability) account for this pattern. However, logic cannot describe or explain (a) epistemic stances toward beliefs, (b) deontic and dynamic stances toward states-of-being and actions, and (c) context-sensitivity in conditional interpretations. (a)–(b) are deictic properties (positions, distance) of 'embodied' Frames of Reference (FoRs)—space-time loci in which agents *perceive* and from which they contextually *act* (Rohrer 2007a, b). I argue that the embodied FoR describes and explains (a)–(c) better than T-values and P-values alone. In this cognitive-functional-descriptive study, I represent these embodied FoRs using Unified Modeling Language™ (UML) mental spaces in analyzing Swahili conditional constructions to show how necessary, sufficient, and contributing conditions obtain on the embodied FoR networks level.

Keywords: Swahili, conditional constructions, UML, mental spaces, Frames of Reference, epistemic stance, deontic stance, dynamic stance, context-sensitivity, non-monotonic logic

[1] The ISO 639-3 identifier [swa] stands for Swahili. ISO 639-3 is a standardized code of three-letter identifiers for all known languages (Eberhard, Simons, & Fennig 2019).

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Glossing Abbreviations

1SG	1st person singular
1PL	1st person plural
2SG	2nd person singular
2PL	2nd person plural
3SG	3rd person singular
3PL	3rd person plural
AUX	auxiliary
COND	conditional marker
CONJ	conjunction
COP	copula
DIST	distal
FUT	future
FV	final vowel
INF	infinitive
IPFV	imperfective
LOC	locative
NEG	negation
NUMBERS	noun class indicating subject and object agreement
PASS	passive
PRF	perfect
POSS	possessive
PREP	preposition
PROX	proximal
PRS	present
PST	past
RECP	reciprocal
REF	referential
REFL	reflexive
REL	relativizer
SBJV	subjunctive
STEM	stem
STV	stative

List of Symbols

Q	Apodosis
B	Belief
cf.[2]	Cross-reference to a qualifying or dissenting publication
≥	Greater than or equal to
iff	'If and only if' (biconditional)
≤	Less than or equal to
–	Negative stance or status; physical absence of referent
=	Neutral stance or status
+	Positive stance or status; physical presence of referent
P	Probability
P	Protasis
*t*n	Time index (n is an integer)
>>	'Toward'

[2] The precise usage of 'cf.' is underspecified in the Unified Stylesheet for Linguistics Journals (Linguistic Society of America) and the Generic Style Rules for Linguistics. Hence, to accommodate cross-disciplinary expectations and coherence, this study uses 'cf.' to cross-reference a qualifying or dissenting publication *per* the American Psychological Association (APA) Stylesheet.

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1. Chapter One: Introduction

1.1 Aims, objectives, and motivations

Studies of several languages, including Swahili [swa],[3] suggest that *realis* (actual, realizable) and *irrealis* (unlikely, counterfactual) meanings vary by degree on a scale (e.g., P = 0.0–1.0). T-values (True, False) and P-values (probability) account for this pattern.[4] However, logics as symbolic systems cannot describe or explain the influences of (a) epistemic stances toward knowledge claims (beliefs), (b) deontic stances (e.g., permission, obligation, desire) and dynamic stances (e.g., (in)ability, volition) toward states-of-being and actions, and (c) context-sensitivity, viz., the flexibility of constructional interpretations due to contextual factors such as (i) discourse content, information structure, and genre, (ii) the semantic influences of co-occurring constituents (e.g., tense marker and a *realis* marker; see §3.2 on Construction Grammar), and (iii) the 'real-world' experiences of 'social stance' and 'social status.'[5] Both (a) and (b) are embodied deictic properties expressing metaphorical positions and distance (see §1.3, (P3) and §2.3, Table 1, Dimension 11)[6] Frames of Reference (FoRs), namely, space-time loci in which agents *perceive* and from which they contextually *act* (Metzinger 1999; Gallese 2000; Kessler & Thomson 2010). Put differently, logics are agnostic about how language, mind, and brain

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[3] The ISO 639-3 identifier [swh] stands for Swahili. ISO 639-3 is a standardized code of three-letter identifiers for all modern (non-ancient) languages (Eberhard, Simons, & Fennig 2019).

[4] 'T-value(s)' and 'truth-value(s)' appear interchangeably throughout this study; the former contrasts with P-values.

[5] The dimension I add to these terms evoked in sociolinguistics and Critical Discourse Analysis is embodiment, namely, that 'social stance' is an embodied Agent's metaphorical, value-asserting 'position' facing 'toward' an individual or collective animate Undergoer. Conversely, the agentively asserted social status value of the animate Undergoer mirrors the Agent's stance value.

[6] Embodied metaphors are cognitive analogies from physical positions to non-physical positions (e.g., social status as 'high' or 'low'; a belief as 'highly' likely or a '*far* cry from the truth', as in colloquial American English) toward the goal of comprehending the world through neurophysiological and mental simulations of states-of-being and events (Perlman, Marcus, & Gibbs 2013).

interrelate (Chilton 2014: 4), and logicians often ignore contextual and pragmatic constraints on constructional meaning (but see, e.g., Kamp 1993; Willer 2010; Stalnaker 2016; Galván 2019).

Does using an embodied FoR as a heuristic describe and explain (a)–(c) (see §2.3 on embodiment)? In this cognitive-functional-descriptive study, my *primary aim* is to argue and show that the embodied FoR is a better heuristic for conditional interpretations than T-values and P-values alone. An underlying presupposition of my analysis is that each semantic modality type (epistemic, deontic, and dynamic) has a corresponding pragmatic stance type that influences T-values and P-values. My *secondary aim* is to show that necessary, sufficient, and contributing conditions, as the logical properties correlating with T-values and P-values, obtain on the level of embodied FoR networks between agentive stances and 'real-world' states-of-being and action.

My *primary objective* is operationalizing Unified Modeling Language™ (UML) mental spaces as embodied FoRs as a heuristic of semantics, pragmatics, and context-sensitivity in Swahili conditional constructions.[7] Thus, comprehensively describing Swahili conditional semantics and pragmatics is not in view, nor are the morphosyntactic distributions of the conditional prefixes and conjunctions; these are the tasks of multiple corpus analyses. The *analytical focus* is on expressions of modal stances in Swahili conditional conjunctions as they pattern with conditional prefixes and conjunctions in situational-discursive contexts. For instance, I discuss examples in which the socio-cultural values of 'real-world' embodied agents expressed through modal stances impinge upon T-values and P-values. My *secondary objective* is to argue and show that deontic stance and dynamic stance are significant for linguistic analysis, especially of conditional constructions. Studies on epistemic stance abound, while

[7] Used by permission. Per the copyright requirements of the Object Management Group (2017), I hereby state that my implementation of OMG UML 2.5.1 is not exhaustively representative.

deontic stance has only recently been studied in languages besides English (e.g., Stevanovic 2013). I conceptualize dynamic stance (Maciuchová 2016: 24) as a pragmatic function that indicates an agent's assertions regarding instances of (*in*)*ability* and *volition* in contexts (§2.3.4).

The *theoretical motivation* for my selecting Embodied Cognition (EC) as my methodological framework (Rohrer 2007a, b) is my desire to empirically ground (i.e., involving reproducible data collection methods and testable hypotheses, see Samson 2001) claims about human cognition while synthesizing descriptive findings in corpus and discourse data. Specifically, I claim that (a) modal stances are embodied deictic properties and that (b) embodied FoRs are cognitively plausible. Moreover, a *typological motivation* guides this study. Non-Indo-European languages such as Swahili are common in cognitive linguistic studies (e.g., Idström & Piirainen 2012: 17; Levinson 2003, Rau, Wang, & Chang 2012, Buszard 2003, and Kwon 2012, 2014; see Rice 2017b for a historical description) but rarely appear in studies in the philosophy of language and logic. Since this interdisciplinary study falls within all three categories, choosing Swahili mitigates this substantial under-representation in the latter two categories. Among other contributions is a synthesis of experimental findings in cognitive neuroscience with findings in descriptive, cognitive, and functional linguistic studies.

In this chapter, I define key terms and concepts (§1.2), state the problem I address (§1.3), propose a solution (1.4), anticipate potential objections (§1.5), delimit the research scope (§1.6), and outline the thesis structure (§1.7).

1.2 Definitions

This section defines key terms and concepts. First, a CONDITIONAL CONSTRUCTION is a pairing of a *P* (protasis or antecedent) clausal proposition and *Q* (apodosis or consequent) clausal proposition that depicts *realis* (actual, realizable) and *irrealis* (unlikely, counterfactual) events.

Three logical conditions relate to conditional constructions: NECESSARY CONDITION, that the non-existence of A makes B impossible; SUFFICIENT CONDITION, that the existence of A makes B the case, and CONTRIBUTING CONDITION, that the existence of A makes B more probable (quantitative) *or* more extensive (qualitative). Conditional constructions express the following properties in varying proportions: truth-value (T-values), probability (P-values), possibility, permission, obligation, desire, ability, volition, causality, agency, and contingency (e.g., necessary, sufficient, and contributing conditions).

In MONOTONIC LOGICS as symbolic systems, T-values of *P* (protasis) and *Q* (apodosis) propositions are (a) BINARY (two-valued: True or False) (b) NON-DEFEASIBLE, viz., *not* revisable by degree or cancellable across time indexes; *P* is *only and always* True or False.

In NON-MONOTONIC logics as symbolic systems, P-values (§3.3.2.1, Table 7) of *P* (protasis) propositions are (a) SCALAR (many-valued, viz., along a scale on which P = 1.0 denotes True/certainty and P = 0.0 denotes False/impossible[8] and (b) DEFEASIBLE, viz., revisable by degree or cancellable across time indexes; an agent's confidence about *P* may change across time indexes (over time). In contrast, *Q* (apodosis) propositions in non-monotonic logics are binary (two-valued: True or False). In this sense, non-monotonicity (P-values) embeds monotonicity (T-values) rather than rejecting it altogether, a notion that entails that P-values of *P* propositions have semantic scope over (causal ability to revise or cancel) T-values.

MENTAL SPACES (Fauconnier 2010 [1994]) are diagrams that model the cognitive processing of (a) semantic and pragmatic properties (e.g., deictic properties) and relations (e.g.,

[8] *P* (protasis); P (probability of *P*).

temporal, sequential, causal, logical) and (b) contextual factors. Crucially, they represent a speaker's/writer's perspectival assertions, not reality itself.

DEICTIC PROPERTIES are semantic and pragmatic functions that concern metaphorical (e.g., social) and physical (i.e., topographic) positions and distance (e.g., proximal, distal). Semantic deictic property types include discourse (e.g., subject, object), person (e.g., 1SG), temporal (tense and aspect), topographic (e.g., locatives), modal (e.g., modal verbs, evidentials), and social (e.g., honorifics). Modal stance types are pragmatic deictic properties, in that they map agentive self-positioning and distancing relative to beliefs (epistemic stance) or states-of-being and actions (deontic and dynamic stances). The division of labor between deontic and dynamic modality is by no means settled in the literature (see Nuyts 2006). In this study, 'deontic modality' and 'deontic stance' indicate the categories of *permission*, *obligation*, and *desire*. In addition, Following Palmer (1979, 1990; see Verstraete 2001), I use 'dynamic modality' and 'dynamic stance' to indicate the categories of *ability* and *volition* (e.g., willingness, decision-making). Deictic property types in embodied FoR mental spaces combinatorially emerge into FoR networks—the discursive situating of body, self, referents, society, and environment in the perception-action cycle (Zheng, Young, Wagner, & Brewer 2009; Paletta, Fritz, Kintzler, Irran, & Dorffner 2007; Friston 2012: 171-177).

1.3 Statement of the problem

In the philosophy of language, logics as symbolic systems incorporate either truth-values (True or False) or probability values for clausal propositions. Some logicians also analyze conditional pragmatics and context-sensitivity, although most do not consider the influence of these factors on conditional interpretations. Worse, symbols signifying logical properties such as truth-values, probability-values, and modality have no internal conceptual structure, unlike the 'real-world'

linguistic propositions they purportedly represent. Hence, the three-fold problem I address is the inadequacy of both monotonic and non-monotonic logics to describe or explain the influences of (a) epistemic stances toward knowledge claims (beliefs), (b) deontic stances (e.g., permission, obligation, desire), dynamic stances (e.g., (in)ability, volition) toward states-of-being and actions, and (c) context-sensitivity on conditional interpretations. Consider the following opening argument based on empirical findings in descriptive and experimental studies:

(P1) Descriptive studies show that epistemic stance and deontic stance influence conditional interpretations (e.g., Akatsuka 1997, 1999; Rhee 2014: 10).[9]

(P2) Epistemic, deontic, and dynamic stance are deictic properties that express positions and distance (see Clift 2006; Zhongyi 2015; Urbanik, Paweł, & Svennevig 2019).

(P3) Epistemic, deontic, and dynamic stance types express embodied, agentively *asserted* 'positions' (in an 'embodied metaphor' sense) on propositional content (see §1.2 and §2.3, Table 1, Dimension 11).[10] This claim pertains to *linguistic* truth (as perceived and expressed), not to *metaphysical* truth (as things are) in the 'real world' (§2.3.1).

(P4) Several neuroimaging studies (e.g., Li, Zhang, Luo, Qiu, & Liu 2014) show statistically significant correlations between (a) specific, predictable neurophysiological (brain, nervous system) activation patterns associated with spatiotemporal (deictic) *orientation* and *navigation* in space and time and (b) brain areas associated with comprehension of conditional semantics (e.g., centro-parietal lobe).

(C) Therefore, modal stances are embodied deictic properties (see Woelert 2011 on 'embodied deixis') that influence conditional interpretations since conditional constructions involve semantics.

To (C) add (P5) below as a corollary proposition (secondary conclusion) that follows from (C):

(P5) Descriptive studies (e.g., Saloné 1983b; Allison 2017) and experimental studies (e.g., Dai, Chen, Ni, & Xu 2018: 906) similarly suggest that situational-discursive contexts influence conditional interpretations.

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[9] P = premise; C = conclusion.

[10] An Agent *asserting* a proposition does not entail that the Agent *believes* the proposition.

Monotonic and non-monotonic truth-conditional accounts often ignore empirical findings in descriptive and experimental studies and their implications. Now consider the non-syllogistic list in (1)–(4) of relatively representative tenets of truth-conditional claims about the interpretation of conditional expressions:

(1) **T-value and P-value level of description**: T-values and P-values *primarily*, if not *exclusively*, obtain on the level of propositional logic symbols representing the semantics of a sentence (e.g., Lycan 2001: 1–15; Jordanoska 2017; Egré, Rossi, & Sprenger 2019).

(2) **T-value distribution**: All subjunctive (*irrealis*) conditionals have T-values, as do many or all indicative (*realis*) conditionals (the extent of T-value distribution varies among, e.g., Lycan 2001: 73, 76; Egré et al. 2019; *inter alia*).

(3) **T-value determination:** T-values determine conditional interpretations; in contrast, context-sensitivity is a relatively insignificant factor (e.g., Lycan 2001: 109; cf. Lycan 2011 as a self-critical review; see also Shilon, Habash, Lavie, & Wintner 2012 using the 'context-free' Stat-XFER Framework to machine-translate between Hebrew and Arabic; cf. Karlsson, Voutilainen, Heikkilae, & Anttila 2011).

(4) **T-value primacy:** T-values are the primary heuristic of conditional interpretations, excepting only limited cases in which P-values and context-sensitivity play minor roles (e.g., Lycan 2001: 74, 141; Malatesta 2002; Jordanoska 2017).

Monotonists vary in their support of tenets (1)–(4) (§2.2). Non-monotonists at large (e.g., Elder & Jaszczolt 2016; Kamp 1993; Willer 2010; Stalnaker 2016; Galván 2019) at least reject (3), would likely qualify (2) and (4), and tend to accept (1). Non-monotonists, by definition, seek to ameliorate what they see as the shortfalls of (3) by reconstituting non-defeasible T-values (truth-values) as defeasible P-values (probability values). Apart from contextual considerations, however, doing so is also descriptively and explanatorily incomplete. Denying (3), however, is a step in the right direction (§2.2.2).

In principle, (4) is—to borrow a term from the philosophy of neuroscience (see Bickle 2006a, 2006b, 2007; cf. Jones 2000, 2013)—a 'ruthless reductionism' of conditional semantics to T-values. All scientific theories, linguistic or otherwise, are abstractions, and in some cases,

reductions (i.e., simplifications) of reality for the sake of analysis. Properties of phenomena are described and put into categories. Explanations are then offered for how these properties relate to each other. However, a descriptive theory that reduces conditional meaning to a solitary property (e.g., T-values) and dismisses all other properties (e.g., P-values, modal stance types) is a *descriptive reductionism*—a 'one-feature-fits-all examples' methodology of description (Jones 2000: 22–23, 27–28, 140). Few non-monotonic studies cleanly match this characterization, but monotonic studies such as Lycan (2001) do not escape unscathed. The empirical findings cited in this section demand an alternative interpretive heuristic that incorporates but also goes beyond analyzing T-values or P-values alone.

1.4 Proposed solution

As a proposed solution for the three-fold problem outlined above, this study operationalizes UML mental spaces (Fauconnier (2010 [1994]) to represent networks of embodied FoRs, their respective deictic properties (§1.2 and §2.4), and context-sensitivity. Again, the deictic properties of interest are epistemic, deontic, and dynamic stance (modal deictic properties) as they influence T-values and P-values. Along the path to effectively using the embodied FoR as an *anti-reductionist* heuristic (Jones 2000: 29–35; Agazzi 1991) are the potential pitfalls of shallow description, trivial prediction (see Brandt 2005), and terminological conflict that often compromise truth-conditional accounts.

My methodological framework is EMBODIED COGNITION (EC), a set of interdisciplinary research programs in the cognitive sciences. In essence, its proponents support variations of the embodiment hypothesis that sensorimotor experience, the sum of (a) sensory inputs with (b) positions and movements *in* and *of* the body *and* mind makes possible, shapes, and constrains human perception and action (Varela, Thompson, & Rosch (2017 [1991]); Levinson (2003);

Rohrer (2007a, b), *inter alia*). This notably dense summary statement raises the question of the significance of the embodiment hypothesis for conditional interpretations, an issue I address in §2.3). EC construes language as an embodied, complex, adaptive system (see also Beckner, Blythe, Bybee, Christiansen, Croft, Ellis, Holland, Ke, Larsen-Freeman, & Schoenemann 2009). On this view, the semantics of conditional constructions are not reducible to logic (e.g., T-values, P-values). In §4, I show how embodied FoR mental space networks visually model contextual constraints, modal stance, possibility, probability, causality, agency, and contingency (e.g., necessary, sufficient, and contributing conditions). T-values and P-values only account for a narrow subset of these properties.

1.5 Potential objections

The interdisciplinary trajectory of this study evokes numerous theoretical, methodological, and practical objections. The first two of the following replies are theoretical, the third is methodological, and the fourth is practical, in that it concerns the usability of UML mental spaces in linguistic fieldwork. First, many logicians and philosophers of language will find it odd to not support the thesis with a parallel analysis of UML mental spaces and a formal logic language (e.g., Descriptive Logic (DL), see Saeed & Dănciulescu 2018). However, doing so would require a consensus on the descriptive and explanatory boundaries between or overlaps of conditional semantics and pragmatics. Unfortunately, no such interdisciplinary criteria exist.

Second, the prevalence of non-monotonic analyses indicates a growing consensus in linguistics and the philosophy of language. Why trouble with another rebuttal of monotonicity? Here it is worth mentioning that the interdisciplinary influence of monotonic logics still warrants an interdisciplinary response (e.g., see Malatesta 2002 on Swahili; cf. Mayes 1994; Jordanoska 2017; Reverberi, Cherubini, Frackowiak, Caltagirone, Paulesu, & Macaluso 2010; Elder 2019).

Monotonic studies tend to move from *a priori* presuppositions to "finding" T-values under every datum and thus ignore contextual constraints and overlook pragmatic factors (e.g., Lycan 2001).

This study aims to avoid these analytical shortfalls. Even so, a potential methodological criticism arises for arguing from single-language data while pursuing descriptive and explanatory adequacy about the cognitive modeling of conditional constructions. What if the minds of speakers of distinct languages either *have* or *enact* vastly different cognitive models of the world? Consider the following counterargument. All humans share our common experience as embodied beings (see Rohrer 2007a, b). Our brains, minds, and environments are deeply interwoven and inseparable in analysis, even though there is no consensus on how language processing in each relates to processing in the other (§2.3.2) Furthermore, given our shared embodied experience, there are no *a priori* reasons to believe that the brain-mind-world maps for one language are radically dissimilar to those of any other language. Even though claims for *linguistic universals* fall short of producing conclusive evidence (Evans & Levinson 2009), claims for embodied, *cognitive universals* (however defined) are based on evidence in descriptive and experimental studies, both in linguistics and cognitive neuroscience (§1.3). Indeed, all findings from single-language data are preliminary and require data triangulation with other languages, but cognitive models (e.g., UML mental spaces) based on it are at least plausibly useful for analyzing another.

Moreover, this analysis is (a) *abductive* (inferring from data to best explanations) and (b) *inductive* (inferring from data to generalities). Most truth-conditional analyses are (c) *deductive* (inferring from *a priori* generalizations to specific conclusions). An abductive-inductive approach entails tacitly making data-based claims. Abductive-inductive approaches constrain *a priori* presuppositions that can skew analyses. Consequently, they tend to yield increased

precision (consistency between results) *and* improved accuracy (descriptive and explanatory adequacy). They also tend to generate testable hypotheses for further investigation.

The following practical objection to using UML mental spaces for field data analysis is plausible. Latent skewing between language and meta-language introduces analytical errors, as in assuming Swahili conditional conjunctions are grammatically equivalent to the English 'if.' This issue already persists in descriptive analyses (e.g., Mwamzandi 2017; Saloné 1983a, 1983b; Mpiranya 2014: 127). Why add further analytical vulnerabilities by using UML mental spaces with English metalanguage?

Indeed, choosing theoretical starting points is crucial. Formalisms are imperfect and can skew analyses. For field linguists, gratuitous theoretical abstractions yield no efficiency in time-pressured data collecting and grammar writing. While field implementation is not the primary methodological focus of this study, §4 operationalizes UML mental spaces to demonstrate how they can inform description in unexpected ways. Take, for instance, the surprising influence of deontic stance on conditional meaning. Some linguists may find UML mental spaces to be needlessly abstract, but they may nonetheless prove helpful in applications such as discourse analyses of narrative and hortatory texts.

1.6 Limitation of scope

This interdisciplinary study evokes numerous theoretical concerns beyond its scope. For instance, cognitive linguists often use mental spaces to model semantic compositionality (see Pagin & Westerståhl. 2010a, 2010b) in conditional constructions. Studies such as Feldman (2010), Sweetser (1999), and Dancygier & Sweetser (2005: 210-211) use mental spaces to argue that lexical and grammatical constituents as semantic-syntactic *parts* combine into constructions as *wholes*, the meanings of which are 'other than' the semantic sum of the constituents ('weak'

compositionality). By contrast, Cognitivists (Fodor & McLaughlin 1990; Fodor 1997) defend 'strong' compositionality, the view that the meanings of constructions as *wholes* are strict sums of their semantic-syntactic *parts* (e.g., quantifiers, modal markers). In this study, I assume 'weak' compositionality while not supplying extended arguments for it. Nevertheless, §3.2 situates this analysis within the broad framework of the Construction Grammar theories and succinctly explains my rationale for supporting 'weak compositionality.'

Two disagreements on Swahili conditional semantics are also beyond the scope of this study. The first concerns whether Swahili has a 'conditional tense' which expresses both deontic modality and counterfactuality in present and past forms (Thompson & Schleicher 2006: 2750–276, 367; Mpiranya 2014: Mohamed 2001: 156, 165–167, Almasi, Fallon, & Wared 2014: 335–342). Of course, a grammatical constituent *could* mark both, say, counterfactuality and present tense. However, this is a different claim than arguing for a compound semantic category—an unhelpful option in this case. Arguing for a 'conditional tense' conflates rather than distinguishes deixis property types, in that deontic modality denotes modal deixis and tense markers denote temporal deixis (tense and aspect, see §1.6). The second disagreement concerns the categorical status of the concessive marker *-japo* '(even) if.' Myachina (1981: 53, 60) classifies *-japo* as a conditional marker while Saloné (1983a, 1983b) does not. Since concessives do not express an inter-clausal condition (e.g., a 'real-world' causal contingency), they are not 'real' conditional constructions (Lycan (2001: 93–138; Nicolle 2017: 11) as I defined them in §1.2. Consequently, no examples and discussions of concessives appear in the analysis.

1.7 Thesis structure

The thesis structure is as follows. Chapter Two outlines the limitations of monotonic and current non-monotonic logics for analyzing conditional semantics, pragmatics, and context-sensitivity

(§2.2), introduces Embodied Cognition (EC) as the present theoretical framework (§2.3), and supplies an overview of Mental Spaces Theory (MST) and how deictic properties function as mental space builders (§2.4). Chapter Three describes the methodological design principles (§3.2), the methods and diagrammatic features of UML mental spaces (§3.3), and the data selection criteria and sources (§3.4). Chapter Four discusses *realis* conditional prefixes and conjunctions in Swahili conditional constructions (§4.2) and *irrealis* conditional prefixes (§4.3). Chapter Five outlines the contributions of this study (§5.1), discusses their theoretical implications (§5.2) and their limitations (§5.3), and recommends research directions (§5.4).

1.8 Conclusion

This study is an extended argument for the embodied FoR as a better heuristic for the analysis of conditionals than T-values and P-values alone. Using this heuristic shows that modal stances and context-sensitivity influence these values. It also shows that necessary, sufficient, and contributing conditions—the logical properties correlating with T-values and P-values—obtain on the level of embodied FoR networks. In §1.2, I opened an Embodied Cognition (EC) case against absolutizing T-values and P-values and then proposed operationalizing UML mental spaces to represent embodied FoRs as a solution (§1.3). Doing so shows how modal stances as deictic properties, along with context-sensitivity, delimit conditional interpretations while also showing that deontic and dynamic stances are significant for linguistic analysis. In (§2), I survey the literature on these divergent themes and provide the theoretical framework for the analysis.

2. Literature review and theoretical framework

2.1 Introduction

In this chapter, I critically examine the literature and establish my theoretical foundations. Toward these ends, the following sections synthesize findings and arguments across several disciplines. Examining the historically extended truth-conditional debates requires narrow selection criteria. An interdisciplinary approach only augments this problem. Hence, recent publications receive more attention than those of historical interest while excepting prominent studies; so also do those which are interdisciplinary and critically original. This chapter focuses on critically examining monotonic and non-monotonic analyses as the two primary classes of truth-conditional theories (§2.2), reviews Embodied Cognition (EC) as my theoretical framework (§2.3) and outlines the use of mental spaces for modeling deictic property types (e.g., epistemic, deontic, and dynamic stances) of conditional constructions in embodied FoRs (§2.4).

2.2 Truth-conditional semantics and pragmatics

Truth-conditionality, the *de facto* heuristic for linguists and philosophers of language, is a nebulous conceptual framework supporting the claim that T-values and P-values relate in some way to conditional interpretations; some researchers integrate pragmatics into their models. As such, the substantial volume of publications on truth-conditional semantics and pragmatics thwarts any attempt to characterize universally-held principles on truth-conditionality. Section 1.2 outlined four common tenets of truth-conditional studies and argued that many such studies do not describe and explain epistemic stance (but see, e.g., Dancygier & Sweetser 2005), deontic stance, dynamic stance, and context-sensitivity. Of course, this evaluation requires demonstration with data (§4). It is not, however, the intent of this study to reject truth-conditionality as such. Rebutting current truth-conditional analyses as far as they support these four tenets does not

entail denying a place for truth-conditionality in conditional interpretations. Thus, the present research question (§1.1) is not about the *legitimacy* of T-values and P-values: it is about their *primacy* (e.g., see (2) in §1.3) and how embodied agents *assert* them in 'real-world' contexts.

2.2.1 Monotonic semantics

2.2.1.1 Overview

Monotonicity (non-defeasibility, non-revisability) is the logical principle that *P* and *Q* are each either True or False; adding further premises to *P* does not cancel the $P \rightarrow Q$ entailment. On monotonicity, the T-value of a proposition does not change across time indexes (over time). The 'real-world' oddness of this notion is evident even in rudimentary examples such as (5):

(5) [*If there is a car in the garage*]$_P$, [*she is home*]$_Q$.

Imagine this sentence being uttered by an older sister to her toddler brother, where '*she*' denotes the children's mother. The older sister *asserts* the generalization in (5) as true, regardless of time index. Now enter the possibility that (5) is true for all times past, but at *t*0 (present), the mother is at a neighbor's home. (5) is thus false at *t*0.

As other non-monotonic studies (§2.2.2) similarly show (e.g., Minsky 1974), monotonicity does not account well for much of human reasoning or delineate the conditional semantics of most language data, yet considerable support persists for monotonicity (e.g., Lycan 2001; Shilon, Habash, Lavie, & Wintner 2012). Worse, some well-meaning descriptive linguists inadvertently assume its validity, as their use of truth tables suggests (e.g., see Malatesta 2002 on Swahili; Jordanoska 2017; cf. Mayes 1994). Doing so obscures the semantic and pragmatic complexities of *realis* and *irrealis* conditional constructions. As seen in §1.3, monotonic conditional analyses focus on positing T-values for condition-expressing sentences like (5) above and not on P-values (e.g., Frege 1967 [1879]; Tarski 1936; Lycan 2001: 73–92; Egré, Rossi, &

Sprenger 2019; see also Douven 2015 and Bennett 2003 as theoretical surveys). Furthermore, self-consistent (some are not, e.g., Lycan 2001) monotonists also ignore contextual constraints. This *modus operandi* flows from claiming that logical properties (e.g., necessary, sufficient, and contributing conditions) primarily obtain on the level of propositional logic. In lieu of further generalizations of monotonicity, §2.2.1.2 critically reviews Lycan (2001) as an exemplar.

2.2.1.2 A critical review of Lycan (2001)

The following brief critical review of Lycan's (2001) version of monotonicity serves as a point of departure for my typologically motivated (§1.2) arguments in §4 for the descriptive and explanatory relevance of conditional pragmatics, P-values, and context-sensitivity. A typologically motivated approach entails that theories of conditional interpretations, the specific research discipline notwithstanding, should be subject to typological confirmation. While space regrettably prohibits a detailed exploration of Lycan's (2001) arguments for monotonicity (T-values) over against non-monotonicity (P-values) and context-sensitivity, consider the following as a summary of his primary argument that linguistic truth-preservation (*de dicto*, 'truth as said', e.g., §1.3, (1)-(4)) is required for metaphysical truth-preservation (*de re*, 'truth in reality').

Against what he characterizes as 'No Truth-Value' theory (NTV), namely, the purported view of Stalnaker (1968, 1984), Appiah (2011) [1985], Edgington (1986), and Bennett (1988), *inter alia*, that truth-values cannot be attributed to indicative conditionals, Lycan (2001) argues that indicative conditional sentences are *either* True or False in reality itself, not merely expressions of a communicator's defeasible (revisable by degree or cancellable across time indexes) confidence about what obtains in reality. For Lycan, indicative conditionals (in this study, *realis* constructions) are not merely *assertoric* (see §1.3, (P3)) expressions of perspectival, subjective viewpoints: they objectively and consistently represent real states-of-affairs (SoAs) as

either True or False. He worries that, if we accept subjective probability as a philosophical construct, we are then bound to accept the view of truth-deflationists (e.g., Horwich 1990) that speaking of truth-value is a useless construct for analyzing linguistic expressions. In short, Lycan is concerned with metaphysical truth-preservation (*de re*) in analysis, rather than allowing that some languages have grammatical constituents that exclusively express probability (*de dicto*).

Certainly, Lycan is correct in aiming to reserve a place for metaphysical truth; if no state-of-affairs ever obtained, then embodied human existence would not be possible. Furthermore, if linguistic expressions about truth *never* paralleled reality, embodied agents could not function within it. However, we are often wrong in declaring propositions to be the case. *De re* truth is foundational for *de dicto* truth, not the inverse, as Lycan seems to imply, despite his rejection of what he views as strictly assorteric theories of conditional semantics (e.g., Appiah (2011) [1985]). Accordingly, the way forward in the linguistic analysis of conditional interpretations is not found by ignoring the reality of the 'tacit', revisable knowledge (see Polanyi 1966) of embodied agents as expressed in both indicative (*realis*, realizable) and subjective (*irrealis*, unlikely, counterfactual) meanings that vary by degree on a scale. *Metaphysical truth-preservation* (e.g., in 'possible worlds' analyses) of either-or (True, False) truth-values does not entail or account for agentive, *linguistic truth-attribution* (e.g., in mental spaces analyses) of propositional content to reality.

My concern is that Lycan's arguments for the non-defeasibility of truth-values and marginal influences of context for the sake of *metaphysical* truth preservation do not consider how many languages such as Swahili have specific *realis* and *irrealis* markers that are scalar in pragmatic application (i.e., in use). Even within the bounds of conditional analyses of English, Stalnaker (1968, 1984), Appiah (2011) [1985], Edgington (1986), and Bennett (1988) present

evidence for the influences of P-values and context-sensitivity on conditional interpretations, yet Lycan dismisses their arguments while granting limited exceptions (e.g., see Lycan 2001: 74 and §1.3). However, Stalnaker (1968) insists that context, probability, and pragmatics impinge on conditional semantics, not that truth-values are irrelevant. Granted, Appiah (1985: 218–219) *does* claim that indicative (*realis*) conditionals have no truth-values. By claiming this, Appiah argues for a division of semantic labor between truth-preservation and probability-preservation in discourse, not truth-value irrelevance. Edgington (1986), and Bennett (1988) argue similarly.

The finer details of these disagreements notwithstanding, another reason for questioning the validity of Lycan's (2001: 74–75) arguments above is typological considerations. In addition to his apparent conflation of *de dicto* and *de re* truth, Lycan bases his arguments concerning truth-value primacy on the syntactic distributions and semantic particularities of 'if' and 'when' in English without considering counterexamples from other languages. He does acknowledge, however, that languages exist in which a lexeme can mean 'if' or 'when' depending on context and pragmatic resolution (Lycan 2001: 75 cites Traugott's 1985 Hittite [hit],[11] Swahili [swa] and Tagalog [tgl] examples and Comrie's 1986 Mandarin [zho] examples). Nonetheless, it is not clear how admitting this supports or is related to his arguments for metaphysical truth-preservation. It is plausible that he was not aware of how widespread this isomorphic (i.e., same form, different meaning) pattern is, say, in Bantu languages (e.g., Nicolle 2017). On the other hand, Bantu languages (e.g., Swahili), and for that matter, numerous other languages (see Thompson, Longacre, & Hwang 2007: 257, François 2010, Pilot-Raichoor 2010) often have no lexical equivalent of 'if'.

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[11] ISO-639-2(T) assigns three-letter identifiers to ancient languages (Grimes 2000) (see also Footnote 3 in §1.1).

To his credit, Lycan (2011) thoroughly revises (i.e., disavows) his earlier views by supporting the interplay of truth-conditions and pragmatic factors in contexts. His reasons for doing so concern assertability conditions and speech acts—matters outside the scope of this study. Unfortunately, Lycan's (2011) nuanced arguments against Lycan (2001) are still based on English and thus are not typologically cognizant. Admittedly, I also argue from single-language data, but also offer theoretical conclusions as being subject to typological confirmation. Lycan (2001) is a *tour de force* presentation of monotonist arguments; few others compare in terms of lucidity and rigor. If this is the case, yet his arguments for monotonicity are not typologically cognizant, then looking elsewhere for a heuristic for conditional interpretations that is typologically valid and context-sensitive is justifiable.

2.2.1.3 Recent monotonic logics

Monotonicity is a core construct in some descriptive studies, many logic applications (e.g., machine translation), and for all consistent neo-logicists and neo-Fregeans. Some recent monotonic logics, especially those of neo-logicists and neo-Fregeans, go as far as reducing conditional semantics to mathematics (e.g., Tennant 2018; Sher 2018; May 2018). Such reductionisms are understandably difficult to justify in the face of sustained criticisms. At least since Minsky's (1974) devastating critique of the inability of monotonicity to describe and explain 'common-sense thought' in ordinary expressions, unqualified support for monotonicity continues to ebb as non-monotonic models continue to emerge in cognitive linguistics, the philosophy of logic, and Artificial Intelligence (AI) (e.g., machine translation, see Karlsson et al. 2011). For instance, philosophers of logic such as Stalnaker (2016) argue that assessing context is necessary to ascertain conditional meanings (see also Nieuwland & Martin 2012 as a supporting neurolinguistic study). However, many (but not all, e.g., Hurskainen 2014) machine

translation practitioners, like descriptive linguists who use truth-tables, relentlessly "translate" on, assuming T-value primacy, T-value determinacy, and context-insensitivity (e.g., Shilon et al. 2012). Context-sensitivity is not *intuitively* lost on descriptive linguists: it is if they invoke truth-tables to the exclusion of pragmatics and embodied contextual factors from analysis.

2.2.2 Non-monotonic semantics and pragmatics

Non-monotonic approaches surpass the descriptive and explanatory inflexibility of monotonicity by reformulating T-values as scalar probabilities (P-values) (e.g., Kern-Isberner, 2001; Leitgeb 2001, 2003, 2004, 2007). Bayesian (non-monotonic statistics) update logics also incorporate belief revision (P-values changing over time), robust experimental designs, and advanced statistical methods (e.g., Van Benthem 2003; Baltag, Christoff, Hansen, & Smets 2013; cf. Spohn 2015). As such, Bayesian methods are particularly useful for analyzing conditional constructions in corpora (e.g., Skovgaard-Olsen, Kellen, Hahn, & Klauer 2019). Given these methodological enhancements, devaluing non-monotonic logics, especially those of the Bayesian sort, is not the purpose of this study; both commendations and critical reflections are in order.

On the one hand, Bayesian models can effectively map probability distributions across contexts, individual agents, and collective agents (e.g., a committee). For instance, different agents express varying degrees of confidence in a belief through a conditional construction in a particular context. Non-monotonists also allow for dynamicity, such as agentive belief revision across time indexes. On the other hand, to the degree they ignore the semantic-pragmatic complexities of conditional modality and context-sensitivity, they fare little better than monotonists, despite their insistence to the contrary (e.g., Cruz, Baratgin, Oaksford, & Over 2015; see also Aung, Aung, & Hlaing 2018 on Myanmar [mya], or Burmese). All non-monotonicity *qua* non-monotonicity adds to conditional semantics is P-value scalarity—nothing

more. It is a valuable addition, nonetheless. Non-monotonic models may allow for contextual and pragmatic factors, but such are not the purview of non-monotonicity. It is only a claim that P-values are defeasible, revisable, cancelable, and dynamic (i.e., changing across time indexes).

2.2.3 Context-sensitivity in truth-conditional semantics and pragmatics

Montague (1974) as a monotonist—in countering the deficiencies of sentential semantics—no less than set the keystone for analyzing context-sensitivity. He did so by examining cross-sentential anaphora, viz., pronouns and demonstratives 'pointing to' referents in previous discourse. He also attempted to allow for discursive pragmatics (see Sbisà, Östman & Verschueren 2011: 19). Developments in monotonic and non-monotonic approaches toward discourse context-sensitivity include Discourse Representation Theory (DRT) (e.g., e.g., Kamp & Reyle 1993; Kamp, Van Genabith, & Reyle 1993, 2011) and its variants, viz., Underspecified Segmented Discourse Representation Theory (USDRT) (Schilder 1998), Segmented Discourse Representation Theory (SDRT) (Lascarides & Asher 2008), and Default Semantics (Jaszczolt 1999, 2003, 2005a, 2005b; see Elder & Jaszczolt 2016). Unfortunately, the recent emergence of Probabilistic Context-Free Grammars (PCFGs) (e.g., Jin, Doshi-Velez, Miller, Schuler, & Schwartz 2018) in computational linguistics suggests that an interdisciplinary consensus on the relevance of context is not forthcoming (see Young, Poria, & Cambria 2018).

In short, mainstream focus on monotonic T-values or non-monotonic P-values to the exclusion of conditional pragmatics and context-sensitivity has regrettably resulted in a 'hermeneutical myopia' (a term borrowed from Villa 1995: 4, *inter alia*) in linguistics and the philosophy of language. An optimistic outlook for non-monotonic models is yet warranted, as far as they model probability distributions, dynamicity, pragmatics, and context. The findings of non-monotonic studies consistently parallel those in descriptive and conversational studies that

show how probability, possibility, and contingency are scalar properties (e.g., Mwamzandi 2017; Greenberg 1986; Akatsuka 1985; Heritage 2013). By extension, this conclusion entails that *realis* and *irrealis* constructions have scalar interpretations (see Greenberg 1986; Mwamzandi 2017).

2.3 Embodied Cognition as the theoretical framework

The descriptive and explanatory shortfalls of monotonic and current non-monotonic models require an alternative heuristic to show how modal stances and context-sensitivity influence conditional T-values and P-values. As such, the EMBODIMENT HYPOTHESIS (EH) (§2.3.1 below) as a theoretical point of departure is a viable but hardly intuitive or self-explanatory candidate. Consider, for example, Rohrer's (2007a) survey of the various senses of 'embodiment' (Table 1):

Table 1 Dimensions of 'embodiment' (adapted from Rohrer 2007a: 348–359)

Dimension	Sense	Definition
1	Philosophy	Non-Cartesian perspectives on mind, cognition, and language
2	Sociocultural situation	Bodily situatedness of self in sociocultural practices as shaping factors
3	Phenomenology	Awareness of bodily experience as shaping force upon self and society
4	Perspective	The physically external (e.g., topographic position) and internal (e.g., neurophysiological) constraints of bodily experience
5	Development	Biological transformation of body in stages
6	Evolution	Biological, genetic transformation of a species in history
7	The cognitive unconscious	Mental processes that occur too quickly for human self-awareness to detect them
8	Neurophysiology	Neurological components (e.g., a brain region) and processes that are necessary for environmental perception and action in frames of reference
9	Neurocomputational modeling	Brain process modeling in software applications (e.g., MatLab, see Sherfey, Soplata, Ardid, Roberts, Stanley et al. 2018)
10	Morphology	Implementing neurocomputational modeling in 'real-world' interactions requires a physical component (e.g., robot)

Dimension	Sense	Definition
11	Directionality of embodied metaphor	One-way semantic flow in multi-tiered 'conceptual' metaphors from bodily experienced,[12] 'source' layers (e.g., ANGER IS HEAT) to abstract 'target' layers in expressions, e.g., *He burned with anger*.
12	Grounding	Bodily experience is the basis from which abstract symbols arise.

As can be seen by comparing Table 1 to preceding sections, the difficulty with grounding an alternative heuristic in Embodied Cognition *contra* reductionist 'T-value-only' analyses is this: they subsist on separate levels of description (i.e., propositional and cognitive, respectively). This dissimilarity precludes directly substituting the latter for the former. In any case, the motivation of this study is to empirically ground and theoretically contextualize T-values and P-values, not to replace them; hence, a further narrowing of theoretical formulations to generate testable hypotheses is necessary. As such, Dimensions 1, 5–7, and 8–11 are beyond the scope of this study, although I adopt them as underlying presuppositions. My doing so for Dimension 8 is based on findings in neuroimaging studies (§1.3). I focus on Dimensions 2–4 and 12 in the §4 data analysis while not referring to them as such.

2.3.1 Empirical foundations

The Embodiment Hypothesis (EH) is the empirically based argument that pan-modal (involving all bodily senses) *sensorimotor experience*, the sum of all (a) sensory inputs (e.g., seeing, touching) with (b) positions (e.g., stance 'toward') and movements *in* and *of* the body *and* mind makes possible, shapes, and constrains all human perception and action in space, time, and environmental contexts (e.g., availability of information and resources) (Rohrer 2007a, b; Varela,

[12] For instance, consider human skin temperature slightly rising in a moment of anger because of sympathetic nervous system activation.

Thompson, & Rosch 2017 [1991]: 147–183; Fowler 2010; Van Dam, Rueschemeyer, Lindemann, and Bekkering 2010; cf. Mahon & Caramazza 2008). In practice, this sweeping claim entails that language learning, production, and comprehension involve cognitive maps of embodied experiences as (a) perceived objects and events and (b) performable actions (e.g., as embodied agents express conditional constructions; see Kuperberg 2007; Pickering & Garrod 2013; Vernon, Lowe, Thill, & Ziemk 2015; cf. Dove 2013: 353–354).

Surprisingly, some language processing models diminish or deny the role of embodiment in language perception and action (e.g., Fodor 2000: 68–69; cf. Weiskopf 2002). For Fodor (2000: 77–78), "language perception *is* perception." This quasi-tautology is a conjunct of his oft-repeated claims that brain and mind have extraordinarily little (if anything) to do with each other when it comes to language processes. Countless thousands of neuroimaging studies suggest otherwise (e.g., in a Web of Science, Semantic Scholar, or PubMed database search). Given these empirical findings, it is highly improbable that findings in neuroscience are irrelevant for describing and explaining the communications of perceiving and acting agents as Fodor claims. Fodor and other Cognitivists (language as mental symbolic manipulation) offer no empirical counterevidence to undermine the findings in neurolinguistics and cognitive neuroscience.

The upshot of these empirical findings is that no conditional construction exists without an embodied agent expressing it. Furthermore, the constraints of embodiment (e.g., not being omniscient or omnipresent) preclude having non-defeasible knowledge about most propositional claims. Thus, propositions are *assertible* as true or false from either minimally innate knowledge (however defined, e.g., moral constraints) or knowledge acquired in collective or individual embodied experiences (see Polanyi 1966 on 'tacit knowledge'; see also Polanyi 1968, 1969,

2015 [1958]; Polanyi & Prosch 1975). Again, this claim pertains to *linguistic* truth (as perceived and expressed), not to *metaphysical* truth (as things are) in the 'outside world'(§1.3, (P3)).

2.3.2 Theoretical foundations

The Embodiment Hypothesis (EH) is the central tenet of Embodied Cognition (EC), which serves as the theoretical framework for the present study. An emphasis on the 'lived body' (see Merleau-Ponty 2010 [1962]; Polanyi & Prosch 1975) pervades and informs EC (see Wilson 2002: 625–636; Shapiro 2012: 118–146), including in the EH. EC is a diverse and sometimes contradictory set of research programs in the cognitive sciences. Proponents do agree, however, that direct correlations exist between mental activity and neurophysiological activity (Clark 1996, 2017 [1998]; Anderson 2003; Johnson & Rohrer 2008). Other representative EC publications include Feldman (2010, 2013), Cassell, Stone, & Yan (2000); Fox (2002); Fowler (2010); cf. Arbib, Gasser, & Barrès (2014: 57–70).

EC describes *neurophysiological* states (e.g., neurons resting or firing) and processes (e.g., one brain area activating another) as necessary conditions for mental states (e.g., attentiveness) and processes (e.g., perceiving, acting) (Gallagher 1986: 139–142). Put differently, having no brain processes means having no correlating mental processes. A detractor might object as follows: if brain states and processes *are* necessary conditions for language learning, production, and comprehension in the same way, say, electrons, blood cells, and mitochondria are, what difference do they make for conditional interpretations? Is this not 'proving too much' by touting trivial and uncontroversial claims?

EC linguists do not equate physical and non-physical processes and thus avoid explaining away non-trivial correlations between them (Varela et al. 2017 [1991], 13; cf. Bickle 2006a, 2006b, 2007). Such correlations are (relatively) uncontroversial. Unfortunately, (a) the

typological complexities of conditional semantics and pragmatics (Funk 1985: 365) and (b) current technological limitations on research methods prevent consensus on these correlations (Stabler 2013: 317). For instance, mismatches of hemodynamic response (HR) (brain blood flow) rates and data recording rates in *f*MRI tend to generate misleading findings (Eklund, Nichols, & Knutsson 2016; Mueller, Lepsien, Möller, & Lohmann 2017).

While acknowledging that no one knows precisely and comprehensively how brain and mind correlate in language processing, the fact that *all* human experience occurs within a 'real world' perception-action cycle should lead to denying the possibility of isolating semantics from pragmatics in a disembodied, context-free sense (see Jacob 2012 and Vakarelov 2014 on EC enactivism and pragmatics; cf. Matthen 2014). The upshot of embracing conditional pragmatics is the ability to see language as an embodied phenomenon enacted by contextually situated agents *using* conditional constructions, even if the sole purpose is to inform addressees (§5.2).

2.3.3 Approaches to data analysis

In the beginning, EC studies were qualitative and theoretical, but they now are becoming quantitative and experimental (Lakoff 2012; Horchak, Giger, Cabral, & Pochwatko 2014; Janda 2013, 2015). EC is, however, no empirical panacea. EC analyses often lack standardized heuristics for generating quantitatively testable and qualitatively plausible hypotheses (Willems & Francken 2012). As a result, their claims concerning linguistic functions are plausible yet empirically unverified in some cases (Mahon & Glenberg 2015; Caiani 2011). On the EC view, reductionistic truth-conditional models are promoted with insular, 'just-so' stories without empirical evidence. Unfortunately, this characterization often befits EC studies as well.

No inherent conflict persists between EC and truth-conditionality *per se*. Conflict arises when a conception of truth-conditionality leads to ignoring the embodied realities of pragmatic

and contextual factors. Few researchers in truth-conditional debates consistently offer testable, reproducible evidence for detractors to assess. Logicians and philosophers of language often reject the primacy of empirical data (e.g., Fodor 2000) and offer "well-formed" logical structures of conditional semantics. EC theorists base claims on empirical data from cognitive neuroscience without operationalizing universal heuristics (e.g., UML mental spaces) to show the practical implications of EC for conditional analyses. This clashing of incommensurable presuppositions and research goals tends to overshadow substantive evidence and supporting argumentation.

In §4, I show by operationalizing UML mental spaces as embodied FoRs that the descriptive and explanatory potential of EC allows for forming testable hypotheses and predictions about conditional pragmatics and context-sensitivity. The first testable prediction of this EC study is that arguing for the effects of modal stances on T-values and P-values will produce coherent descriptions and explanations. Second, examining Agent and Undergoer experiences in situational-discursive contexts will do so as well. Finally, necessary, sufficient, and contributing conditions obtain on the level of embodied FoR networks, *contra* the mainstream notion that they obtain primarily on the level of propositional logic (§1.3, (1)).

2.3.4 Reconceptualizing modal stance in Embodied Cognition

The generating of further testable hypotheses within EC demands a reconceptualizing of modal stance types to account for how each one contextually delimits conditional interpretations. As such, consider the following baseline reconceptualization of modal (i.e., epistemic, deontic, dynamic) stance in EC. First, in descriptive, functional, and cognitive linguistics, epistemic stance concerns probability, possibility, and agentive belief (e.g., Fillmore 1990; Dancygier & Sweetser 2005; Dancygier & Trnavac 2007). An Embodied Cognition construal of epistemic stance is as an embodied agent's metaphorical, value-asserting 'position' facing 'toward' WHAT

truly, probably, or possibly *is* or *is not* the 'state-of-being' in a Frame of Reference. In Table 2 below, an Undergoer belief has a positive, neutral, or negative epistemic status as 'believed', 'disbelieved', or 'neither believed nor disbelieved', respectively (center column):

Table 2 A reconceptualization of epistemic stance in Embodied Cognition

Epistemic stance (Agent)	Epistemic status (Belief as Undergoer)	Range of agentive confidence
Positive (+)	Positive (+): 'believed'	Between P = 0.6 and P =1.0
Neutral (=)	Neutral (=): *neither* 'believed' *nor* 'disbelieved'	P = 0.5 (uncertain/indeterminate)
Negative (−)	Negative (−): 'disbelieved'	Between P = 0.4 and P = 0.0

Positive and negative values have corresponding ranges of agentive confidence, and a neutral value is 0.5 (Table 2, right column). An epistemic status value matches the Agent's stance value.

Alongside epistemic stance, several recent studies in Critical Discourse Analysis (CDA), conversation analysis, and anthropological linguistics show how deontic stance impinges on constructional semantics (e.g., Heritage 2013: 570; Stevanovic 2018; Stevanovic & Svennevig 2015; Xu 2015; Landmark, Dalby, Gulbrandsen, & Svennevig 2015; Shoaps 2017). Thus, it seems reasonable to give deontic stance its long-awaited place alongside epistemic stance. An advantage of doing so is the added ability to distinguish between (a) an Agent's assertions about what *is* the case in a FoR (epistemic stance) from (b) an Agent's assertions about what *ought* to be the case (state-of-being) or be done (action) in an FoR (permission, obligation, desire) (see Teller 2004, Du Bois 2007, and Gray & Biber 2012 on stance-conceptualizing debates). Accordingly, a reconceptualization of deontic stance in Embodied Cognition is as an embodied Agent's metaphorical, value-asserting 'position' facing 'toward' three possible Undergoer scenarios in which animate and inanimate Undergoers can be *permitted*, *obligated*, or *desired* or not to BE in a state-of-being or DO an action. This broad definition even allows for literary expressions in which inanimate objects are prohibited from doing an action. In the center column of Table 3 below, the deontic status values vary against the *stance* values in the left column:

Table 3 A reconceptualization of deontic stance in Embodied Cognition

Deontic stance (Agent)	Deontic status (Undergoer)	Stance-status value contrast examples
Positive (+)	Positive (+), Neutral (=), Negative (−)	+A (desire) >> −U (not be obligated) to DO some action
Neutral (=)	Positive (+), Neutral (=), Negative (−)	=A (indifferent) >> +U (being permitted) to DO some action
Negative (−)	Positive (+), Neutral (=), Negative (−)	−A (desire) >> +U (be obligated) to BE in a 'state-of-being'

Such contrasts arise when a stance involves one category such as *desire*, and its correlating status involves another category such as *obligation* (e.g., right column, first row).

As for dynamic stance, only Maciuchová (2016) mentions it, and, to my knowledge, no peer-reviewed publications suggest it as a functional category. Since each modality type plausibly has a pragmatic dimension, this study attempts to show how it is a valuable construct for interpreting conditional constructions. It also will undoubtedly show the limitations of doing so without the benefit of corroborating publications. A preliminary conceptualization of dynamic stance in Embodied Cognition is as an embodied Agent's metaphorical, value-asserting 'position' facing 'toward' (a) a state-of-being in which the Undergoer 'is' or 'is not' *able* or *willing* to BE and/or (b) an action the Undergoer 'is' or 'is not' *able* or *willing* to DO. Conversely, dynamic status is the agentively asserted value of the Undergoer (Table 4):

Table 4 A conceptualization of dynamic stance in Embodied Cognition

Dynamic stance (Agent)	Dynamic status (Undergoer)	Stance-status value contrast examples
Positive (+)	Positive (+), Neutral (=), Negative (–)	+A (willing) >> –U (to not be able) to DO some action (e.g., to encounter an enemy)
Neutral (=)	Positive (+), Neutral (=), Negative (–)	=A (indifferent) >> +U(A) (to be able) to BE in a 'state-of-being' (e.g., debt-free)
Negative (–)	Positive (+), Neutral (=), Negative (–)	–A (unwilling) >> +U(A) (to be able) to DO an action (e.g., mountain-climbing)

In Table 4, stance and status values contrast when one involves a category such as *volition*, and the other involves another category such as *ability*, as in the right column on the first row. In self-attribution, an Agent is also the Undergoer.

2.4 Modeling deictic properties in mental spaces as embodied FoRs

This EC and Mental Space Theory (MST) study models deictic properties (e.g., epistemic, deontic, and dynamic stances as modal deixis) of Swahili conditional constructions with UML mental spaces as embodied FoRs. The following is my taxonomy of the deictic properties (see also Laczkó 2010; Giaxoglou 2015; Fillmore 1975) encoded by grammatical and lexical constituents that build these embodied FoRs: (a) referential (nouns), (b) discourse (e.g., subject and object markers), (c) person (i.e., pronouns, including number), (d) temporal (tense as event-external time and aspect as event-internal time), (e) topographic (i.e., physical space, see Aikhenvald 2015), (f) modal (modality), and (g) social (Levinson 1979; Manning 2001).

Fauconnier (2010 [1994]) initially used mental spaces to model the logical structure of propositions, although he emphasizes that a mental space is not a visual representation of a 'possible world' (e.g., Stalnaker 1968). Instead, it is a partial, dynamic representation of an agent's assertions *about* the external world (Sweetser & Fauconnier 1996: 11; Lakoff & Sweetser (2010 [1994]). Mental Space Theory (MST) studies of conditional constructions include Dinsmore (1987: 1–21; 1991); Sweetser (1996; 1999); Dancygier & Sweetser (1996; 1997; 2005); Takubo & Kinsui (1997); Tabakowska (1997); Mok, Bryant, & Feldman (2004); Sanders, Sanders, & Sweetser (2009); Dancygier & Vandelanotte (2010); Bivin (2018); Sanders & Van Krieken (2019), *inter alia*. This list spanning several decades shows that cognitive linguists often find MST to be useful for analyzing conditional constructions.

The research goal of MST set forth in Fauconnier (2010 [1994]) and Fauconnier & Turner (2002: 40, 102) is 'neurobiological plausibility' (Coulson 2011: 414). For Fauconnier (2007: 351), mental spaces represent "sets of activated neuronal assemblies," and the "connections between elements correspond to coactivation-bindings" (see also Fauconnier 2010 [1994]; Fauconnier & Turner 2002: 40, 102; see Kowalewski 2017 as a supporting neurolinguistic study). Feldman (2006: 224) and Kowalewski (2017: 168) as EC and MST proponents nevertheless caution that, although studies show correlations between hippocampus (a brain region) activity, spatiotemporal processing, and semantic memory (e.g., Burgess, Maguire, & O'Keefe 2002; Fernandino, Binder, Desai, Pendl, Humphries, Gross, Conant, & Seidenberg 2016, Kepinska, de Rover; Caspers, & Schiller 2018: 8), the brain mechanisms and processes for mental spaces are still unknown.

Recent neuroimaging studies also suggest surprising correlations between sensorimotor processing and the processing of conditional semantics in the brain (e.g., Li et al. 2014) which involve all bodily senses (or, are 'pan-modal,' see Jackson, Ralph, & Pobric 2015). Even so, the precise correlations between mental spaces and brain activity are the source of many open, and in some cases, open-ended questions. Determining the extent to which spatiotemporal (deictic) memory constrains and shapes conditional semantics will require aggregating data and findings across multiple studies (e.g., *f*MRI[13] meta-analyses, e.g., Binder, Desai, Graves, & Conant 2009) on semantic memory and spatiotemporal processing. In agreement with Feldman's (2006) and Kowalewski's (2017) assessments, at this point in the history of cognitive neuroscience, claiming

[13] Functional Magnetic Resonance Imaging (*f*MRI) yields real-time, dynamic scans, as opposed to the static, single images of MRI scans.

as Fauconnier (2007) does that mental spaces correlate with specific neurophysiological mechanisms and processes is premature at best.

As seen already with Feldman (2006) and Kowalewski (2017), the strongest criticisms of MST are often from MST theorists themselves. For example, Brandt (2005: 1579) concludes that one fault of MST theory is the focus on the T-values of propositions and sentences to the detriment of descriptive adequacy. Indeed, using MST to explore conditional T-values alone would be short-sighted. Furthermore, as Brandt (2005: 1582) points out, MST analyses are by default context-insensitive because they usually focus exclusively on the sentence level. These empirical shortfalls are not due to any inherent methodological limitations of MST and need not be the case. However, they impede the process of making MST fully compliant with EC tenets (§2.3.2; Wilson 2002). As expected, researchers not using MST often disregard or ignore it, presumably because of MST theorists overstating its descriptive and explanatory efficacy.

Despite these shortcomings of MST, few other research programs unite (a) descriptive-functional findings on semantic and pragmatic functions in discursive-situational contexts (see Chelliah & de Reuse 2010: 15, 325), and (b) explanatory findings in neurolinguistics and cognitive neuroscience on language perception, comprehension, and production (see Lakoff 2012). These findings suggest that symbolic logics, whether they be monotonic or non-monotonic, are inadequate for doing so (§1.3). Mental spaces as embodied FoRs—whatever their correlating neurophysiological mechanisms and processes happen to be—model how semantic and pragmatic functions, specifically in the form of embodied deictic properties mapping physical and metaphorical positions and distance, along with context-sensitivity, contribute to conditional interpretations.

2.5 Conclusion

In this chapter, I first outlined descriptive and explanatory inadequacies of monotonic and non-monotonic models for analyzing modal stances context-sensitivity in conditional constructions. I then introduced and critically evaluated Embodied Cognition (EC) as the theoretical framework and Mental Spaces Theory (MST) as the method of analysis. Despite their methodological shortfalls, EC and MST nonetheless merge to create a viable framework in which Embodied FoR networks shown as mental spaces better model (a)–(c) than T-values and P-values alone in monotonic and non-monotonic analyses, respectively. Therefore, the embodied FoR is a preferable heuristic for conditional interpretations. Next, §3 describes the methodology, methods of using UML mental space ontologies, the data selection criteria, and data sources.

3. Methodology, methods, and data

3.1 Introduction

As I discussed in §1.5, this study is an abductive-inductive methodological approach to data, which in practice entails cycling between data description and theoretical explanation. It also unites (a) descriptive-functional findings of how embodied agents use language in discursive-situational contexts and (b) explanatory findings in neurolinguistics and cognitive neuroscience on language perception, comprehension, and production (§2.3). This chapter outlines the methodological design principles (§3.2), delineates the methods of using UML mental spaces (§3.3), and describes the data selection criteria and sources (§3.4).

3.2 Methodological design principles

Three methodological design principles guide this study. First, carefully selecting, modifying, or designing a diagrammatic ONTOLOGY is crucial in developing 'object-oriented' (OO) models such as mental spaces. In information science (e.g., computer science, cognitive linguistics, systems biology) an object-oriented ontology is a formal, semiotic system (concerning representations of reality) of (a) objects (e.g., boxes in diagrams as mental spaces or diamonds to represent agent decisions, see §3.3.1.4, Table 5), (b) features that represent 'real-world' properties, (b) interrelations (e.g., 'is a,' 'is a necessary part of') between the objects, (c) a set of specifications, and a (d) system-specific terminology (see Fonseca 2007, Man 2013).

The more common usage of the term 'ontology' in philosophy refers to theories about what exists (i.e., being *qua* being) in reality or 'possible worlds.' This study employs a narrower sense of 'ontology' as what exists (e.g., deictic properties) as components of human cognition. Crucially, mental spaces are objects in diagrams of cognitive processing (thought processes) of speakers and writers and not only the constructional constituents that evoke the cognitive

processing. By extension, mental spaces of relevant and possible implied FoRs (implicatures) appear along with mental spaces representing grammatically expressed FoRs (explicatures). It is not, however, necessary or even possible to map all 'possible worlds' (i.e., scenarios).

Mental spaces are diagrammatic ontologies that often appear in cognitive linguistics, albeit in a mosaic of stylistic presentations. For instance, Dancygier & Sweetser (2005) integrate metalanguage into mental spaces, while Bierwiaczonek (2013) integrates paraphrases. Moreover, mental space ontologies—unlike ontologies that model language as 'object' (e.g., those used in machine translation) only—model language as both static 'object' (properties and relations) and dynamic 'event' (communicative act) (see Walrod 2006 on 'language as event'). However, given the nature of complex, adaptive systems (e.g., a language), no diagrammatic ontology captures every nuance of the communicative act. As Fauconnier (2007: 351) similarly insists, mental spaces non-exhaustively and dynamically represent thinking and communicating.

On the one hand, any diagrammatic ontology (e.g., UML mental spaces) should be conceptually and structurally as minimal as possible to avoid over-generating predictions and thus "proving" what the data cannot substantiate. On the other hand, a mental space ontology must accommodate the vast array of semantic, pragmatic, or morphosyntactic properties expressing conditionality, such as sequential markers (Allison 2017: 34–35) or combinations of grammatical constituents jointly marking conditionality. For example, Ute [ute] speakers combine an *irrealis* suffix, an anterior aspect marker (i.e., denoting an out-of-sequence, previously-unmentioned event) and a subject nominalizer to form a hypothetical counterfactual—a construction denoting an event that did not occur, but could, should, or would have happened (Givón 2011: 141–142). Such grammatical collocations require a further design principle to account for them.

As such, the second methodological design principle is incorporating into the analysis the claims of Construction Grammar (CG) regarding the semantics-morphosyntax interface (Goldberg 1995, 2013; Bergen & Chang 2005; Bergen, Chang, & Narayan 2004; Verhagen 2007; see Gries 2013 on data in CG). In CG, all grammatical units from morphemes up to sentences are *syntax* : *semantics* :: *form* : *content* pairings which jointly form a construction. Crucially, the meaning of the construction is not always the sum of the meaning of its parts (weak compositionality, §1.5). Moreover, constructions as form-meaning pairings aggregate into complex, adaptive discursive systems of constituents (see Croft 2010: 463; Beckner et al. 2009).

In comparison to syntax-primary generative theories supporting strong compositionality (§1.5), CG is a set of semantic-primary theories that better accounts for how morphemes map to semantic functions in polysynthetic languages (e.g., Rice 2017a; Baker 2018; Kpoglu 2019; cf. Genee 2018) and agglutinative languages (e.g., Gildea & Jansen 2018).[14] In such languages, semantic properties delineating conditional interpretations are often sub-lexically encoded (e.g., Swahili conditional prefixes, in contrast with the conditional conjunctions); CG allows for these morphosyntactic patterns. Crucially, in CG, a semantic function (e.g., probability) does not always correspond to a single grammatical constituent; instead, the function can *emerge* from constituent collocations (see Schmid 2007 on the significance of emergent meaning in CG for corpus studies). This claim also aligns with those in Emergent Grammar (e.g., Hopper 1988, 2011, 2014 [1998]; Rhee 2014; see Auer & Pfänder 2011: 8).

The third and final design principle is this: successfully analyzing conditional constructions within a complex, adaptive discursive network of form-meaning pairings *requires*

[14] Understandably, this generalization requires demonstration, yet space prohibits accommodation. See Boas & Ziem (2018) for a CG perspective and Müller (2018) for a critical review.

focused attention on the tangled interactions between semantics, pragmatics, and context, no matter how one limits the scope of analysis. Even though a study that *brackets* pragmatics can elucidate the semantic complexities of conditional constructions, the reality of human embodiment in situational-discursive contexts poses a challenge for any decontextualized approach that *excludes* pragmatics. As Saloné (1983a: 312) similarly argues, a 'pragmaticless' analysis of conditional constructions (e.g., Lycan 2001) is descriptively inadequate. In §4, I show how semantic and pragmatic functions consistently overlap, specifically at the loci of epistemic, deontic, and dynamic modality (Papafragou 2000; see also Depraetere & Salkie 2017 as a survey of perspectives). The next section introduces the UML mental spaces used in §4 that model these overlaps and the effects of context on conditional interpretations.

3.3 Methods

3.3.1 Designing a mental space ontology in Unified Modeling Language™

The mental space diagrammatic ontology in §4 diverges from Fauconnier's (2010 [1994]) ontology which consists of networks of circles, co-indexed dots, lines, letters, and descriptive text for modeling semantics, pragmatics, and contextual factors.[15] The circles in Fauconnier's (2010 [1994]) ontology each serve as mental spaces (e.g., place, event, state-of-being) in which dots with attached letters denote referents. When a referent appears in more than one mental space, its dots are connected by association lines. Regrettably, this minimalistic format is not optimal for analyzing the semantic, pragmatic, and contextual properties of morphemes. For instance, in the diagrams of Korean semantics in Kwon (2014) only contain English. How the

[15] My mental space ontology also incorporates these components. Due to space limitations, however, a detailed comparison of UML mental spaces and Fauconnier's mental spaces is not possible in this thesis.

diagram features relate to Korean morphemes is not made clear, an issue that consistently arises in Mental Space Theory publications on non-Indo-European languages.

Thus, while I adopt Fauconnier's methodological principles such as modeling the grammatical and cognitive components of a speaker or writer's assertions, my mental spaces conform (with a few minor exceptions) to the OMG Unified Modeling Language™ (UML) (Rumbaugh, Jacobson, & Booch 2004; Seidl & Brandsteidl, Huemer, & Kappel 2012; Lavagno & Martin, & Selic 2003; Duc 2007; Rumpe 2016), an interdisciplinary, broadly implemented diagram protocol consisting of 14 diagram types. UML diagrams frequently appear in software engineering, systems biology (e.g., Roux-Rouquié & Caritey, Gaubert, & Rosenthal-Sabroux 2004), and computational linguistics (e.g., Kurdi 2017; Schalley 2004) but infrequently in cognitive linguistics (e.g., Schalley 2011). Imaz & Benyon (1999; 2007) conceptualize but do not operationalize UML 'use case' diagrams as mental spaces but not UML 'state machine' diagrams (§.3.3.1.1 below). No publication to date conceptualizes or uses UML 'state machine' diagrams as mental spaces.

Comparable ontologies in cognitive linguistics to those in UML are used in Embodied Construction Grammar (e.g., Chang, De Beule, & Micelli 2012). Similarly, 'merger representations' in Default Semantics (e.g., Jaszczolt 1999, 2003, 2005a, 2005b; Elder & Jaszczolt 2016) are diagrammatic objects (e.g., text boxes) that incorporate pragmatics and context along with semantics. However, in contrast with these explanatorily proficient but non-universal ontologies, UML is an interdisciplinary universal diagrammatic interface that is useful for pursuing descriptive and explanatory adequacy of languages as complex, adaptive systems. Crucially, I intend UML mental spaces to be optimal for analyzing the semantic, pragmatic, and contextual properties of morphemes, words, constructions, and discourse.

3.3.1.1 UML 'state machine' diagram

The mental space networks in §4 are STATE MACHINE DIAGRAMS, one of the fourteen diagram types in UML. Despite its name being reminiscent of computational models of language cognition, the UML 'state machine' is appropriate for networking mental spaces as diagram objects modeling embodied FoRs since it (a) represents State of Affairs (SoA) in a complex, adaptive system of events and (b) only includes contextually relevant information. In this study, a FoR is conceptually equivalent to a SoA in other truth-conditional publications, excepting the added notion of embodied experience (see Tavangar & Amouzadeh 2006; Vaysi & Salehnejad 2016 on SoAs). A standard UML state machine object template appears in (Figure 1):

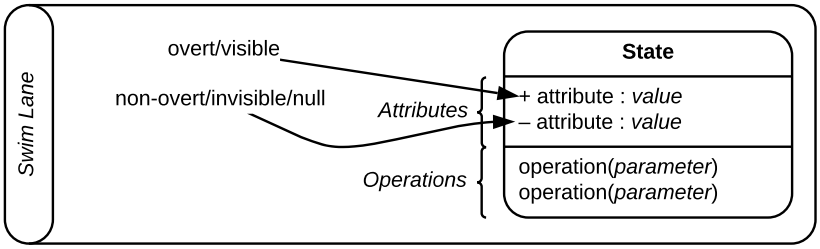

Figure 1. UML state machine template nested in a swim lane.

The mental spaces in §4 resemble the State diagram object in Figure 1 with two notable exceptions. First, although the overt/non-overt (+, –) attribute distinction often appears in linguistic analyses, this study does not assume the existence of null grammatical markers and thus excludes this optional feature. Second, the Operations box and its included parameters are designed explicitly for use in software engineering and are also absent from the mental spaces.

3.3.1.2 Specifications for UML mental spaces

Below are specifications (S-1–S-16) for UML mental spaces:

S-1. **UML mental spaces** each represent an embodied Frame of Reference (FoR).

S-2. **Bolded title-case headers** include a time index *and* referent names (not in alphabetical order) or co-indexes (e.g., *s* = speaker; *a* = addressee), but not 'not' for negation (S-11).

S-3. **Referent co-indexes** appear attached to referent names/titles in headers and in the *Attributes* box lines (see (7)).

S-4. **Referent co-indexes** appear *alphabetically* in the Referent(s) line (Attributes box) when they occur in the header or the lines below the Attributes Box; contextually required referents are also included.

S-5. **Referent co-indexes** indicate coreference as follows:
   a. Attribution: *a*(*b*) where *b* is an appellation to *a*, e.g., *a* (person) 'is a' *b* (leader).
   b. Collection: *a*(*b*) where *a* 'is a member of' set *b*, e.g., *a* = frog, *b* = amphibians.
   c. Identity: *a*(*b*) where *a* and *b* are singularly identical, e.g., same person.

S-6. **Co-index letters** are prioritized in descending order (a–d) for visual predictability:
   a. {*s* = speaker, *a* = addressee, *w* = writer, *r* = reader} (used as applicable)
   b. First letter of data language (i.e., Swahili) lexeme
   c. First letter of analysis language (i.e., English) lexeme
   d. Default order in linguistic publications (*i*, *j*, *k*, etc.) (e.g., indicating phrasal referents, e.g., [slave owner]$_i$). Note that (a)–(d) are general guidelines only.

S-7. **Time (*t*) indexes:** Present = (*t*0); Past = (*t*–1), (*t*–2), etc.; Future = (*t*1), (*t*2), etc. The (*t*n) index indicates an undefined moment or ongoing interval, depending on context.

S-8. **Row content types** appear sequentially as referent, discourse, person/number (P/N), temporal, topographic, modal, and social (top to bottom) in the *Attributes* box.

S-9. **Solid borders** indicate a FoR as *realis*.

S-10. **Dashed borders** indicate a FoR as *irrealis* and thus invert positive and negative stance and status values (+ to –, – to +) inside the FoR. When a stance or status value is neutral (=), the dashed *irrealis* borders do not specify a resultant value (+, –).

S-11. **Dashed borders** indicate negation when a negation marker appears in the data and FoR.

S-12. **Beliefs** are formatted with square brackets, e.g., [*s* B2] (P = n), where *s* denotes speaker and B2 denotes a specific belief. Curly brackets group beliefs into sets attributed to *one and only one* Agent, e.g., {[*w* B1], [*w* B2]}.

S-13. **Beliefs** are formatted as below in bold text when they correspond with 'given' (old) information flowing from a contextual FoR (MOD = modal deixis, epist = epistemic stance, *w* = writer, *k* = Kaduma, *t* = Tanzania):

MOD : epist : +*w* >> +*k* Representing *t*

This line is read as: 'The writer$_w$ knows that Kaduma$_k$ is representing Tanzania$_t$.'

S-14. **UML swim lanes** (see Figure 1 above) group mental spaces, e.g., *P* (protasis), *Q* (apodosis). *P* and *Q* swim lanes do not contain FoRs evoked by dependent clauses (e.g., (36) and (40) in §4.3).
   a. *P* and *Q* Swim lanes are not line-connected since their contained FoRs are.
   b. Lines connecting other swim lanes are optional, (e.g., two context swim lanes).
   c. Context swim lanes are optional.

S-15. **Operator arrow lines** (§3.3.2) cross by using 'line jumps' (half-circle indentations).

S-16. **UML simple states** have no internal parameters and represents a concept, e.g., 'Being educated', as in Figure 2:

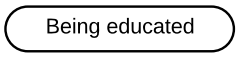

Figure 2. UML simple state.

Note that for S-14a, no part of a FoR network is the exact equivalent of a proposition in the symbolic sense, but *P* and *Q* Swim lanes are the closest features. However, atomic symbols have no internal structure; swim lanes do. Thus, the propositional level of abstraction on which symbols subsist is only roughly equivalent to the interrelation of *P* and *Q* Swim lanes.

3.3.1.3 UML mental spaces and deictic properties

The Attributes box in the UML FoR mental space template contains deictic properties (Figure 3):

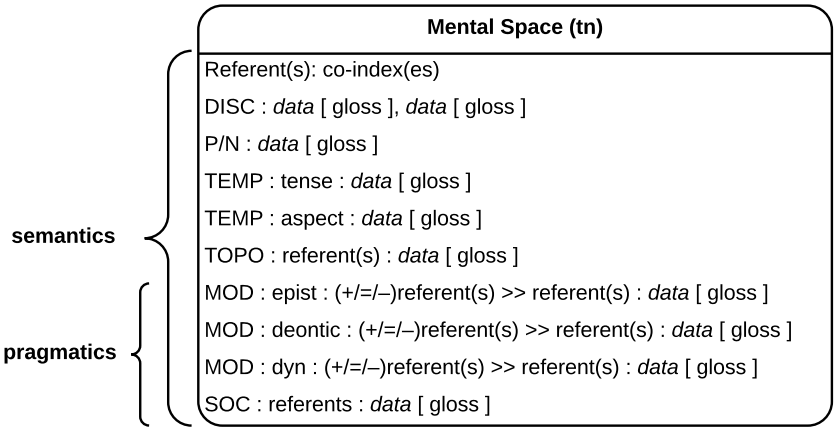

Figure 3. UML template for a Frame of Reference (FoR) mental space.

The Referents row contains referent co-indexes. The abbreviations for row content types (S-8) in Figure 3 are: DISC = discourse deixis, P/N = person/number, TEMP = temporal deixis (tense and

aspect), TOPO = topographic deixis, MOD = modal deixis (epistemic, deontic, and dynamic), and SOC = social deixis. Discourse deixis markers (e.g., subject and object agreement) connote previously introduced referents as proximal (old, familiar) information and other referents as distal (new, unfamiliar) information. The semantics-pragmatics overlap in Figure 3 shows epistemic and deontic modality as semantic functions and epistemic, deontic, dynamic, and social stance as pragmatic functions (Staples & Fernández 2019: 349; Mortensen 2012).

For the topographic deixis row (TOPO) in Figure 3, two possible values (+, –) (binary function) indicate the physical presence or absence of a referent, respectively (e.g., *+r, –z*).

For the pragmatics rows (MOD and SOC), three possible values (+, =, –) indicate both modal deixis (i.e., epistemic, deontic, and dynamic stances) and social deixis (i.e., social stance). Stance values precede an Agent co-index which is followed by the symbol >> for 'toward' and then by an Undergoer co-index to indicate that an Agent's attributing of a status value to a concrete Undergoer (e.g., person) or an abstract Undergoer (e.g., action, belief) (§2.3.4). Note that for the epistemic stance line, '+' preceding the '>>' signifies the 0.6 to 1.0 P-value range, '=' signifies 0.5, and '–' stands for the 0.4 to 0.0 P-value range (§3.3.2.1, Table 7).

As another example, when ***–y>>–{s, a}*** appears on the SOC (social deixis) line, it is read as 'Agent *y* is (a) taking a negative social stance *toward* (>>) and (b) attributing a negative social status *to* Undergoers *s* and *a*.' Opposite values (i.e., +, =, –) are possible on pragmatics lines, even for the same referent, where an Agent in an FoR is taking a stance of the same type (e.g., dynamic) but with contrasting subtypes (e.g., *ability* and *volition*, see §2.3.4) on opposite sides of the '>>'. For instance, MOD : dyn : *+r >> –r* means either (a) referent *r* is (taking a positive stance toward) 'willing, but not able,' or (b) 'able, but not willing'. Note that whenever data expresses a deictic property in a FoR, it appears row-finally.

For the tense and aspect rows seen in Figure 3, Figure 4 below explicates the UML-compatible format for the tense and aspect rows of FoR mental spaces:

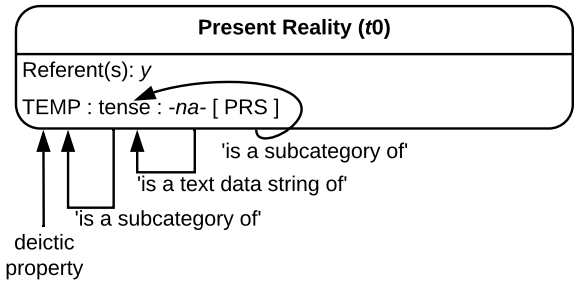

Figure 4. UML-compatible format for the tense and aspect rows of FoR mental spaces.

In Figure 4, the all-caps deixis property (e.g., TEMP for temporal deixis) is followed by (a) a subcategory (e.g., tense), (b) the corresponding data string of orthographic segments (e.g., *-na-*), and then by (c) the corresponding gloss which is a subcategory (e.g., PRS for present) of second-position category (e.g., in (8) above, tense). In this chapter (§3), all of the deictic property lines that appear below Referent(s) line in Figure 3 (this section) are omitted in all examples except (6) (Figure 7) to incrementally introduce UML formalisms.

3.3.1.4 UML pseudostates

In UML, PSEUDOSTATES are information flow nodes rather than States-of-Affairs (SoAs, or FoRs in this analysis) (Table 5):

Table 5 UML pseudostates (Object Management Group 2017: 709)

Node		Function
Initial State	●	Beginning point of flow sequence
Choice	◇	Junction in flow sequence, viz., Branch (AND: arrow in, two or more arrows out), and Merge (OR: two or more arrows in, one arrow out)
Exit	⊗	Exit point in flow sequence (e.g., a mid-sequence 'dead-end' option such as an unspecified outcome of an Agent's decision)
Final State	◉	End point of flow sequence

UML state machine diagrams begin at *only one* Initial State node (Table 5, top row) and flow to states (e.g., a FoR mental space) and pseudostates (e.g., Choice, Exit, and Final State nodes). In this study, a Belief node (a diamond containing a 'B') is a Choice node subtype (Figure 5):

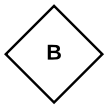

Figure 5. Belief node (subtype of Choice node).

The Belief node is a junction from which beliefs flow. A belief can flow to an optional X-ed circle Exit node (Table 5, row 3). Alternatively, it can flow to the Final State node. State machine diagrams flow to *only one* Final State.

State machine diagrams of FoR networks only show speaker/writer beliefs that are relevant for the construction. Beliefs the speaker/writer presumably shares with the audience (e.g., about an event) appear as context FoRs denoting 'given' information. The P-values for complementary (codependent) beliefs (e.g., §4.3.2, (33), Figure 29) on arrows flowing from a Belief node (§3.3.2.1) add to 1.0 (e.g., 0.4 and 0.6); supplementary (independent) beliefs do not.

Next, the Decision node is another Choice node subtype (Figure 6):

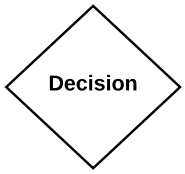

Figure 6. Decison node (subtype of Choice node).

Unlike lines flowing from the Belief node, P-values on lines after the Decision node *either* add up to P = 1.0 (e.g., see §4.2.2, (17)) *or* are unspecified, depending on context. Finally, state machine diagrams end at *one and only one* Final State node (bottom row, Table 5). Instances of each of the pseudostates except for the Exit node appear later in (10) (§3.3.2.5).

3.3.2 UML Operator arrows

UML operator arrows for networking FoR mental spaces appear in Table 6:

Table 6 UML operator arrows contextualized for embodied FoR mental space networks

Operator Arrow		Interrelationship(s)	Definition(s)
Flow	Y ——→ Z	Sequence	Y sequentially (e.g., informationally, logically, temporally) precedes Z.
Inheritance	Y ——▷ Z	Property scope (e.g., context, quality, quantity)	Y having property *x* causes Z to have *x*.
Composition	P ——◆ W	Part-whole (strong); Necessary condition	W (whole) impossible without P (part); P is necessary for W.
Aggregation (large head)	P ——◇ W	Part-whole (weak)	W (whole) is possible without P (part) (standard UML definition; used in §4).
Aggregation (small head)	P ——◇ W	Contributing condition	P makes W more probable (quantitative) *or* more extensive (qualitative) (contextualized definition in this study, see §3.3.2.4).
Realization	Y - - -▷ Z	Implementation/Causation; Sufficient condition	Y implements Z/Y causes Z to be the case; Y suffices for Z.
Dependency	Y - - -→ Z	Contingency	Y depends in some way for a time interval on Z (standard UML definition; *not* used in §4, see §3.3.2.6)
Codependency	Y ←- - -→ Z	Biconditional	Y is True *iff* Z is True. Y and Z have the same T-value (True, False) (contextualized definition in this study, see §3.3.2.6).

These UML operator arrows indicate that the arrow head FoR is *cognitively accessible* from the FoR at the arrow tail (§3.3.2.1). Constraints on cognitive accessibility include factors such as the (a) extent of shared contextual knowledge, (b) beliefs of communicating Agents about each other and discussion subjects, and (c) attentiveness (see Leonard 1995 on Swahili 'attention deixis'). Each of the operator arrows above in Table 6 are discussed separately next in §3.3.2.1–§3.2.2.6, excepting only codependency as a variation of dependency (§3.2.2.6). All of the operators can point to either a FoR as a whole or to a FoR line for emphasis.

3.3.2.1 Flow

In a sense, all UML operator arrows indicate flow, each with their specific semantics. However, in standard UML and this study, the flow operator arrow is the most general type of flow that simply reads 'moves/navigates to next' (process sequence) and is semantically underspecified for logic or temporal sequence. Put differently, flow indicates the sequence interrelationship, viz., that the tail Y sequentially precedes the head Z, as seen in the first row of Table 6 above.

In Mental Space Theory (§2.4), Fauconnier (2010 [1994]) conceptualizes mental spaces as being cognitively (in)accessible from each other in mental maps of semantic and pragmatic properties and how these properties interrelate. In my UML mental space networks, the flow arrow serves this purpose of interconnecting UML mental spaces and deictic properties (e.g., epistemic stance). In addition, flow can be either unidirectional or bidirectional. Flow also appears on arrow ends that do not have a more specific arrow type to assure that *all* network FoRs are accessible from the Initial node—a UML 'state machine' diagram requirement to make the diagram 'executable' (completable).

Now, in Figure 7 below for (6), three flow arrows connect the FoRs and Belief node (diamond containing a B, §3.3.1.4) in a cognitive sequence:

(6) *The hobbits$_h$ lit the fire$_f$* (*t*–3) *and then the Nazgûl$_n$ saw the fire$_f$* (*t*–2).

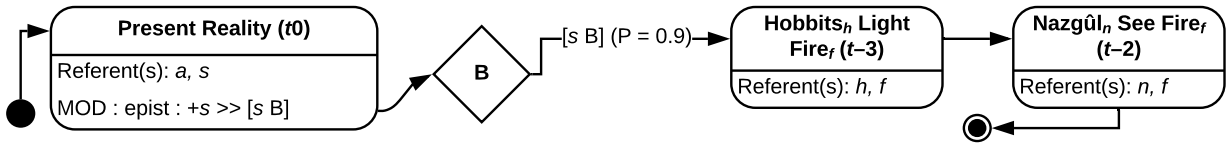

Figure 7. Flow operator arrow indicating cognitive sequence.

Referent(s): *a* = addressee, *f* = fire, *h* = hobbits, *s* = speaker, *n* = Nazgûl

The crucial point to draw from Figure 7 is that the flow arrows before and after all of the FoRs and the Belief node indicate cognitive flow. Again, the flow operator arrow is semantically underspecified for logic or temporal sequence; however, flow can also facilitate progression

through FoRs with out-of-sequence time indexes (e.g., in narrative flashbacks, see §4.3.2, Figure 30 below (34)). The FoR header time indexes alone specify the flow temporality. In (6) above, [*s* B] (P = 0.9) represents the speaker's$_s$ belief (S-9, §3.3.1.2) about the entire sequence 'downstream' (after) the flow arrow on which it sits, viz., through all of the FoRs that follow it to the Final State node (black circle with surrounding line, §3.3.1.4). To semantically disambiguate P-values as for an Agent's belief, the P = 0.9 Allan's (2012: 231) credibility metric for a protasis proposition in Table 7 below concisely synthesizes probability and possibility and specifies the P-values on flow arrows:

Table 7 P-values for a protasis proposition (adapted from Allan 2012: 231)

P-value	Degree of Agentive confidence	Propositional attribution
P = 1.0	Undoubtedly true	Necessarily *P*, I know that *P*.
P = 0.9	Most probably true	I am almost certain that *P*.
P = 0.8	Probably true	I believe that *P*.
P = 0.7	Possibly true	I think *P* is probable.
P = 0.6	Just possibly true	I think that perhaps *P*.
P = 0.5	Indeterminable	I don't know whether or *not P*.
P = 0.4	Just possibly false	I think that perhaps *not P*.
P = 0.3	Possibly false	I think *not P* is probable.
P = 0.2	Probably false	I believe that *not P*.
P = 0.1	Most probably false	I am almost certain that *not P*.
P = 0.0	Undoubtedly false	Necessarily *not P*, I know that *not P*.

The left column contains the P-values which appear on flow arrows to indicate an Agent's degree of confidence in a belief (center column) at a time index (*t*). The corresponding propositional attributions appear in the right column. The selection of P-values for examples in §4 are estimates only. Consequently, the selection of P-values in this study are heuristic estimates rather than being mathematically precise and thus are not critical for the §4 analysis. In this study, P = 1.0 (certainty) is reserved for known past or present events or states-of-being.

3.3.2.2 Inheritance

Inheritance expresses the property scope interrelationship, viz., space Y having property *x* causes space Z to have *x* and that a conceptual property (e.g., context) of a deictic property or FoR has

scope over another deictic property or FoR. In Figure 8 below for (7), the FoR at the arrow tail has contextual scope (CS) over the head FoR in which the historian$_h$ recounts the event:

(7) *On April 20, 1653, Cromwell$_c$ suspended parliament$_p$.*

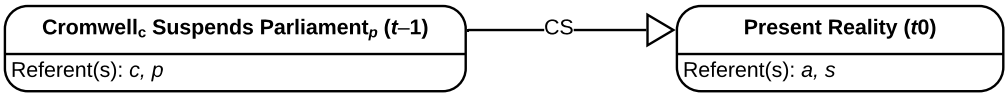

Figure 8. Inheritance operator arrow indicating the context scope (CS) of the left FoR over the right FoR.

Referent(s): *a* = addressee, *c* = Cromwell, *p* = Parliament, *s* = speaker

In Figure 8, the past left FoR (*t*–1) in which Cromwell$_c$ suspends parliament$_p$ has contextual scope (CS) (as marked on the inheritance arrow) over the historian's$_h$ present reality FoR on the right. The use of inheritance precludes needing a context swim lane (§3.3.1.2, S-14) to indicate contextual FoRs. In this study, I restrict inheritance to this use indicating context scope, while acknowledging the inclusion of other property types is plausible. For instance, the inheritance operator could be used to indicate the qualitative scope (QUAL-S) or quantity scope (QUAN-S) of one FoR or deictic property (e.g., dynamic stance) over another.

3.3.2.3 Composition

Composition *simultaneously* expresses two interrelationships: (a) strong *part-whole* relation: W (whole) impossible without P (part) and (b) P is necessary for W (necessary condition). In (14) below, composition indicates that the [Highway Safety Law]$_l$ (head simple state) in Figure 9 below is incomplete without the [Quality Standards]$_s$ (tail simple state) as a necessary part:

(8) [Quality Standards]$_s$ as a necessary component of the [Highway Safety Law]$_l$

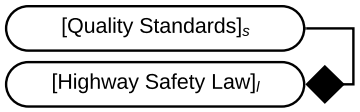

Figure 9. Composition operator arrow indicating that the [Quality Standards]$_s$ 'simple state' at the arrow tail is a necessary component of the [Highway Safety Law]$_l$ 'simple state' at the arrow head.

Referent(s): *s* = [Quality Standards], *l* = [Highway Safety Law]

3.3.2.4 Aggregation

The complementary part-whole relation in standard UML for composition is aggregation (i.e., 'strong' versus 'weak' part-whole relationships, respectively), which indicates the interrelationship that (a) a W (whole) possible without P (part) (§.3.3.2, Table 6). While using aggregation in this standard UML sense, I also contextualize aggregation for a second use to indicate that (b) without P (part) makes W (whole) more probable (contributing condition). To distinguish between instances of (a) and (b) in diagrams, a large head diamond arrow indicates (a) above and a small head diamond arrow indicates (b), as in Figure 10 below for (9):

(9) Polomé (1967: 153):

[*If the child$_c$ is in the habit$_h$ of playing at the shoemaker's$_s$ door$_d$*]$_P$, [*perhaps he'll$_c$ want to help him$_s$ next*]$_Q$.

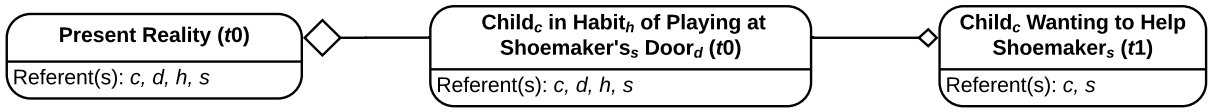

Figure 10. Aggregation operator arrow (large head, left) indicating that the FoR at the arrow tail is a optional component of the FoR at the arrow head. Aggregation operator arrow (small head, right) indicating the FoR at the arrow tail is a contributing condition of the FoR at the arrow head.

Referent(s): *c* = child, *d* = door, *h* = habit, *s* = shoemaker

In Figure 10, definition (a) as a 'weak' part-whole relationship is shown by the arrow white diamond (large head) between the left two FoRs to indicate that the child$_c$ being in the habit$_h$ of playing at the shoemaker's$_s$ door$_d$ (tail FoR) is an optional part of the Present Reality FoR (left). On the right, (a) as a contributing condition is shown by the arrow white diamond (small head) between the right two FoRs to indicate that the child$_c$ being in the habit$_h$ of playing at the shoemaker's$_s$ door$_d$ (tail FoR) at *t*0 increases the probability of the child$_c$ wanting to help the shoemaker$_s$ at *t*1 (head FoR). However, the child's$_c$ habit$_h$ of playing there is neither necessary nor sufficient for the head FoR being *realis* (True) at *t*1. The probability (not shown above) of the head FoR being *realis* at *t*1 is also shaped by embodied, cognitive factors such as the child's$_c$

disposition and pre-existing beliefs about shoemakers, what they do, and the desirability of participating in shoemaking (factors of cognitive accessibility, see §3.3.2).

3.3.2.5 Realization

Realization simultaneously expresses two interrelationships: (a) Y implements Z/Y causes Z (Implementation/Causation), and (b) Y suffices for Z (sufficient condition) (Figure 11 for (10)):

(10) Context: *While resting on the ancient* [*Watchtower of Amon Sûl*]$_w$, *the hobbits*$_h$ *lit a fire*$_f$.
Conditional Construction: *However,* [*if the hobbits*$_h$ *had known the Nazgûl*$_n$ *would arrive*]$_P$, [*they*$_h$ *would not have lit the fire*$_f$]$_Q$:

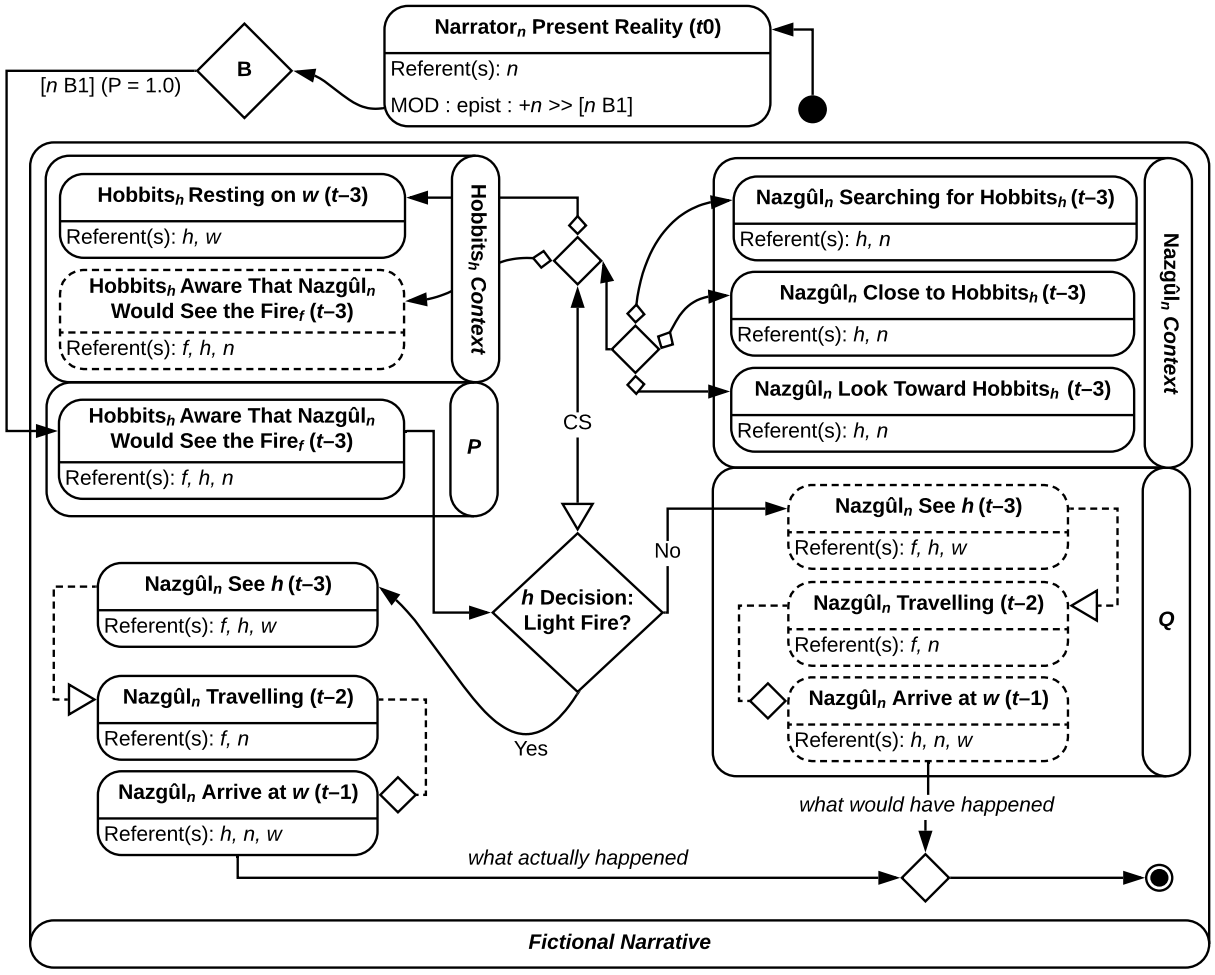

Figure 11. Realization operator arrows (bottom left, right) indicating tail FoRs as sufficient conditions for head FoRs.

Referent(s): *f* = fire, *h* = hobbits, *n* = narrator, *n* = Nazgûl, *w* = [Watchtower of Amon Sûl]

To review, in UML state machine diagrams, flow proceeds from the Initial State node (top center) through states (e.g., FoRs) and pseudostates (e.g., Merge nodes, e.g., upper center, bottom right), occasionally to Exit nodes (not shown above), and ultimately to the Final State node (bottom right) (§3.3.1.4).

Now, in Figure 11, first notice the Hobbits$_h$ Context swim lane (upper left) and Nazgûl$_n$ Context (upper right) swim lane. The (a) Nazgûl$_n$ relentlessly searching for the hobbits$_h$, (top right) (b) the Nazgûl$_n$ being topographically proximal (physically close) to the hobbits$_h$, (second top right), (c) the Nazgûl$_n$ looking in the direction of the hobbits$_h$ lighting the fire$_f$, (third top right), (d) the hobbits$_h$ resting on the [*Watchtower of Amon Sûl*]$_w$ (top left), and (e) the hobbits$_h$ not being aware the Nazgûl$_n$ would see their$_h$ fire$_f$ are all *contributing and jointly sufficient conditions* (aggregation, small head) arrows, upper middle, Figure 11) for their$_h$ decision to light the fire (center Decision node and 'Yes' scenario, three bottom left FoRs). Put differently, any from among (a)–(e) alone would *not* result in the Nazgûl$_n$ seeing the fire$_f$; together they *do* yield this result. Crucially, the realization arrows connect the top two FoRs in the *realis* 'what really happened' scenario (i.e., the Nazgûl$_n$ arriving, bottom left) and also the top two FoRs in the *irrealis* 'what really happened' scenario (i.e., the Nazgûl$_n$ *not* arriving, bottom right). In both FoR pairs, the tail FoR suffices for (realizes, makes *realis*) the head FoR.

3.3.2.6 Dependency

The UML dependency operator arrow is the weakest interrelationship between objects (e.g., a FoR mental space). Dependency indicates that A at the arrow tail depends in some way for some time interval on B at the arrow head—a very general definition that allows for flexibility in application. Like the other UML operators, dependency is a unidirectional arrow by default, but the UML 2.5.1 protocol (Object Management Group 2017) also permits non-contradicting

double-headed arrows. Accordingly, in this study, codependency (double-headed dependency) arrows indicate a biconditional interrelationship, viz., as in Figure 12:

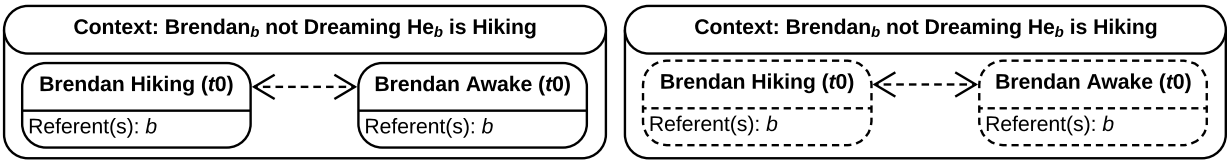

Figure 12. Codependency operator arrow indicating biconditional contingency of T-values (True, False) (biconditionality).

Referent(s): *b* = Brendan

In Figure 12, the head and tail FoRs have the same T-value (True, False) (bidirectional contingency). On the left, if Brendan$_b$ is awake at *t*0 (e.g., a specific Saturday at 7:00 A.M.), then he$_b$ is hiking at that time. Again, the solid FoR borders indicate *realis*. In this instance, the dependency narrows FoR interpretation within the P-value (P = 0.6–P = 1.0) range to P = 1.0 (True). On the right, the same principle inversely applies: if Brendan$_b$ is *not* awake at *t*0, then he$_b$ is *not* hiking at that time. The dashed FoR borders indicate *irrealis*. Here the dependency narrows the FoR interpretation within the P-value (P = 0.5–P = 0.0) range to P = 0.0 (False).

3.4 Data selection criteria and sources

The language under analysis in this study is Swahili [swa] (alternatively, Kiswahili), an SVO constituent-order Bantu language in the Niger-Congo family (see Ashton 1993 [1944], Loogman 1965, Wilson 1970, Polomé 1967, Myachina 1981, and Vitale 1981 as descriptive grammars). Since analyzing corpus data where possible minimizes the risk of generalizing from a small, unrepresentative data set, several examples are selected from the annotated Helsinki Corpus of Swahili (HCS 2.0), which contains around 25 million words (Hurskainen 2016). Other available Swahili corpora are the TshwaneDJe Kiswahili Internet Corpus (de Schryver & Joffe 2009) and the SAWA Corpus (De Pauw, Wagacha, & de Schryver 2009). Mwamzandi (2017), the only descriptive corpus study of Swahili conditional constructions, analyzes data from the HCS 1.0

Corpus (12.5 million words) (Hurskainen 2004; see also Hurskainen 2014) and engages descriptive publications (e.g., Saloné 1983a, 1983b). The data in §4 are selected from the HCS 2.0 and several descriptive publications. Several discourse examples are from Musyoki & Murphy (1985), a collection of Tanzanian newspaper articles.

The following are observations regarding the descriptive analyses on which this study builds. The terms *conditional marker* and *conditional conjunction* appear interchangeably in Mwamzandi (2017), inconsistently between Saloné (1983a) (on *ikiwa* as a conjunction) and Saloné (1983b) (i.e., *ikiwa* as a conjunction *and* as a marker), and somewhat incoherently in Saloné (1983b). Further, Mwamzandi (2017: 157) argues that Swahili conditional prefixes are not pragmatically contrastive, while Saloné (1983b: 21) holds that the contrasting distributions of some of them are pragmatically determined. A descriptive focus would allow for sorting out some of these descriptive discrepancies, but my theoretical focus only permits a partial account.

3.5 Conclusion

In this chapter, I first described the methodological design principles and then introduced UML mental spaces as the ontological method of analysis. I then described the data selection criteria and sources of the present study. The motivation for my abductive-inductive approach to the data is the goal of pursuing descriptive and explanatory adequacy for Swahili conditional semantics, pragmatics, and context-sensitivity. The standardized UML modeling language facilitates doing so by analyzing deictic properties (e.g., epistemic and modal stance) within language as a complex, adaptive system. Next, in §4, I operationalize these UML mental spaces in analyzing Swahili conditional constructions.

4. Data analysis and findings

4.1 Introduction

This data analysis demonstrates that the embodied FoR is a better heuristic of conditional interpretations than T-values and P-values alone. It also shows how necessary, sufficient, and contributing conditions as the logical properties correlating with T-values and P-values obtain on the level of embodied FoR networks. Toward these goals, I operationalize UML mental spaces representing embodied FoRs to show the influences of epistemic, deontic, and dynamic stances as modal deictic properties and context-sensitivity on conditional interpretations.

This chapter as a cognitive-functional-descriptive analysis has two primary aims: (a) to describe the grammatical features of Swahili conditional constructions and (b) to explain the cognitive networks of FoRs represented as UML mental spaces that the data evoke in the *mind* of and from the *perspectival viewpoint* of the communicator. Again, mental spaces do not objectively map features in reality or function as sentence diagrams; only the most relevant factors of unspoken context (e.g., contextually required, unmentioned referents) are represented. These aims ((a) and (b)) present a challenge for a trackable presentation of data and explanations. Sections for conditional prefixes and conditional conjunctions proceed from data and data description, to the diagram, and then to explanatory prose for the data and diagram, respectively. Each diagram contains details that are not critical for my arguments but are nonetheless required for completeness within my formal framework; space prohibits explicating them in the prose. Also, verbs are not co-referenced in the analysis for the sake of simplifying the presentation. In this chapter, Section 4.2 discusses *realis* constructions and their grammatical constituents, and §4.3 does so for *irrealis* constructions.

4.2 *Realis* conditional constructions

4.2.1 Overview

Four conditional conjunctions (*ikiwa*, *iwapo*, *endapo*, and *kama*) and one conditional prefix (*ki-*) occur in Swahili *realis* conditional constructions. This chapter argues that the conditional conjunctions are truth-functional (T-values) and that the prefixes (*ki-* and the *nge-* and *ngeli-* /*ngali- irrealis* prefixes) map a *realis-irrealis* probability scale (P-values). These prefixes have semantic scope over the conditional conjunctions while the latter have syntactic scope over the former. Along with examining conditional pragmatics, this section (§4.2) explores this issue of semantic scope of the conditional prefixes over the conjunctions.

On non-monotonicity, P-values express levels of agentive confidence in a belief (§2.2.2, §3.3.2.1, Table 7) and have semantic scope over (determine) T-values. Mwamzandi (2017) implicitly yet commendably presupposes non-monotonicity in arguing for a *realis-irrealis* scale, although he implements a four-level scale from van der Auwera (1983) and not P-values as such. However, Mwamzandi claims that the *ikiwa* conditional conjunction also expresses degrees of probability. Unfortunately, yet understandably, he does not consider semantic scope as a confounding factor for his analysis. I argue that this oversight skews his description of the collocations of *ikiwa* with other constituents. In contrast, my findings are that the conditional conjunctions such as *ikiwa* as construction *parts* express T-values. When *ikiwa* occurs without intervening constituents such as (a) negation markers (i.e., *si-*, *hatu-*, *hu-*, *ham-*, *ha*, *hawa-*, (b) modal verbs (e.g., *-wezekana* ‘be.possible’, *elekea* ‘be.probable’), (c) adverbs (e.g., *labda* ‘perhaps’, *pengine* ‘possibly’), and (d) the *ta-* FUT or *labda* ’perhaps’, the most coherent glosses for it are truth-functional (e.g., is ‘since it was True’ for past *realis* constructions). More precisely, the additional constituents that override the P-value of *ikiwa* from True (P = 1.0)

have semantic scope over it, even though it has syntactic scope over them. The 'difference-making' factor between these two cases is semantic scope.

Furthermore, conditional constructions as *wholes* also express P-values (§3.3.2.1, Table 7) from 1.0 (True) to 0.0 (False) that emerge from constituent collocations, as such as the constructions containing *ikiwa* in (11)–(16) (Hurskainen 2016):

(11) [***Ikiwa*** *tunakubaliana kuwa lugha ya kipicha ni muhimu sana katika ushairi*]$_P$,
[*basi ni dhahiri kuwa lugha hii haikujitokeza sana humu*]$_Q$.
'[If we agree that figurative language is especially important in poetry]$_P$,
[then it is evident that this language [literary device] did not feature much here [in this text]]$_Q$.' (P = 1.0)

(12) [***Ikiwa*** *Marekani itaanza vita*]$_P$, [*hakika Irak haitakaa kimya ...*]$_Q$.
'[If America begins the war]$_P$, [Iraq will certainly not remain silent ...]$_Q$.' (P = 0.9)

(13) *Kuhusu mkutano na rais Yasser Arafat*, *Powell alisema* [*atakutana naye*]$_P$,
[***ikiwa*** *hali itakubali*]$_Q$.
'Concerning a meeting with president Yasser Arafat, Powell said [he will meet him]$_P$,
[if circumstances permit]$_Q$.' (P = 0.8)

(14) [*Bwana Amoako amesema kuwa lengo hilo litawezekana*]$_Q$, [***ikiwa*** *nchi za Afrika zitasaidiwa kuweka uzito zaidi katika miradi ya kuongeza mapato yake*, *kuinua elimu na kuhakikisha inajitosheleza kwa chakula*]$_P$.
'[Mr. Amoako said that this goal would be achieved]$_Q$, [if African countries were helped to put more weight on projects to increase their income, improve education, and ensure food security]$_P$.' (P = 0.7)

(15) [*Labda tu* ***ikiwa*** *wahusika wengine watakuwa wametoka*]$_P$—*naona Mheshimiwa Magdalena Sakaya hayupo*—[*ni mmojawapo wa wazungumzaji*]$_Q$.
['Perhaps just in case the other persons in charge will be gone]$_P$—I see the Honorable Magdalena Sakaya is not there—[he is one of the speakers]$_Q$.' (P = 0.6)

(16) [... *sijui wanachama na mashabiki wao wategemee nini*]$_Q$ [***ikiwa*** *hata wachezaji wenyewe na makocha wao pia hawana uhakika wa kufanya vema*]$_P$.
[... I don't know what members and their fans have to rely on]$_Q$ [if even the players themselves and their coaches have no certainty about how to do well]$_P$.' (P = 0.5)

As Emergent Grammar and Construction Grammar similarly argue, the encoding a semantic function such as probability need not be the task of one lexeme, as Mwamzandi implies concerning *ikiwa*. For (12), even though *hakika* 'certainly' appears in this construction, the P-

value is not P = 1.0 (certainty). The P = 0.9 value reflects the writer's awareness that, even though she is *asserting* certainty, the future may turn out differently. In this study, P = 1.0 (certainty) is reserved for known past or present events or states-of-being.

The reason for Swahili having four conjunctions instead of one, if indeed they all denote T-values, certainly requires an explanation, although this issue is beyond the scope of the present study. Since the *ikiwa* (*i-ki-wa*: 9-IPFV-STEM 'it being,' see Saloné 1983b: 20), *iwapo* (*i-wa-po*: 9-STEM-16REL 'when it be/is True', see Saloné 1983b: 20) and *endapo* (*enda-po*: AUX-16REL 'when/where (it) goes', see Mohamed 2001: 84) conjunctions were at one time compounds, it seems that this fact is at least a partial explanation. The fourth conjunction *kama* is borrowed from Arabic, so it is lexical in Swahili and thus not a compound. In any event, Saloné (1983b: 21) notes that, in modern Swahili, speakers no longer recognize the conjunctions as compounds.

The following is a summary of previous assessments of the semantic contrasts between the four conditional conjunctions. Loogman (1965: 372) considers *ikiwa* and *iwapo* almost semantically equivalent while adding that *ikiwa* marks a marginally higher degree of doubt. Contrariwise, Saloné (1983b: 23) concludes they are functionally identical as high-probability constituents that primarily appear in future constructions. The HCS 2.0 has 3,045 tokens of the *endapo* conditional conjunction, but no publication has examined its semantic functions. Mpiranya 2014: (127–128) equates *endapo* and *iwapo* in examples without comment. Mwamzandi (2017) glosses all four conjunctions as lexical analogs of 'if'; so also do Loogman (1965), Myachina (1981), Saloné (1983a: 318; 1983b: 23), and Mpiranya (2014: 127–128) for *kama*. Mpiranya (2014: 127) regards *kama* and *iwapo* as semantically equivalent. All of these studies classify *iwapo* and *kama* as *realis*-marking conjunctions but gloss *iwapo* variously as 'if',

'when', and 'even'. Only Saloné (1983a, b) argues that these meanings are context-sensitive (e.g., pragmatic implicatures), as seen in other Bantu languages (cf. Mwamzandi 2017).

This tangled web of perspectives on the semantics of the conditional conjunctions highlights the need for further corpus analyses. Even so, these open issues need not preclude using examples of the four conjunctions to illustrate the roles of modal stance and context-sensitivity in delimiting conditional interpretations. Consequently, this section (§4.2) discusses the four conjunctions along with the conditional prefix *ki-*.

4.2.2 *ki-* conditional prefix

The *ki-* conditional prefix denotes a high or neutral probability (i.e., P ≥ 0.5; see §3.3.2.1, Table 7; see also Mwamzandi 2017: 157), depending on contextual constraints and agentive stances. In (17), the speaker$_s$ pairs *ki-* with the deontic stance marker (deontic modal verb) *lazima* 'must' to depict the addressee's$_a$ socio-cultural obligations to repay a debt$_d$ to a creditor$_c$:

(17) Mwamzandi (2017: 163)

[*U-**ki**-w-a*	*na*	*deni*$_d$]$_P$,	[*lazima*	*u-lip-e*]$_Q$.
2SG-**COND**-be-FV	with	5debt	must	2SG-pay-SBJV

'[If you$_a$ have a debt$_d$]$_P$, [you$_a$ must pay]$_Q$.'

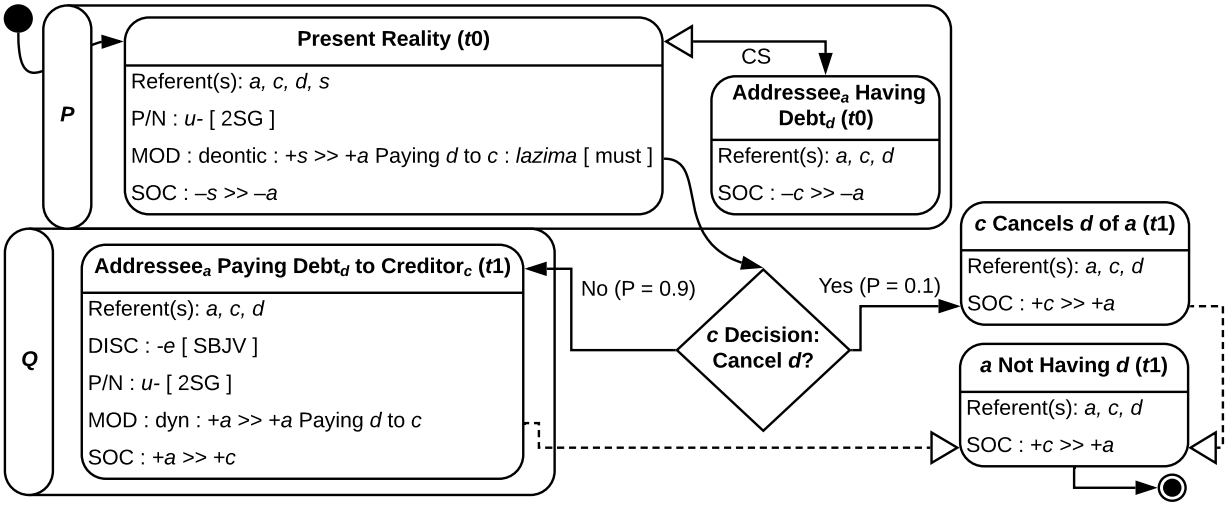

Figure 13. The *ki-* conditional prefix indicating a P-value (P = 0.9) for the protasis (*P*) (Mwamzandi 2017: 163).

Referent(s): *a* = addressee, *c* = creditor, *d* = debt, *s* = speaker

The speaker$_s$ in Figure 13 for (17) above insists (positive deontic stance, *P* FoR) that the addressee$_a$ *lazima* 'must' pay (volition, positive dynamic stance, lower left FoR). Again, whenever data expresses a deictic property, it appears row-finally (§3.3.1.3). A highly unlikely (P = 0.9) decision of the creditor$_c$ to cancel the debt$_d$ (positive social stance) would suffice (realization arrow, bottom right) for the addressee$_a$ not having the debt$_d$. This result also obtains (realization arrow, bottom center) when the addressee$_a$ has the ability and willingness (positive dynamic stance) to pay and then does so.

Mwamzandi (2017: 163) explains that the *realis* protasis in (17) is a sufficient condition for the speaker's$_s$ apodosis speech act of commanding the addressee$_a$ to pay. Even though speech acts are not the focus of this study, Mwamzandi's observation nevertheless highlights the fact that a sufficient condition can obtain on the 'higher' level of pragmatics instead of the 'lower' level of propositional logic where the T-value of a *P* proposition suffices for the T-value of a *Q* proposition. A bare propositional reading of (17) denudes the expression of embodied, 'real-world' but unmentioned contextual contingencies such as the creditor$_c$ cancelling the debt$_d$.

As the FoR network for (18) below, Figure 14 below shows how embodied socio-cultural perspectives again influence the *ki-* P-value as the speaker$_s$ expresses a high probability (P=0.8) of the *realis P* FoR resulting in the *realis Q* FoR:

(18) Mwamzandi (2017: 162)

[*Tu-**ki**-som-a*]$_P$,	[*tu-ta-erevu-k-a*]$_Q$.
1PL-**COND.IMPV**-study-FV	1PL-FUT-clever-STV-FV

'[If we$_{\{s,\ a\}}$ get educated]$_P$, [we$_{\{s,\ a\}}$ will become wiser]$_Q$.'

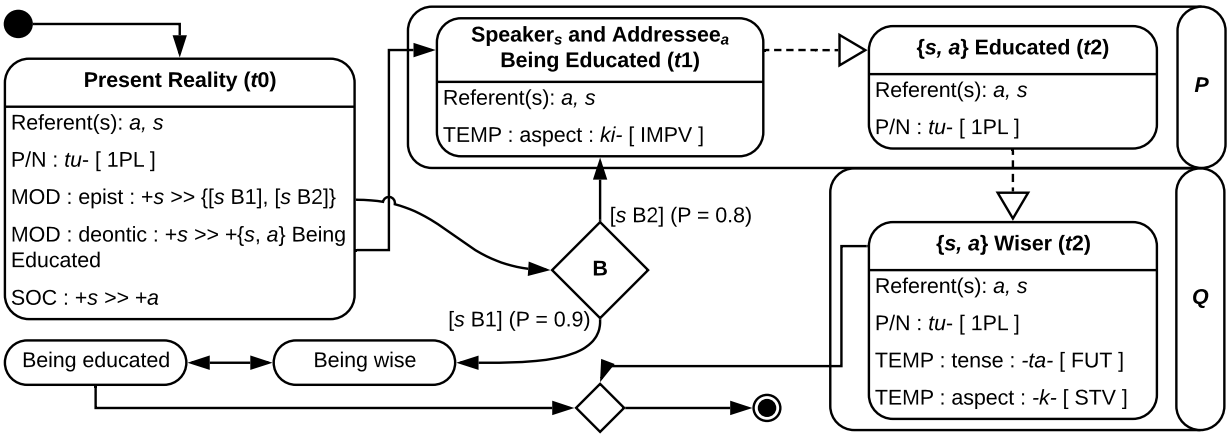

Figure 14. The *ki-* conditional prefix indicating a P-value (P = 0.8) for the protasis (*P*) (Mwamzandi 2017: 162).

Referent(s): *a* = addressee, *s* = speaker

The speaker's$_s$ positive epistemic stance toward [*s* B1] (background belief) and [s B2] (foreground belief) expresses socio-cultural expectations of education. The [*s* B1] flow arrow points to the 'Being wise' simple state that is bidirectionally linked (conceptually correlated) with the 'Being educated' simple state (bottom left). This link models [s B1] that being educated conceptually correlates with being wise. Based on [*s* B1] and [*s* B2], the speaker$_s$ desires (positive deontic stance, left FoR) to be educated by studying with the addressee(s)$_a$ (*P* FoRs). While including all agentive beliefs in a diagram is impossible, including the [*s* B1] background belief in Figure 14 illustrates the cognitive principle that agentive beliefs about perceived or imagined FoRs inform and guide agentive desires. These modal stances are cognitively upstream of the sufficient condition between the *P* and *Q* FoRs.

The analysis above of the sufficient condition (causal relation) obtaining between FoRs in the *P* swim lane contrasts with a monotonic analysis of (18) in which the T-value of *P* suffices for the T-value of *Q* on the level of propositional logic (see §3.3.2.1). This analysis seems plausible only if one takes the non-monotonist view that the *P* and *Q* propositions are *atomic*, namely, that both are semantically primitive with no internal semantic components (e.g., aspect

markers). This presupposition ignores the internal temporal structure of *P* and the internal sufficient condition between the left and right FoRs.

The embodied experience of acquiring first-hand or second-hand knowledge about agentive action patterns across time indexes informs choices of grammatical constituents to convey expected T-values or P-values. Example (19) below involves both value types, with *ki-* grammatically indicating a P-value based on knowledge about an Agent's behavior patterns:

(19) Mwamzandi (2017: 162)

Kwa	*kawaida*	*Lukova*	*ha-kuwa*	*na*	*tabia*$_t$	*ya*	*ku-andika*
17of	normally	Lukova$_l$	NEG-AUX	with	9behavior	9of	INF-write

andik-a	*barua*$_b$.	[*A-**ki**-andika*]$_P$,	[*ku-na*	*jambo*$_j$]$_Q$.
write-FV	10letter	3SG-**COND**-write	17LOC[16]-with	5something

'Normally, Lukova$_l$ would not write (lit., 'is not with the behavior$_t$ of writing) letters$_b$. [If he$_l$ writes (a letter)$_b$]$_P$, [there is an issue$_j$]$_Q$.'

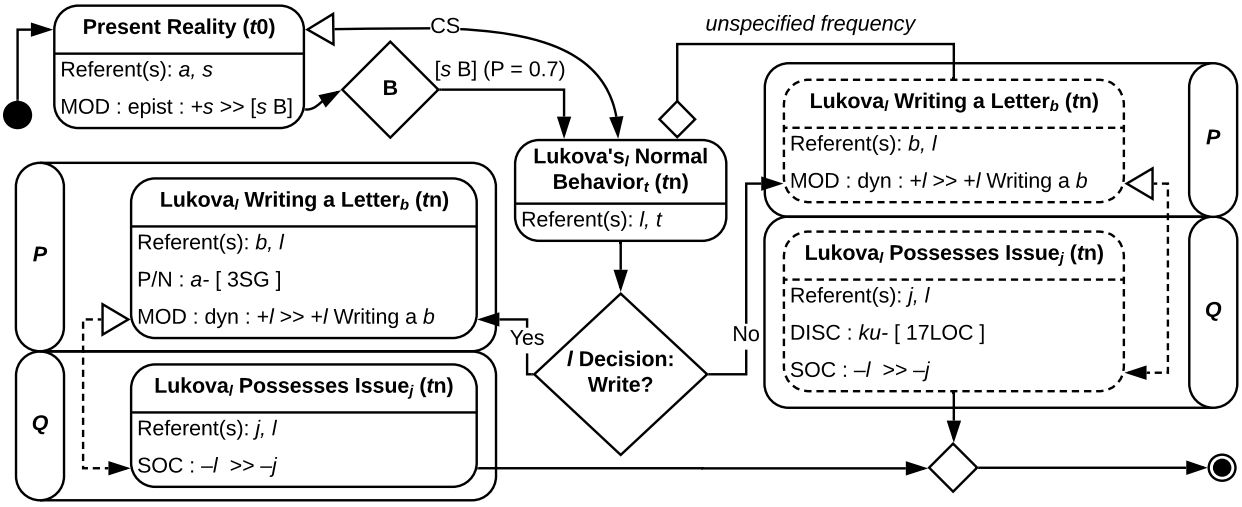

Figure 15. The *ki-* conditional prefix indicating a P-value (P = 0.7) for the protasis (*P*) (Mwamzandi 2017: 162).

Referent(s): *a* = addressee, *b* = letter, *j* = issue, *l* = Lukova, *s* = speaker, *t* = behavior

[16] In Bantu languages such as Swahili, locative markers such as *ku-* can have a non-topographic, abstract meaning that denotes possession (Ziervogel 2007 [1971]).

In (19) above Figure 15, the speaker$_s$ uses *ki-* and adverbial qualifier *kawaida* 'normally' to express strong confidence (positive epistemic stance, P = 0.7) of [*s* B] that Lukova$_l$ does not usually (i.e., *t*n as ongoing time interval, see §3.3.1.2, S-7) exhibit the *tabia*$_t$ 'behavior' (lit., 'is not with the behavior') of writing letters. This claim is based on the speaker's$_s$ contextual knowledge (inheritance arrow) as indicated by the optional FoR (aggregation arrow, upper right).

The information flow between FoRs downstream of the Present Reality FoR in Figure 15 is unspecified for time index(es) (non-temporal) as (*t*n) in each FoR indicates. The sequence flows through the *l* Decision node to two alternative scenarios. Each realization-flow arrow between the *P* FoRs and *Q* FoRs in the *realis* (left) and *irrealis* (right) scenarios indicates that the *Q* FoR social stance values of Lukova$_l$ suffice for his$_l$ corresponding dynamic stance (volition) values in the corresponding *P* FoR. Further context is needed to ascertain whether or not Lukova$_l$ desires (positive deontic stance) or feels obligated (positive deontic status) to write letters, so these details are not shown in Figure 15.

Direct observations of FoRs about states-of-being or events are not required to posit P-values for them in hypothetical scenarios; elements of encyclopedic knowledge are often grounds for doing so (cognitive accessibility, §3.3.2). For instance, the speaker$_s$ in (20) need not have encountered a *mtumwa*$_m$ 'slave' to have cognitive access to a slave's$_m$ experiential context:

(20) Saloné (1983a: 316)

[*Mtumwa*$_m$	*a-**ki**-tak-a*		*ku-ondoka-na*	*na*	*minyororo*	*ya*
1slave	3SG-**COND.IMPV**-want-FV		INF-leave-RECP	with	4chain	4of
unyonyaji$_u$	*na*	*ukandamizaji*$_o$	*ili*	*a-pet-e*	*uhuru*$_f$	*halisi*]$_P$,
11exploitation	CONJ	11oppression	so.that	3SG-get-SBJV	11freedom	real
[*i-na-m-**lazimu***		*a-fany-e*	*mapambano*]$_Q$.			
9-PRS-3SG-**be.necessary**		3SG-do-SBJV	5struggle			

'[If a slave$_m$ wants to rid himself$_m$ of his$_m$ chains of exploitation$_u$ and oppression$_o$ to gain real freedom$_f$]$_P$, [he$_m$ must struggle$_t$]$_Q$.'

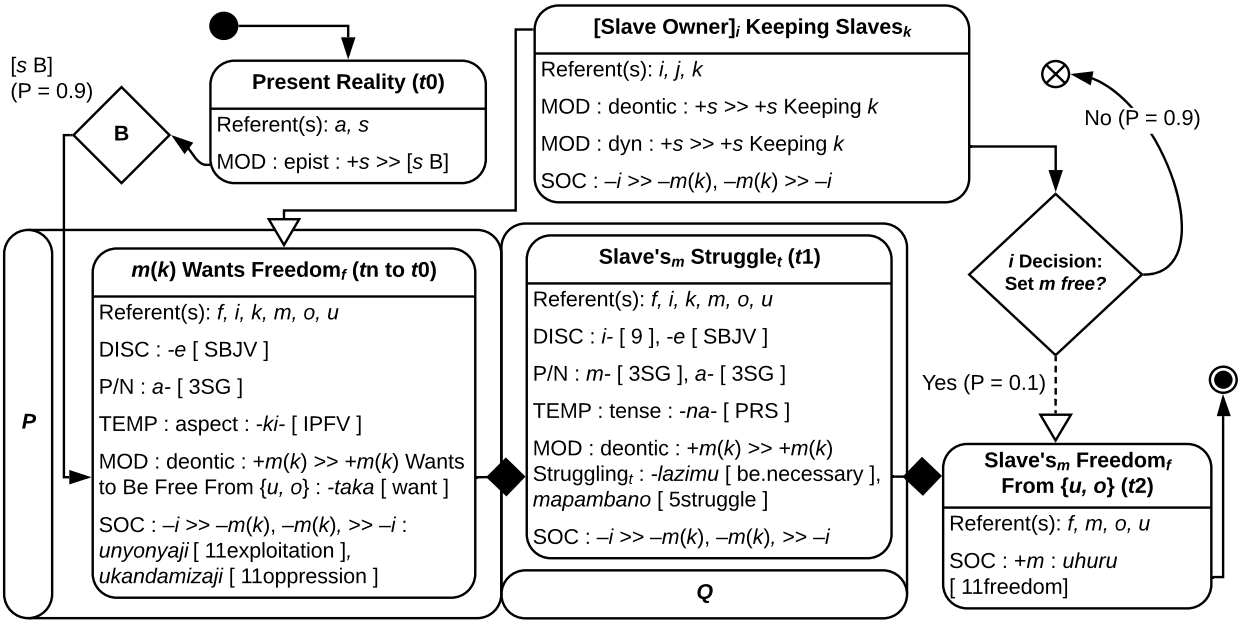

Figure 16. The *ki-* conditional prefix indicating a P-value (P = 0.9) for the protasis (*P*) (Saloné 1983a: 316).

Referent(s): *a* = addressee, *f* = freedom, *m* = slave, *i* = [slave owner], *k* = slaves, *s* = speaker, *t* = struggle, *o* = oppression, *u* = exploitation

The speaker$_s$ and addressee$_a$ in (20) and Figure 16 share encyclopedic knowledge that a slave$_m$ being socially proximal to *unyonyaji*$_u$ 'exploitation,' and *ukandamizaji*$_o$ 'oppression$_o$' while being socially distal from *uhuru*$_f$ 'freedom' (negative social status, bottom left FoR) makes his$_m$ desire (positive deontic stance) to be free (*P* FoR) highly probable (P = 0.9) as denoted by the *ki-* prefix in the protasis. In the bottom right FoR, a highly unlikely (P = 0.1) decision of a [*mmiliki wa mtumwa*]$_i$ 'slave owner' as a contextually required referent to set the slave$_m$ (positive social stance) free would suffice for the slave$_m$ being free.

The slave's$_m$ *mapambano*$_t$ 'struggle' (however defined) is an instance of positive deontic stance, *Q* FoR) at *t*1 is a necessary condition (composition arrow, bottom right) for the *t*2 FoR in which the slave$_m$ is free—the embodied state-of-being for which he$_m$ longs (positive deontic stance) at *t*0. While his$_m$ struggle$_t$ is not a sufficient condition for this outcome, it is a necessary (*lazimu* 'be necessary') condition (composition arrow between *P* and *Q* FoRs) for it. Various scenarios could result from the slave's$_m$ struggle such as slave running away secretly or openly

fighting for freedom. However, adding FoRs for all scenarios is not necessary since mental spaces are not 'possible worlds'; they are meant to represent what is asserted and implied (§3.2). The Exit node terminating the 'No' scenario (P = 0.9) denotes the 'dead-end' outcome of the slave's$_a$ condition remaining unchanged without a struggle.

4.2.3 *ikiwa* conditional conjunction

This section re-analyzes the *ikiwa* conditional construction as a truth-functional constituent (*contra* Mwamzandi 2017, see §4.2.1) from a Construction Grammar (CG) perspective (§3.2). Also, examples in this section are discussed in greater depth than others in this chapter in order to develop several concepts (e.g., social stance, social status). Also, in CG, it is not always the case that one lexeme or morpheme grammatically encodes a semantic function (e.g., P-value). For instance, the fact that scalar *realis*-*irrealis* (P-values) apply to a construction when *ikiwa* is present does not entail that the P-value is the semantic contribution of *ikiwa*. The functions of other constituents which have semantic scope over the T-value of *ikiwa* must also be considered.

In (21), *ikiwa* appears in a construction that *as a whole* denotes a high-probability belief:

(21) Mwamzandi (2017: 171)

[***Ikiwa***	*serikali*$_s$	*i-ta-pata*	*hasara*$_h$	*hiyo*]$_P$,	[*i-ta-kuwa*	*i-me-tokana*	*na*
CONJ	9government	9-FUT-get	9loss	9REF	9-FUT-AUX	9-PRF-cause	CONJ
uwezo$_u$	*mdogo*	*wa*	*menejimenti*$_m$]$_Q$.				
14skill	small	14of	6management				

'[If the government$_s$ will get that loss$_h$ (mentioned previously)]$_P$, [it$_h$ will be because of poor skills$_u$ of the [management team]$_m$]$_Q$.'

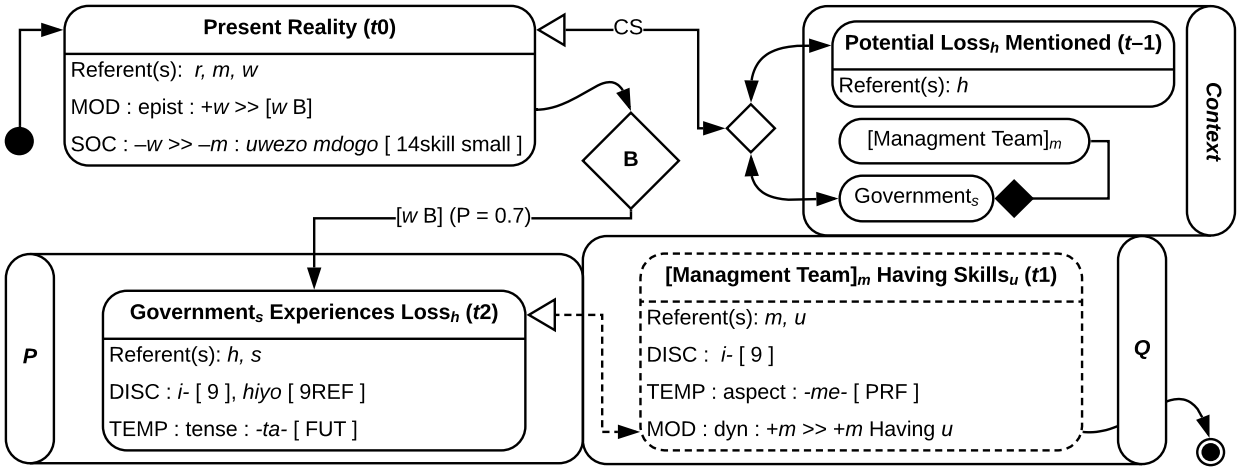

Figure 17. The *ikiwa* conditional conjunction indicating a T-value (True) for the protasis (*P*) in a construction expressing a P-value (P = 0.7) as a whole (Mwamzandi 2017: 171).

Referent(s): *h* = loss, *m* = [management team], *r* = reader, *s* = government, *u* = skills, *w* = writer

Mwamzandi analyzes *ikiwa* as being the sole constituent indicating probability (P-value) in (21). However, doing so overlooks the semantic scope of the P-value-reducing *ta-* future marker over *ikiwa* that results from embodied, 'real-world' limitations on human knowledge of the future. The writer$_w$ in Figure 17 above takes a negative social stance toward the *menejimenti*$_m$ '[management team]' regarding a previously mentioned potential *hasara*$_h$ 'loss' (Context swim lane). Her$_w$ assertion is not that the future scenario is likely to occur (P = 0.7), even though this is her background belief ([*s* B]) which is cognitively upstream of the proposition; as an embodied agent, the writer$_w$ cannot know what will occur. Instead, she$_w$ uses *ikiwa* 'it being' (True, P = 1.0) to assert that a refusal (negative dynamic stance, *Q* FoR) of the [management team]$_m$ to develop the requisite financial skills$_h$ will suffice for the *serikali*$_s$ 'government' experiencing the loss$_h$ (*P* FoR, *t*2). The flow-realization arrow indicating this sufficient condition obtaining from *P* FoR to the *Q* FoR represents the phrase *i-me-tokana na* '9-PRF-cause by.' Notice that it obtains in the opposite direction (*Q* FoR→*P* FoR) as in the *modus ponens* form but *not* on the level of propositional logic (i.e., *P*→*Q*). Instead, it obtains between pragmatic deictic properties on the level of embodied FoRs.

Mwamzandi (2017: 157–158) insists that no examples of the four lexemes (including *ikiwa*) in his analysis have a necessary/True interpretation (T = True, P = 1.0) in his data set from the HCS 1.0. However, his example of *ikiwa* below in (22) is not probabilistic and thus must be truth-functional if a condition obtains between the protasis and apodosis:

(22) Mwamzandi (2017: 163)

[***Ikiwa***	*mtoto*$_m$	*huyo*	*a-ta-tosheleza*	*vigezo*$_v$	*vyetu*	*vya*
CONJ	1child	1REF	3SG-FUT-fulfill	8prerequisites	1PL.POSS	8of

utoaji	*wa*	*misaada*$_f$]$_P$,	[*basi*	*tu-ta-m-saidia*	*kadri*	*ya*	*uwezo*$_u$
14giving	14of	4aid	then	1PL-FUT-3SG-help	9extent	9of	14capability

wa	*chama*$_c$	*chetu*]$_Q$.
14of	7organization	1PL.POSS

'[If the child$_m$ meets all the prerequisites$_v$ we$_c$ have set for giving [financial aid]$_f$]$_P$, [then we$_c$ will help him$_m$ to the best of our$_c$ organization's$_c$ ability$_u$]$_Q$.'

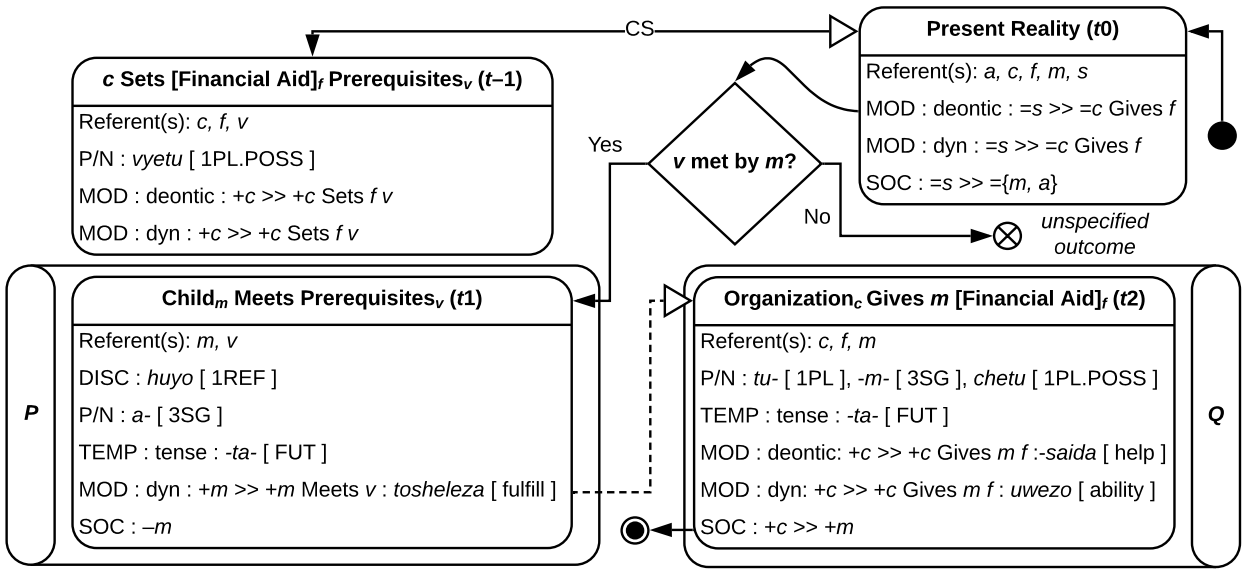

Figure 18. The *ikiwa* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Mwamzandi 2017: 163).

Referent(s): *a* = addressee, *c* = organization, *f* = [financial aid], *m* = child, s = *speaker*, *u* = ability, *v* = prerequisites

The speaker$_s$ in Figure 18 informs the addressee$_a$ of a *Q* FoR realization at *t*2 if the *P* FoR is *realis* at *t*1. However, even if the *P* FoR is *realis* at *t*1 (left), the speaker$_s$ cannot guarantee the financial need will be met because of the organization's$_c$ fiscal limitations. Accordingly, the [organization representative]$_s$ takes a neutral social stance (upper left FoR) toward the addressee$_a$

and child$_m$ by not assuring that the need will certainly (P = 1.0) be met. Nevertheless, as seen previously in (21), the protasis in (22) contains a *ta-* future marker that has semantic scope over *ikiwa*. However, the positive deontic stance of the *chama*$_c$ 'organization' toward setting the *vigezo*$_v$ 'prerequisites' (contextual FoR) is cognitively upstream of *ikiwa* and *ta-* (*P* FoR). Put differently, the P-value of the likelihood of *P* sufficing for *Q* is probabilistically qualified by the cognitively upstream P-value of the speaker's belief. As a result, this deontic stance value cancels the P-value-reducing influence of *ta-*.

Moreover, a sufficient condition obtains between the child$_m$ meeting the prerequisites$_v$ (positive dynamic stance, *P* FoR) and the organization's$_c$ positive deontic status (obligated) and its positive dynamic stance (*Q* FoR) (willingness) toward giving [financial aid]$_f$. Neither (a) the child's$_m$ efforts (positive dynamic stance) toward meeting prerequisites$_v$ (e.g., academic excellence) nor (b) the child's$_m$ negative social status (financial need) alone suffices for the organization$_c$ doing so. This plausible hypothesis builds on the presupposition that if there were only one prerequisite$_v$, it would correlate with either (a) or (b). A contextual FoR representing the addressee$_a$ choosing (volition, positive dynamic stance) to apply for [financial aid]$_f$ is not shown in Figure 18 because it is not clear whether or not it has already occurred. This event would also a be contributing condition—and perhaps a necessary condition, depending on whether applying is a required—for a *realis Q* FoR, while not being sufficient for it.

Mwamzandi also uses (22) to argue that *ikiwa* appears more commonly than *ki-* in answers to polar ('Yes', True; 'No', False) questions, which implies that *ikiwa* indicates logical inter-clausal relationships. He also claims that *ki-* tends to denote temporal relationships (e.g., time index progression) more often than does *ikiwa* (Mwamzandi (2017: 163–164). However, these claims do not match the temporal succession of events (i.e., sequential time indexes) in

(22) above and next in (23), nor the logical-only succession (unspecified time indexes (*t*n)) in (19). In any event, distinguishing *ki-* and *ikiwa* in this way seems unnecessary; logical succession can flow in tandem with temporal succession, as (22) shows (see Contini-Morava 1991).

As an example of another constituent having semantic scope over *ikiwa* and reducing the constructional True (P = 1.0) value, the modal adverb *labda* 'perhaps' in (23) below encodes positive epistemic stance concerning a *Q* FoR with a 'just possibly True' (P = 0.6) realization:

(23) Polomé (1967: 153)

[***Ikiwa***	*mtoto*$_m$	*hu-cheza*	*mlango*$_d$*-ni*	*pa*	[*mshoni*	*viatu*]$_i$]$_P$,
CONJ	1child	HAB-play	3door-LOC	16of	1maker	8shoes
[***labda***	*a-ta-taka*	*ku-m-saidia*	*baadaye*]$_Q$.			
perhaps	3SG-FUT-want	INF-3SG-help	next			

'[If the child$_m$ habitually plays at the shoemaker's$_i$ door$_d$]$_P$, [perhaps he'll$_m$ want to help him$_i$ next]$_Q$.'

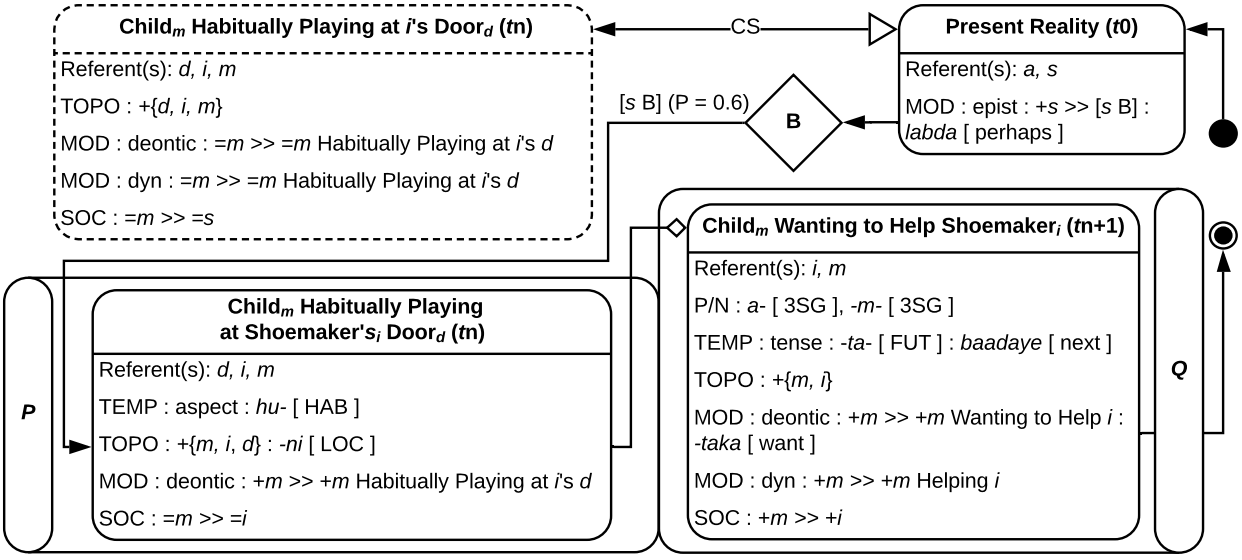

Figure 19. The *ikwa* conditional conjunction indicating a T-value (True) for the protasis (*P*) in a construction expressing a P-value (P=0.6) as a whole (Polomé 1967: 153).

Referent(s): *a* = addressee, *d* = door, *i* = shoemaker, *m* = child, *s* = speaker

In Figure 19 for (23), the child$_m$ is indifferent (neutral deontic and dynamic stances, neutral social stance, context FoR) to helping the shoemaker$_s$. The speaker$_s$ speculates that *labda* 'perhaps' the child$_m$ *habitually* (*hu-* HAB) (*t*n time index, §3.3.1.2, S-7) being topographically

proximal to the shoemaker's$_i$ door$_d$ (flow line to TOPO line, *P* FoR) will be a contributing condition (aggregation, small head arrow, bottom center) for the child$_m$ wanting to help the shoemaker$_i$ (positive deontic, dynamic, and social stances, *Q* FoR, *t*n+1). The essential generalization to draw from (23) is that T-values do not obtain for apodoses that contain modal adverbs (*labda* 'perhaps'), verbs, and other constituents that express uncertainty and thus reduce the P-value. In contrast, the protasis-introducing *ikiwa* only depicts the *P* FoR as *realis* (True) in the scenario, not the probability of the *Q* FoR following from it.

Contextual factors such as the high emotive valency of interwoven socio-political contexts and their embodied participants rule out any probability less than P = 1.0 (True, certainty) for *ikiwa* in (24) below. Also, a deontic stance value cancels the P-value-reducing influence of *ta-*. The writer$_w$ quotes [Ibrahim Kaduma]$_k$, a Tanzanian spokesperson, who commented on Tanzanian$_t$ international relations the previous day:

(24) Musyoki & Murphy (1985: 17, 111)

"*Tanzania*$_t$	*i-na-li-ona*	*suala*$_s$	*la*	*wa-Palestina*$_p$	*kuwa*	*ni*	*suala*$_s$	*la*
Tanzania	9-PRS-5-see	5issue	5of	3PL-Palestinians	CONJ	AUX	5issue	5of

ukombozi$_u$,	*na*	[[*mapambano*	*dhidi*	*ya*	*ukoloni*	*katika*	*Afrika*$_a$]$_m$
14liberation	CONJ	6struggles	against	of	14colonialism	PREP	Africa

ha-ya-ta-kuwa	*na*	*maana*$_n$]$_Q$	[***ikiwa***	*Tanzania*$_t$	*i-ta-fumba*	*macho*
NEG-9-FUT-AUX	with	9meaning	**CONJ**	Tanzania	9-FUT-close	6eyes

[*watu*	*wengine*	*dunia-ni*	*wa-na-po-kandamizwa*]$_o$"]$_P$,	[*Waziri*	*wa*
2people	2other	5world-LOC	3PL-PRS-16REL-oppressed	5Minister	1of

Biashara]$_w$,	*Ndugu*	[*Ibrahim Kaduma*]$_k$	*a-li-sema*	*mji-ni*	*hapa*$_h$	*jana*.
9Trade	9comrade	Ibrahim Kaduma	3SG-PST-say	3city$_q$-LOC	16PROX	yesterday

"Tanzania$_t$ considers the issue$_s$ of the Palestinians$_p$ as an issue$_s$ of liberation$_u$, and
[[the struggle against colonialism in Africa$_a$]$_m$ will be without meaning$_n$]$_Q$
[if Tanzania$_t$ closes its$_t$ eyes while [other peoples of the world are being oppressed]$_o$"]$_P$,
said [Minister of Trade]$_l$, Comrade [Ibrahim Kaduma]$_k$, here in town$_q$ yesterday.'

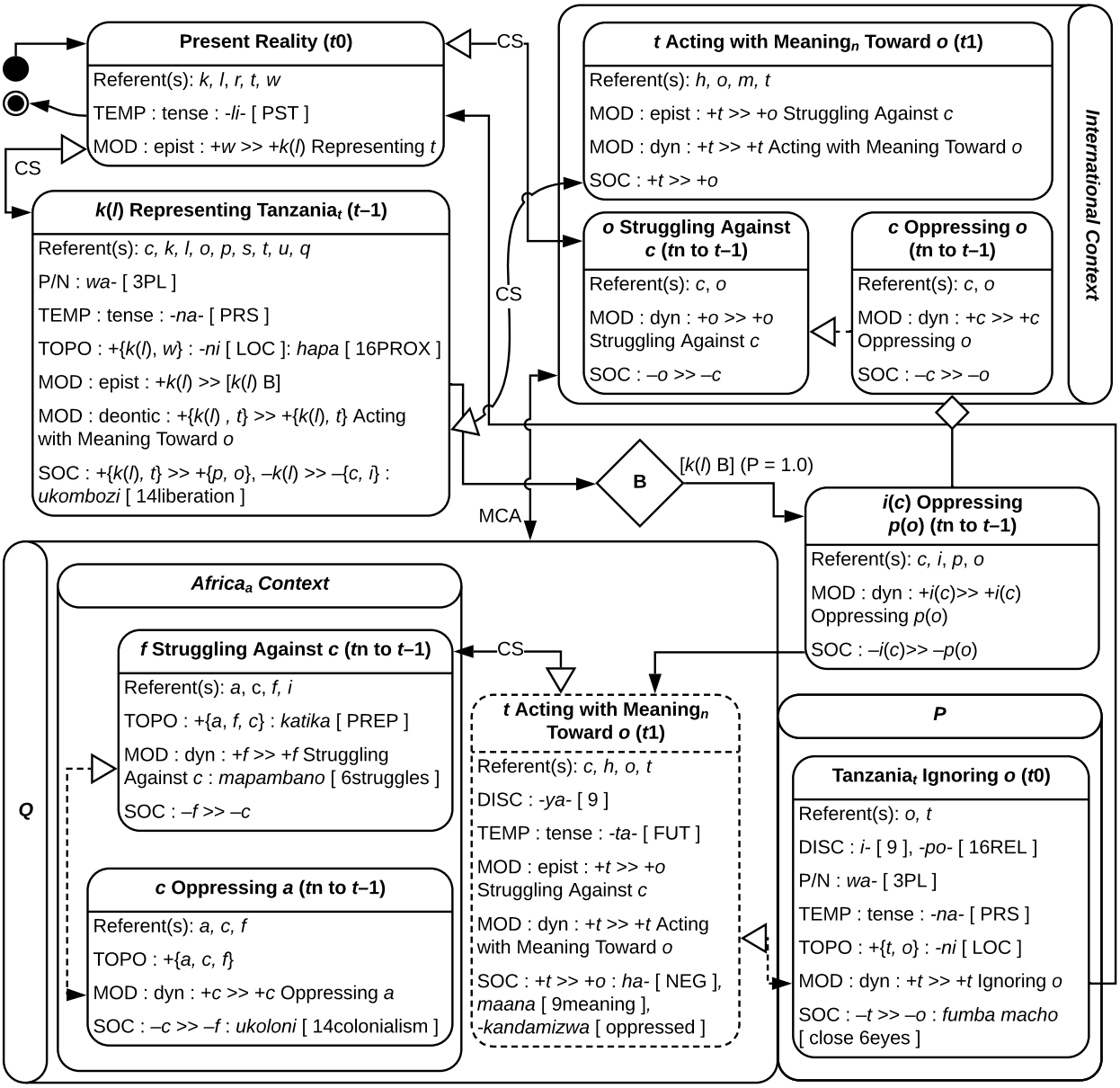

Figure 20. The *ikiwa* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Musyoki & Murphy 183: 17, 111).

Referent(s): *a* = Africa, *c* = [colonialist power(s)], *f* = Africans, *i* = [Israeli Government], *k* = [Ibrahim Kaduma], *l* = [Minister of Trade], *m* = [struggle against colonialism in Africa], *n* = meaning, *r* = reader, *s* = issue, *t* = Tanzania, *o* = [Other Oppressed Peoples in the World], *p* = Palestians, *q* = city, *u* = liberation, *w* = writer

According to the writer$_r$ in (24) and Figure 20, Kaduma$_k$ views the [Israeli government]$_i$ within the international context (upper right swim lane and embedded middle right FoR) as a colonialist$_c$ power who is oppressing the Palestinians$_p$. The writer's$_w$ combining of the reporting verb stem *sema* 'say' with the past marker *li*-, brackets the T-value of Kaduma's$_k$ views within

the reported speech. This illocutionary strategy allows the writer$_w$ to avoid expressing support or non-support for the truth of what was said (see Ivanova 2013; Massamba 1986). The context scope (CS) inheritance arrow from FoR below the MOD row in Present Reality FoR indicates the writer's$_r$ 'given', experiential knowledge of Kaduma$_k$, speaking.

As for Kaduma$_k$, he believes (positive epistemic stance, upper left FoR) that the ongoing (*t*n to *t*–1) Palestinian-Israeli conflict (*suala$_s$* 'issue') and the African$_a$ struggles (*mapambano$_m$* 'struggles') against colonialism$_c$ are *contextually comparable*, a notion which entails the mutual cognitive accessibility (MCA) (§3.3.2; Sergo & Thome 2005) of embodied states-of-being (e.g., being oppressed) experienced by Undergoers (i.e., Africans$_f$, Palestinians$_p$) in the two contexts. This analogy between the two socio-political contexts is modelled by the bidirectional flow arrow between African$_a$ Context swim lane and the International Context swim lane.

To set up this analogy, Kaduma$_k$ shifts between socially proximal (e.g., agreeing) and socially distal (e.g., disagreeing) referents. He$_k$ asserts that Tanzania$_t$ ignoring (*P* FoR) the plight of [other oppressed peoples in the world]$_o$ would suffice for Tanzania$_t$ acting dishonorably (*ha-*NEG + *maana* 'honor') (right FoR, *Q* swim lane). Kaduma$_k$ strongly disapproves of this outcome (negative deontic stance), stating that Tanzania$_t$ should not ignore (*i-ta-fumba macho* '9-FUT-close eyes') the shared experience of Africans$_s$ and [other oppressed peoples]$_o$. In sum, the positive social stance of Tanzania$_t$ (or at least of Kaduma$_k$) toward the Palestinians$_p$, *ikiwa* in (24) contextually frames the constructional interpretation as truth-functional; no P-value is in view.

4.2.4 *iwapo* conditional conjunction

As seen previously with *ikiwa*, the *iwapo* conditional conjunction consistently functions to denote T-values (truth-functionality). In (24), the clashing of agentive actions and deontic stances in a socio-political context evoked the use of a truth-functional conjunction; the

speaker's purpose was to express the certainty of a future outcome given a specified agentive decision. This contextual template also applies to the construction with *iwapo* in (25):

(25) Saloné (1983b: 17)

[*Mwenyekiti*	*wa*	*CCM*]$_m$,	[*Mwalimu*	*Nyerere*]$_n$	*a-me-sisitiza*	*jana*	*kwamba*		
1chairman	1of	CCM	1teacher	*Nyerere*	3SG-PRF-insist	yesterday	that		
[*Tanzania*$_t$	*i-ta-m-piga*	*sana*	*fashisti*	[*Idi Amin*]$_a$	*ndani*	*ya*	*Uganda*$_u$]$_Q$		
Tanzania	9-FUT-3SG-hit	hard	fascist	Idi Amin	inside	of	Uganda		
[***iwapo***	*a-ta-jaribu*	*tena*	*ku-i-tumia*	*Tanzania*$_t$	*kama*	*dirisha*	*la*	*ku-tolea*	
CONJ	3SG-FUT-try	again	INF-9-use	Tanzania	as	5window	5of	INF-vent	
matatizo$_p$	*yake*	*ya*	*ndani*]$_P$.						
6problems	his	of	inside						

'The [chairperson of CCM]$_m$, [Mwalimu Nyerere]$_n$ insisted yesterday that [Tanzania$_t$ will beat fascist [Idi Amin]$_a$ hard inside of Uganda$_u$]$_Q$ [if he$_a$ tries again to use Tanzania$_t$ as a window out of which to vent his$_a$ internal problems$_p$.'

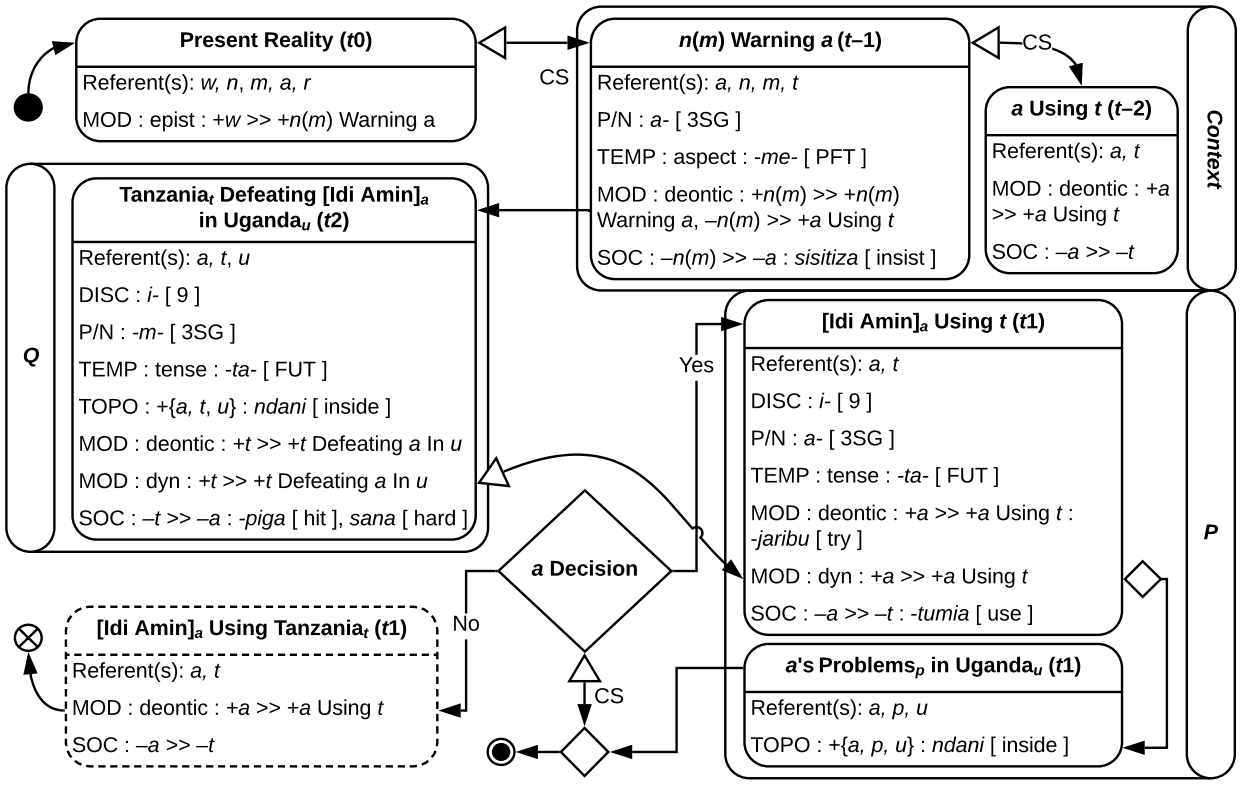

Figure 21. The *iwapo* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Saloné 1983b: 17).

Referent(s): *a* = [Idi Amin], *i* = [Chama Cha Mapinduzi], *m* = [chairman of Chama Cha Mapinduzi (CCM)], *n* = [*Mwalimu Nyerere*], *p* = problems, *r* = reader, *t* = Tanzania, *u* = Uganda, *w* = writer

In (25) and Figure 21, [Mwalimu Nyerere]$_n$, as the [chairperson of the Chama Cha Mapinduzi (CCM)]$_m$ political party in Tanzania$_t$, uses *iwapo* to assert that [Idi Amin]$_a$ resolutely using (positive dynamic stance, negative social stance, *P* FoR) Tanzania$_t$ again as a socio-political victim will suffice for Tanzania$_t$ defeating him$_a$ (positive deontic and dynamic stances, negative social stance, *Q* FoR). The *-piga sana* 'hit hard' verb phrase reflects Nyerere's$_n$ warning (positive deontic stance and negative social stance) and characterizes Tanzania's$_t$ predicted defeat of Amin$_a$. From Nyerere's$_n$ perspective, while Amin$_a$ *could* independently decide to abstain from reckless military actions within Tanzania's$_t$ borders, the notorious idiosyncrasies of his$_a$ embodied psychological traits rule out this scenario (bottom left FoR and Exit node). Hence, as seen in (21)–(23) with *ikiwa*, the semantic scope of the *ta-* future marker over *iwapo* is cancelled by contextual factors cognitively upstream of *iwapo* and *ta-*. Also, a biconditional interpretation of (25) above disregards situational contingencies. For instance, Tanzania$_t$ may choose to defeat Amin$_a$ for another reason. The contextual details of this alternative 'No' scenario (flow arrow, *irrealis* FoR, and Exit node) are unspecified.

Within academic debate as another rhetorical genre, *iwapo* in (26) is truth-functional:

(26) Hurskainen (2016)

Msimamo$_m$	*na*	*madai*$_a$	*ya*	*baadhi*	*ya*	*hawa*	[*"Washairi*	*wa*	*Kisasa"*]$_i$			
3position	CONJ	6assertions	of	some	of	2PROX	2poets	2of	modern			
u-me-potoka,	*kwani*	[***iwapo***	*tu-ta-ya-kubali*]$_P$			[[*i-ta-kuwa*	*tu-me-sema*]$_{Q1}$					
14-PRF-mistaken	for	**COND**	1PL-FUT-6-accept			9-FUT-AUX	1PL-PRF-say					
kwamba	*Waswahili*$_s$,	*au*	[*makabila*	*mengine*	*ya*	*Kiafrika*]$_t$	*kwa*	*ujumla*,	*na*	*wa*		
SBJV	Swahili	CONJ	6tribes	6other	of	African	17of	14totality	CONJ	1of		
hasa	*yale*	*ya*	*Kibantu*$_b$,	*haya-kuwa*	*na*	[*u-tanzu*	*wa*	*ushairi*	*katika*			
especially	6DIST	of	Bantu	6PROX-AUX	with	11-genre	11of	11poetry	PREP			
fasihi]$_u$	*y-ao*	*kabla*	*ya*	*kuja*	*kwa*	*Waarabu*$_k$	*katika*	[*Pwani*	*ya*			
9literature	9POSS-3PL	before	of	15arrival	15of	2Arabs	PREP	9coast	of			

Afrika	*ya*	*Mashariki*]]$_p$—	[*jambo*$_j$	*amba-lo*	*si-kweli*	*kabisa*,]$_{Q2}$	*kwani*
Africa	of	eastern	5matter	which-5REL	NEG-true	completely	because

[*historia*	*ya*	*asili*	*ya*	*ushairi*	*wa*	*Kiswahili*]$_h$	*ha-i-ta-kubali*.
9history	of	9origin	of	11poetry	11of	Swahili	NEG-9-FUT-accept

CONTEXT: 'The position$_m$ and assertions$_a$ of some of these ["Modern Poets"]$_i$ are
PROTASIS (*P*): mistaken, for [if we$_{\{w, r\}}$ accept them$_{\{m, a\}}$]$_P$,

APODOSIS (*Q*1): [[we$_{\{w, r\}}$ will have posited]$_{Q1}$

BACKGROUND/ (False Conclusion)$_j$: that the Swahili$_s$, or [other African tribes]$_t$ in general, and especially those of the Bantu$_b$, did not have a [genre of poetry in their$_{\{b, s, t\}}$ oral literature]$_u$ before the Arabs$_k$ arrived to the [coast of Eastern Africa]$_p$ —

APODOSIS (*Q*2): [a conclusion$_j$ which is not entirely true]$_{Q2}$

CONTEXT: because the [historical origins of Swahili poetry]$_h$ will not accommodate it$_j$.'

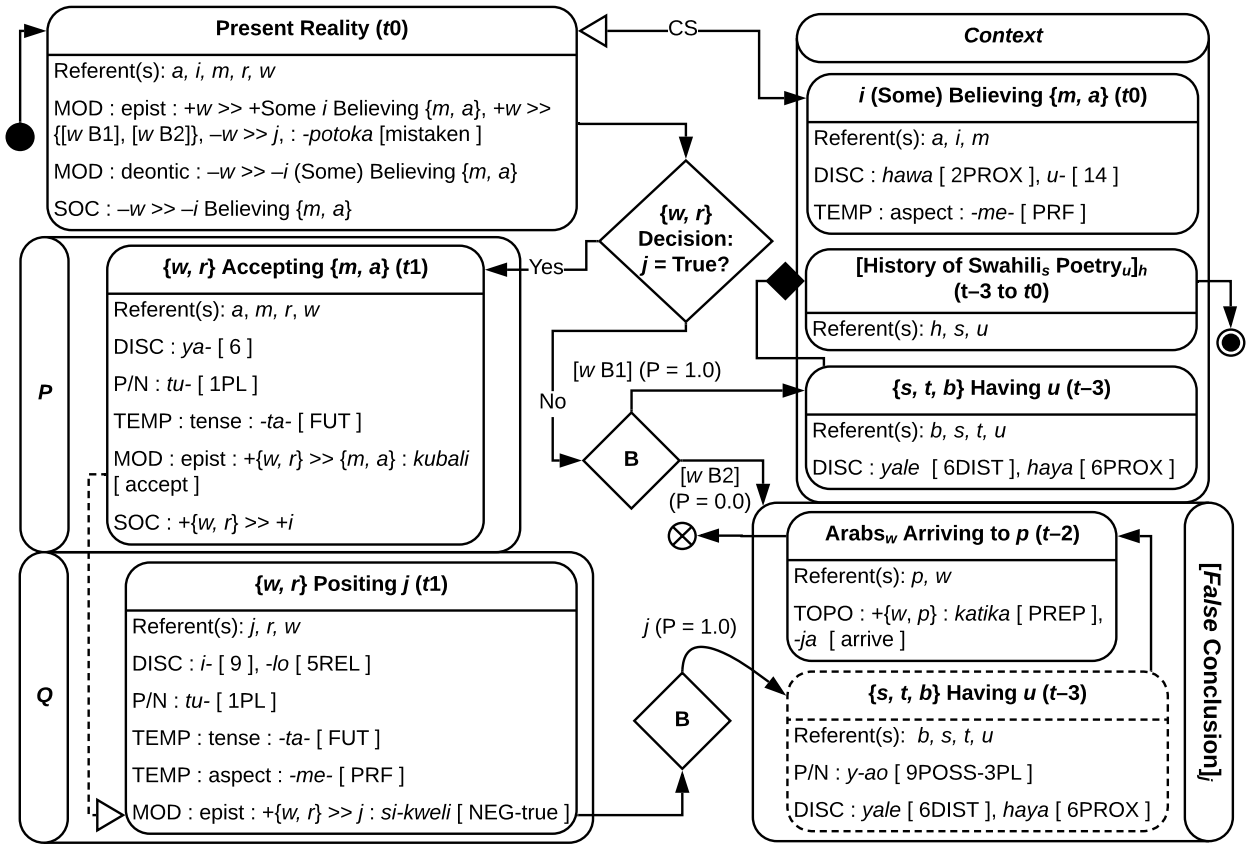

Figure 22. The *iwapo* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Hurskainen 2016).

Referent(s): *a* = assertions, *b* = Bantu, *h* = [historical origins of Swahili poetry], *i* = [Modern Poets], *j* = [false conclusion], *k* = Arabs, *m* = position (opinion), *s* = Swahili (tribe), *t* = [Other African tribes], *p* = [coast of Eastern Africa], *u* = [a genre of poetry in the literature], *w* = writer

The writer$_w$ in (26) and Figure 22 expresses negative epistemic and social stances (upper left FoR) by (a) disagreeing with a subset (*baadhi* 'some') of the [Modern Poets]$_i$, (b) making a counter-assertion (*P* and *Q* FoRs), and then (c) appealing to historical evidence as epistemic justification. The information flow in Figure 22 for (26) is both logical and temporal. Transitions between the *me-* perfective aspect marker, *ta-* future marker, and the *kuwa* stative verb (see Contini-Morava 1991), along with *kabla* 'before' and *historia* 'history' as temporally encoded lexemes map time-index changes throughout this *iwapo*-marked truth-functional construction.

The T-value contrasts between [*w* B1] and [*w* B2] as the writer's$_w$ actual beliefs (center) and the hypothetical belief *j* (bottom right swim lane) which the writer$_w$ finds problematic exhibit EPISTEMIC INCONGRUENCE, viz., disagreement about what *is* the case in a FoR (Stivers, Mondada, & Steensig 2011; Hayano 2011; Vatanen 2018; García-Ramón 2018). The *iwapo* conjunction introduces a hypothetical future scenario in which the writer$_w$ and readers$_r$ believe that *j* is true, hence their$_{\{w,\, r\}}$ positive epistemic stance toward *j* and positive social stance toward the [Modern Poets]$_i$ (*P* FoR). The writer$_w$ then inserts a background relative clause between the first and second halves of the apodosis to summarize the position$_m$ and assertions$_a$ with which he$_w$ disagrees and believes as false (*si-kweli* NEG-true). The writer$_w$ expresses distal social deixis (negative social stance, upper left FoR) while excoriating the [Modern Poets]$_i$ for asserting the backgrounded relative clause as true, contrary to the historical record (second top right FoR).

Even though *iwapo* is clearly truth-functional in the previous two examples, other examples in the HCS 2.0 such as (27) below could be invoked as counterexamples:

(27) Hurskainen (2016)

[***Iwapo***	*Simba$_s$*	*i-ta-shinda*	*katika*	*fainali$_f$*]$_P$,	[*i-ta-chukua*	*moja kwa moja*
COND	Simba	9-FUT-win	PREP	9final.game	9-FUT-take	immediately

[*kombe*	*la*	*ubingwa*]$_k$	*baada*	*ya*	*ku-li-twaa*	*mara*	*mbili*	*mgongo-ni*
5cup	5of	11championship	after	9of	INF-5-take	9time	9two	3back-LOC

mwa watani$_w$ *wao wa-kubwa*, *Yanga*$_y$]$_Q$.
18of 2rival 3PL.POSS 2-big Yanga.

'[If the Simba$_s$ win in the [final game]$_f$]$_P$, [they$_s$ will immediately take the [championship cup]$_k$ after being back-beaten twice by their$_s$ major rivals$_w$ Yanga$_y$]$_Q$.'

Once again, however, a reservation about the truth-functionality of a Swahili conditional conjunction can be jettisoned by taking a Construction Grammar (CG) approach; otherwise, *iwapo* itself seems to mark the indeterminate probability (P = 0.5). A CG analysis of (27) is that *iwapo* 'in case (of)' is truth-functional as also seen in (25)–(26), and, when it co-occurs with the *ta-* future marker in *P*, the P-value emerges from the constituent pairing unless upstream pragmatic deictic properties cancel the semantic scope of *ta-*, as in Figure 23 below for (27):[17]

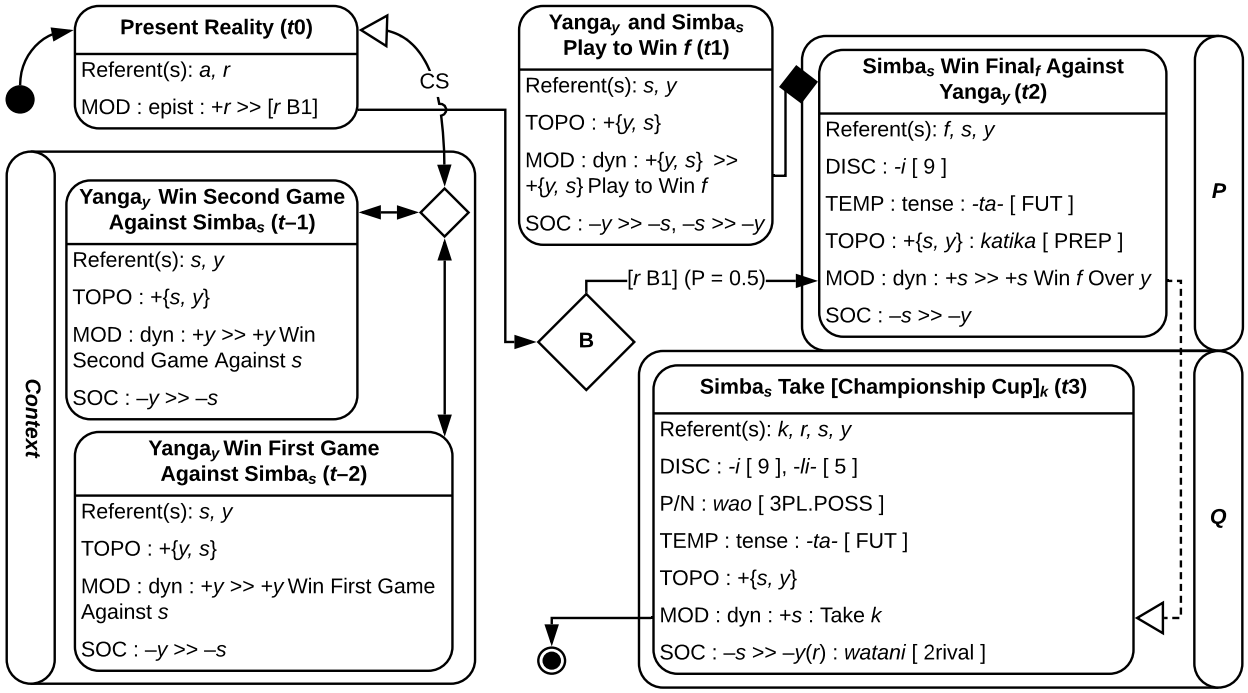

Figure 23. The *iwapo* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Hurskainen 2016).

Referent(s): *s* = Simba (a Tanzanian soccer team), *f* = [final game], *k* = [championship cup], *w* = rivals, Yanga (a Tanzanian soccer team), *r* = reporter, *a* = addressees

[17] The reader may have noticed by this point that the example set for the conjunctions is skewed toward future-oriented constructions. The non-representativeness of this approach notwithstanding, such examples better show the semantic scope of other constituents over the conjunctions—a crucial point in arguing for their truth-functionality.

By default, the probability of the construction *as a whole* that Figure 23 represents denotes that the Simba$_s$ winning the *fainali*$_f$ 'final.game' at *t*1 is indeterminate (P = 0.5) (center) because it is underspecified for probability since it describes a future (*ta-* marker) event with an outcome that is yet to be determined. However, if the reporter$_r$ believes that one team or the other is favored to win, the P-value will be higher, depending on the reporter's$_r$ beliefs. The efforts (positive dynamic stance, top center FoR) of both teams toward winning against the opposing team are necessary, but not sufficient conditions for winning (Context swim lane FoRs). In the case of (i.e., *iwapo*) Simba$_s$ winning at *t*2, such will suffice for them$_s$ taking the [championship cup]$_k$ at *t*4 as a result of their positive dynamic status, viz., *being able to* take it (see §2.3.4).

4.2.5 *endapo* conditional conjunction

Like *ikiwa* and *iwapo*, the *endapo* conditional conjunction is truth-functional, so the principle of semantic scope again applies. In (28) below, an example that parallels (25) in pragmatics, socio-political context, and FoR network structure, *endapo* denotes truth-functionality:

(28) Musyoki & Murphy (1985: 73, 134)

Tanzania$_t$	*i-me-wa-ony-a*	[*vibaraka*	*na*	*Namibia*$_n$]$_v$	*kwamba*
Tanzania	9-PRF-3PL-warn-FV	8puppets	PREP	Namibia	that

[*mwisho*$_d$	*wao*	*u-ta-kuwa*	*sawa*	*na*	*ule*	*wa*	[*vibaraka*	*na*
3end	3PL.POSS	3-FUT-AUX	equal	PREP	3DIST	3of	8puppets	PREP

Zimbabwe$_z$]$_w$]$_Q$	[***endapo***	*wa-ta-zidi*	*ku-shiriki-ana*	*na*
Zimbabwe	**CONJ**	3PL-FUT-increase	INF-cooperate-RECP	PREP

[*Makaburu*	*wa*	*Afrika*	*Kusini*]$_m$]$_P$	*katika*	*njama*$_p$	*za*	*ku-taka*
Boers	2of	Africa	South	PREP	10plots	10of	INF-intend

ku-endelea	*ku-wa-kandamiza*	[*wananchi*	*nchi*$_n$*-ni*	*humo*]$_w$
INF-continue	INF-3PL-oppress	2citizens	10country-LOC	18REF

'[Tanzania$_t$ has warned the [puppets of Namibia]$_v$ that [their$_v$ end$_d$ will be equal to that of the [puppets of Zimbabwe$_z$]$_w$]$_Q$ [if they$_v$ cooperate further with the [Boers of South Africa]$_m$]$_P$ in plots$_p$ intending to continue oppressing the [citizens in this country$_n$ (Namibia$_n$)]$_x$]$_Q$.'

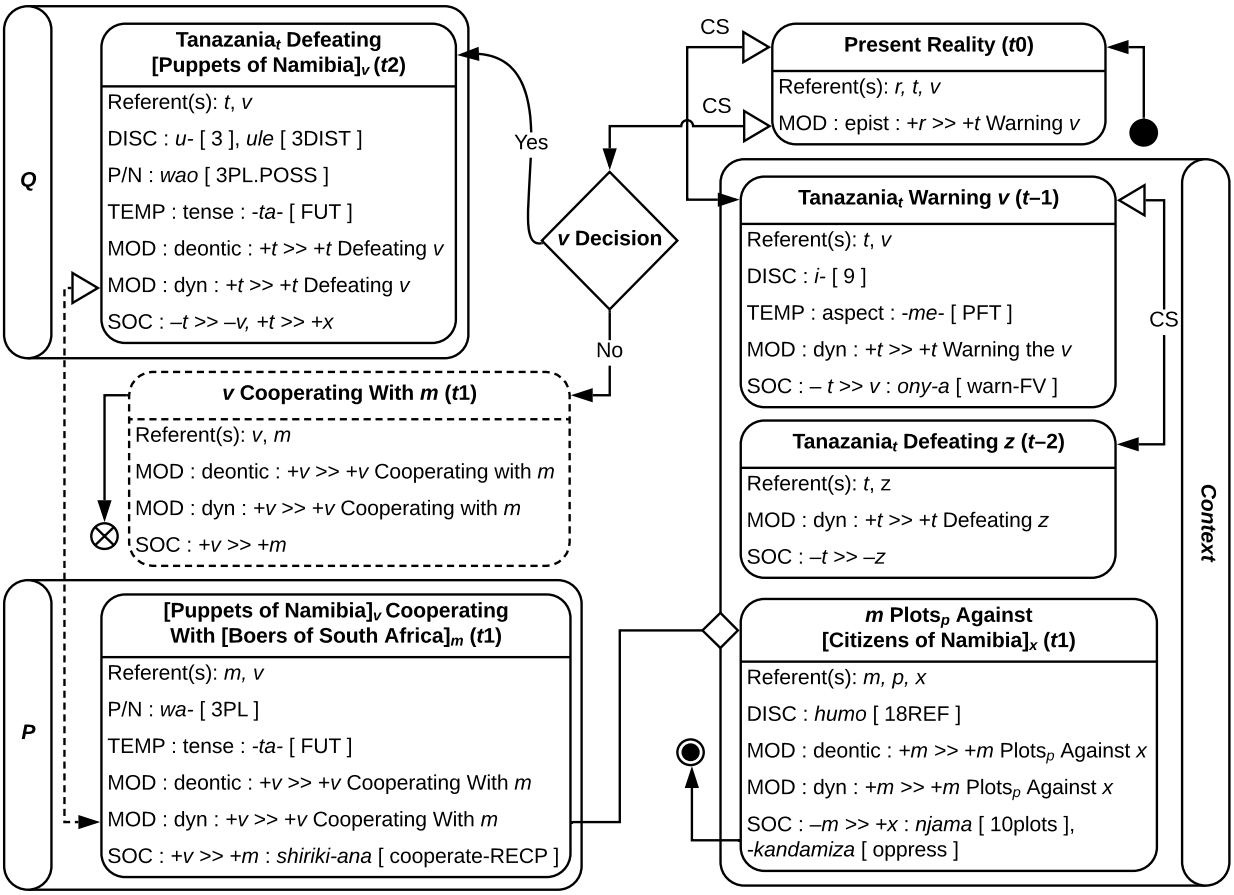

Figure 24. The *endapo* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Musyoki 1985: 73, 134).

Referent(s): *a* = addressees, *c* = [Comrade Mkapa], *m* = [Boers of South Africa], *n* = Namibia, *p* = plots, *r* = reporter, *t* = Tanzania, *v* = [puppets (controlled leaders) of Namibia], *w* = [puppets (controlled leaders) of Zimbabwe], *x* = [citizens of Namibia], *z* = Zimbabwe

In (28) and Figure 24 above, Tanzania's$_t$ spokesperson [Comrade Mkapa]$_c$ (unmentioned contextual referent) depicts the internationally [controlled leaders of Namibia]$_v$ as *vibaraka*$_v$ 'puppets' of the [Boers of South Africa]$_m$ because they$_v$ are cooperating with them$_m$ (positive deontic, dynamic, and social stances) in *njama*$_p$ 'plots' against the [citizens of Namibia]$_x$. This act of cooperation exhibits DEONTIC CONGRUENCE, viz., agreement between speakers about what is permitted or obligated to 'be the case/be done' in a FoR (see Stevanovic 2018). Furthermore,

since these plots$_p$ are already transpiring (Context swim lane), Mkapa$_c$ expects that they$_p$ undoubtedly will increase (*P* FoR).[18]

As a result, Mkapa$_c$ warns (positive deontic stance, negative social stance) that their$_v$ cooperating with the Boers$_m$ against their$_v$ own citizens$_x$ will suffice for Tanzania$_t$ defeating them$_v$ (positive deontic and dynamic stances, negative social stance, *Q* FoR) to champion the cause of the [Namibian citizens]$_x$. As supporting evidence, he$_c$ points to Tanzania's$_t$ proven ability to defeat its$_t$ enemies (e.g., Zimbabwe$_z$, bottom context FoR). Earlier in the article, Mkapa$_c$ declares that "*hatimaye wananchi wa Namibia watawatupilia mbali katika jaa la historia*" 'eventually the inhabitants of Namibia will cast them$_v$ into the rubbish-heap of history' (Musyoki & Murphy 1985: 73, 134). His$_c$ illocutionary bravado (negative social stance) prohibits a probabilistic reading of *endapo*, even if one does not accept the principles of CG (§3.2). As also seen in (25), a biconditional interpretation of (28) above disregards situational contingencies because Tanzania$_t$ may choose to defeat the so-called [puppets of Namibia]$_v$ for another reason (contextually underspecified 'No' scenario).

As in (28), *endapo* in (29) marks truth-conditions in a non-biconditional construction:

(29) Mwamzandi (2017: 165)

[***Endapo***	*walinzi*$_w$	*wa-**ngeli**-kuwa*	*imara*]$_P$,	[*vitendo*	*vya*	*wizi*$_z$
CONJ	2security.agents	3PL-**COND**-AUX	vigilant	8cases	8of	11theft
na	*uporaji*$_u$	*vi-**nge**-weza*	*ku-pungua*	*ama*	*ku-isha*	*kabisa*]$_Q$.
CONJ	11vandalism	8-**COND**-can	INF-decrease	CONJ	INF-end	completely

'[If the [security agents]$_w$ were to be vigilant]$_P$, [cases of theft$_z$ and vandalism$_u$ would be reduced or completely end]$_Q$.'

[18] The plots$_p$ referenced in the article (see Musyoki & Murphy 1985: 53, 134) involve a substantial list of interacting referents and thus cannot be included in Figure 24 due to space constraints.

Unlike other examples in this chapter, (29) contains both of the Swahli *irrealis* prefixes *ngeli-* and *nge-* (§4.3.2 and §4.3.3). The difference between the *irrealis* prefixes and the *ki- realis* prefix is that the former reduce the constructional T-value by a higher degree than *ki-* to within the P ≥ 0.5 range. The emergent meaning is comparable to the 'if only' gloss for *laiti* ((36), (40)).

Now, in Figure 25 for (29) below, the truth-functional *endapo* marks a hypothetically true (*realis*) *P* FoR sufficing for either or both of the *Q* FoRs ('or' node in *Q* swim lane):

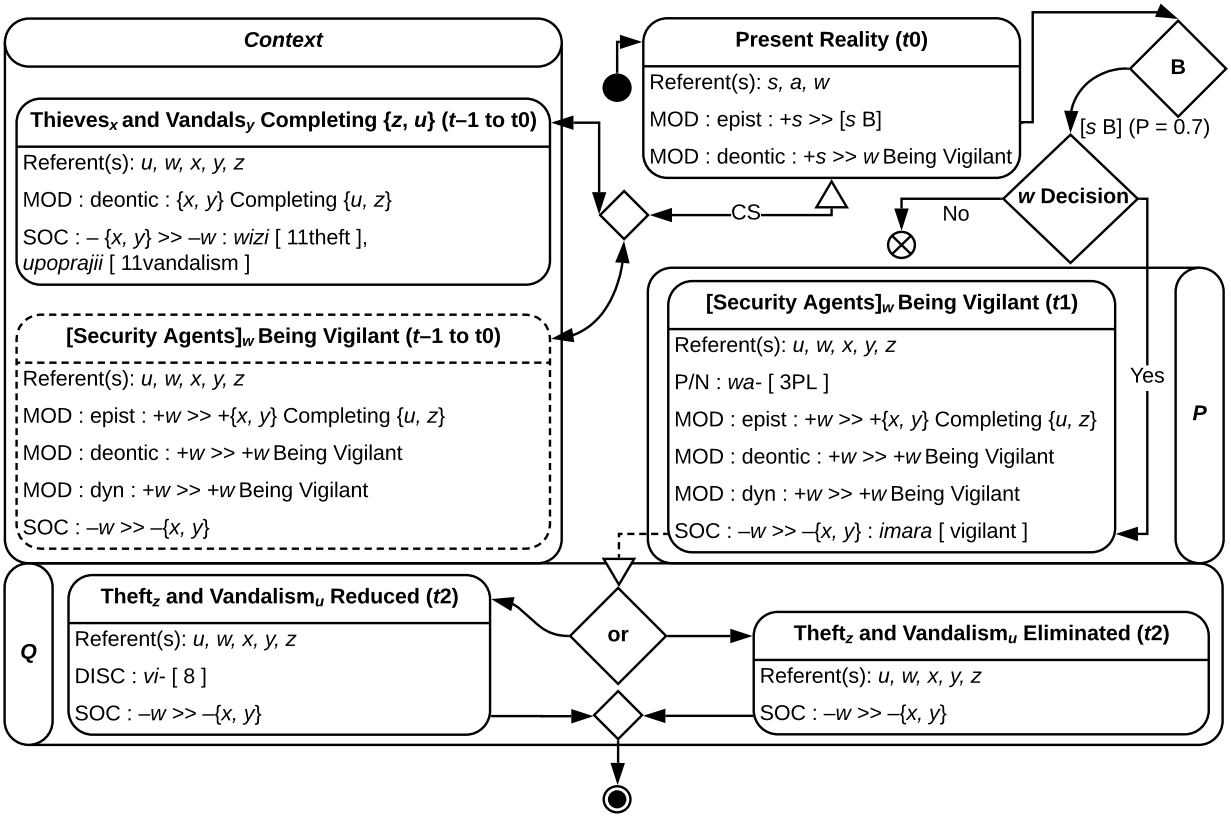

Figure 25. The *endapo* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Mwamzandi 2017: 165).

Referent(s): *a* = addressees, *s* = speaker, *u* = [cases of vandalism], *w* = [security agents], *x* = theives, *y* = vandals, *z* = [cases of theft]

However, the construction as a whole is *irrealis* because of the speaker's$_s$ cognitively upstream doubt (negative epistemic stance, upper right FoR) of the likelihood of the 'Yes' scenario cognitively downstream of the [security agents]$_w$ Decision node (upper right). Interestingly, *endapo* and the *ngeli-* counterfactual prefix jointly express the speaker's$_s$ positive deontic stance

toward the [security agents]$_w$ being vigilant against the acts of thieves$_x$ and vandals$_y$ (unmentioned contextual referents). Consider the following paraphrase of (29) and Figure 25 that illustrates the truth-functionality of *endapo*: 'It is not true (*endapo* + *ngeli-* counterfactual prefix) now that the [security agents]$_w$ are being vigilant; if only they were. Given a counterfactual case being true (*endapo*) (*P* FoR), cases of theft$_t$ and vandalism$_v$ can (*nge-* hypothetical prefix, §4.3.2) be reduced or completely end (*Q* FoR).'

4.2.6 *kama* conditional conjunction

In §4.2.3 through 4.2.5, I showed that the *ikiwa*, *iwapo*, and *endapo* conditional conjunctions are truth-functional, and this section does the same for the *kama* conditional conjunction. Again, the previously discussed principles of semantic and pragmatic scope apply. In (30) below, the *kama* conditional conjunction is truth-functional, and has a True (P = 1.0) (certainty) reading within the framework of a fictional narrative:

(30) Maw (2013 [1992]: 34)

[*A-ni-ta-ua-w-a*]$_Q$	[***kama*** *ni-ta-sema*	*jambo$_j$* *hili*,	*a-na*	*kwa*	*baba$_b$-ko*]$_P$.
3SG-1SG-FUT-kill-PASS-FV	**CONJ** 1SG-FUT-say	5thing	5PROX	1-CONJ	17of 9father-2SG.POSS

'[He$_{k(b)}$ will have me$_{s(m)}$ killed]$_Q$ [if I$_{s(m)}$ say such a thing$_j$, and to your$_{a(p)}$ father$_{k(b)}$]$_P$.'

In the narrative, (30) is uttered by a [poor man]$_{s(m)}$ to a princess$_{a(p)}$ who insists that he$_{s(m)}$ should marry her$_{a(p)}$. When he$_{s(m)}$ discloses that he$_{s(m)}$ does not have the money to do so, she$_{a(p)}$ offers to give him$_{s(m)}$ the needed funds. The *jambo* 'thing' is his$_{s(m)}$ requesting her$_{a(p)}$ hand in marriage from her$_{a(p)}$ father the king$_{k(b)}$. At another point in the discourse, the [poor man]$_{s(m)}$ avers that he$_{s(m)}$ will be killed for so asking because he$_{s(m)}$ is a poor man's son (Figure 26):

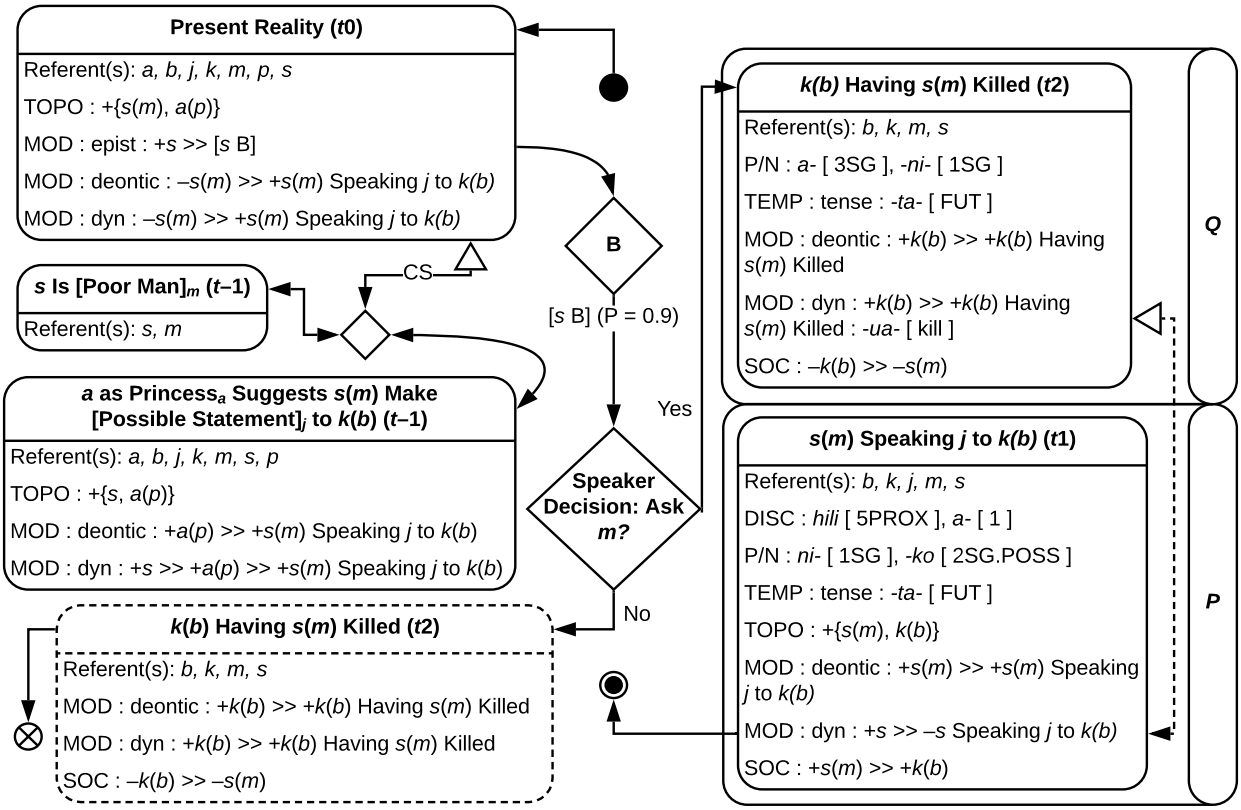

Figure 26. The *kama* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Maw 2013: [1992]: 34).

Referent(s): *a* = addressee, *b* = [princess' father], *k* = king, *m* = [poor man], *p* = princess, *s* = speaker

As Figure 26 above is intended to show, the construction in (30) has nothing to do with a probabilistic prediction of a self-action at *t*1. To the contrary, the [poor man]$_{s(m)}$ uses *kama* to express a high probability belief [*s* B] (P = 0.9) about being killed in the future (*Q* FoR) in the case of deciding (positive dynamic stance, *P* FoR) to *sema* 'say' the request in question to the princess's$_{a(p)}$ father$_{k(b)}$ (*P* FoR). The embodied experiences of fear and self-preservation also prompt the [poor man]'s$_{s(m)}$ negative response (negative social stance) to princess's$_{a(p)}$ suggestion, hence the reason it is plausible that his belief of being killed in making the request is strong. His$_{s(m)}$ caution against the princess's$_{a(p)}$ suggestion also instantiates DEONTIC INCONGRUENCE, viz., disagreement about what *ought* to be the case/be done in a FoR (Stevanovic & Peräkylä 2012; Smart, Pollock, Aikman, & Willoughby 2018: 104; Stevanovic

2018). While *kama* is truth-functional in (30), the construction is not biconditional because of the embodied possibility that he$_{s(m)}$ could be killed by the king$_{k(b)}$ for a different reason.

In (31) below, *kama* has a truth-functional reading in a biconditional construction:

(31) Saloné (1983a: 314–315)

Jambo$_j$	*la*	*ku-zingatia*	*ni*	*kwamba*	[*ujamaa$_u$*	*na*	
5matter	5of	INF-remember	AUX	that	11socialism	CONJ	
ku-ji-tegemea$_t$	*ku-na-wezekana*]$_Q$	*tu*	[***kama***	*tu-na-zalisha*	*zana$_z$*	*na*	
INF-REFL-rely	15-PRS-be.possible	only	**CONJ**	1PL-PRS-produce	10products	CONJ	
vitu$_v$	*vya*	*ku-kidhi*	*mahitaji$_m$*	*yetu*	*wenyewe*]$_P$.		
8things	8of	INF-satisfy	6needs	2PL.POSS	our.own		

'Something$_j$ to bear in mind is that [socialism$_u$ and self-reliance$_t$ are only possible]$_Q$ [*iff* we$_{\{s,\,a\}}$ produce products$_k$ and the things$_v$ to satisfy [our$_{\{s,\,a\}}$ own needs]$_m$]$_P$.'

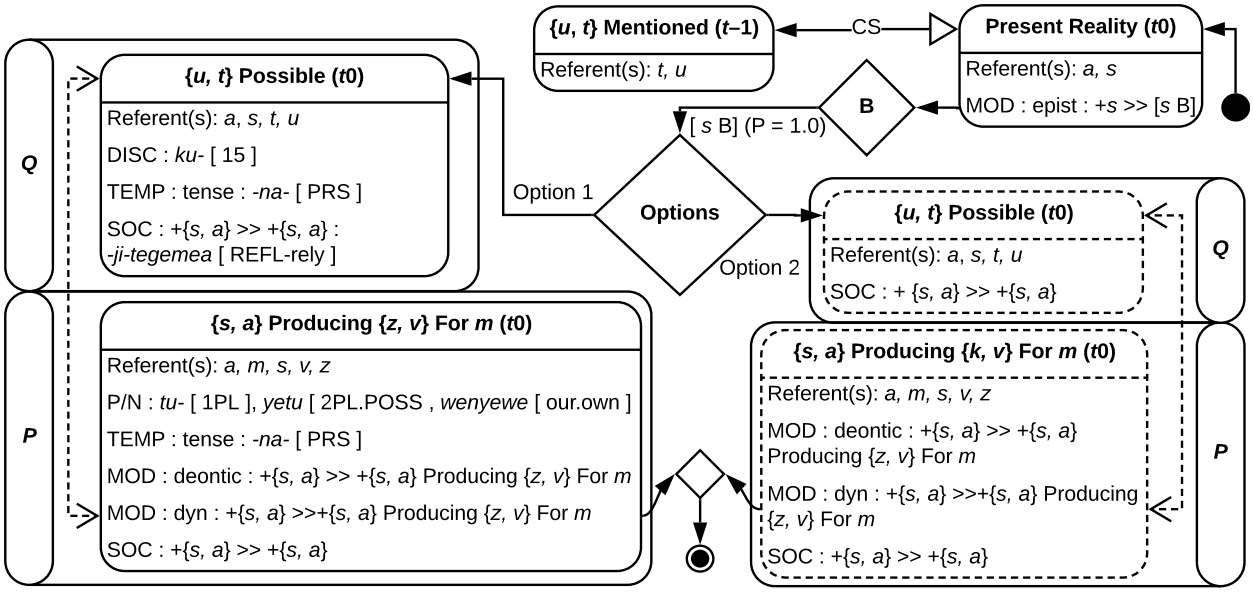

Figure 27. The *kama* conditional conjunction indicating a T-value (True) for the protasis (*P*) (Saloné 1983a: 314–315).

Referent(s): *a* = addressee(s), *m* = [speaker's and addressees' needs], *s* = speaker, *u* = socialism, *t* = self-reliance, *v* = things, *z* = products

In Figure 27 above for (31), the information flow downstream of the epistemic stance of the speaker$_s$ (upper right FoR) is logical rather than also being temporal. Moreover, the *tu* 'only' adverb preceding *kama* above grammatically encodes the constructional biconditionality. The FoRs in the expressed *realis* (Option 1, left) and implied *irrealis* (Option 2, right) scenarios contain opposite collective deontic and dynamic stance and status values of the speaker$_s$ and the

addressees$_a$, respectively. The dependency arrow in each scenario indicates a codependency (§3.3.2.6) between T-values for the cultural practices of socialism$_u$ and self-reliance$_k$ (*Q* FoRs). If one of the *P* or *Q* FoRs is hypothetically True at *t*0 (present), so is its complementing proposition at *t*0. The logically inverse interrelation applies when one or the other is False. Whether or not the speaker$_s$ is amicable toward these practices is unclear, so a corresponding deontic stance value is omitted in the Present Reality FoR (*t*0).

When *kama* appears with a negation marker (e.g., *ha-*, *sipo-*, see Beaudoin-Lietz 1997 and Contini-Morava 2011), it co-produces[19] a truth-functional interpretation of False (P = 0.0) for the protasis in (32):

(32) Musyoki & Murphy (1985: 7, 107)

Bani-Sadr$_b$	*a-li-tahadharisha*	*kuwa*	[***kama***	*hali$_h$*	*hiyo*
Bani-Sadr	3SG-PST-caution	that	**CONJ**	9situation	9REF

ha-i-ta-patikana]$_P$,	[[*basi*	*nchi*	*yake*]$_i$	*i-ta-lazimika*	*kw-enda*
NEG-9-FUT-be.available	then	9country	3SG.POSS	9-FUT-be.obliged	INF-go

[*sehemu*	*nyingine*]$_n$	*na*	*ku-fanya*	*nazo*	*biashara*]$_Q$
9region	9other	CONJ	INF-do	with.3PL	9trade

‘Bani-Sadr$_b$ cautioned that [if this situation$_h$ (previously mentioned) was not realized]$_P$, [his$_b$ country (Iran)]$_i$ would be obliged to go [other regions]$_r$ and trade (with them)$_o$]$_Q$.’

Before the text above in (32) from a Tanzanian newspaper that is modeled Figure 28 below, Bani-Sahr$_b$ as a representative of Iran$_i$ insists (positive deontic stance, negative social stance, second from upper left FoR) that [European nations (unspecified, but not Russia)]$_e$ relying on the [United States]$_u$ and Russia$_r$ must diversify their$_e$ trade (positive deontic and dynamic stances, middle right FoR) or lose trading privileges with Iran$_i$.

---

[19] Since all Swahili conditional conjunctions (i.e., *ikiwa*, *iwapo*, *endapo*, *kama*) consistently indicate a T-value (True) for protases, this pattern of combining with a negation marker to indicate a T-value (False) arguably applies to all four conjunctions. However, space constraints prohibits demonstration.

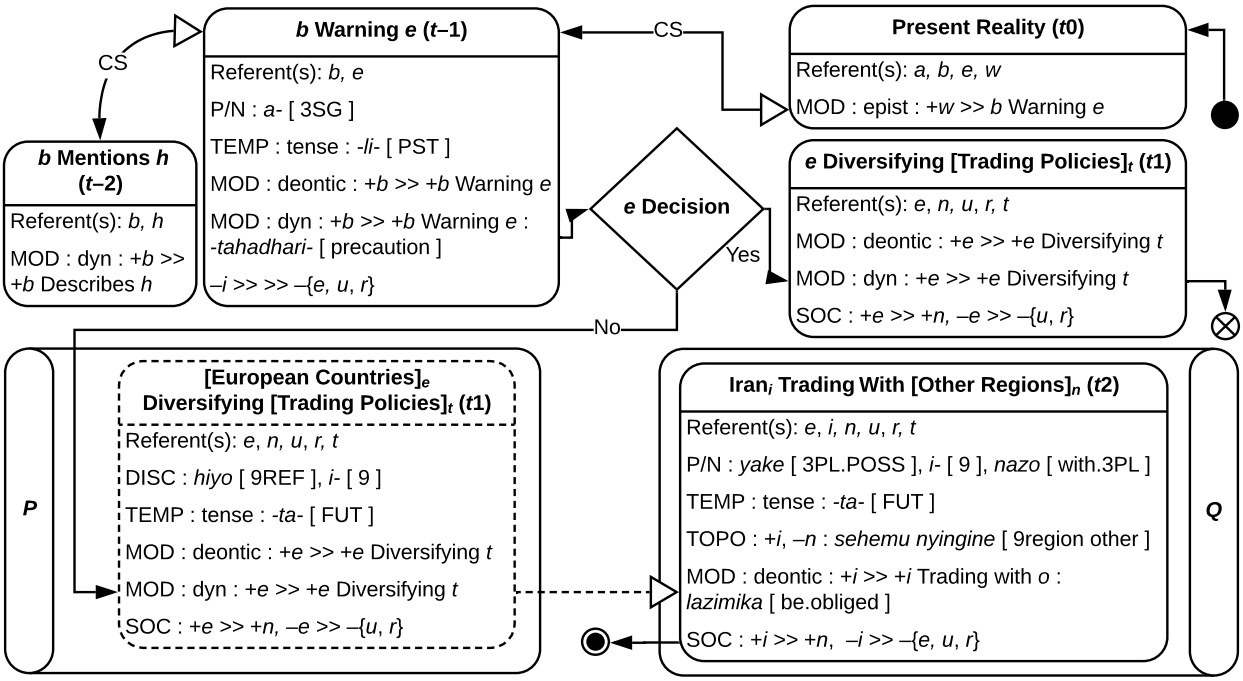

Figure 28. The *kama* conditional conjunction combining with the *ha-* negation marker to indicate a T-value (False) for the protasis (*P*) (Musyoki & Murphy 1985: 7, 107).

Referent(s): *a* = addressees, *b* = Bani-Sadr, *e* = [European nations (unspecified, but *not* Russia)], *h* = [previously mentioned situation], *i* = Iran, *n* = [other regions], *u* = [United States], *r* = Russia, *w* = writer

This scenario is the previously mentioned situation$_h$ (upper left FoR) that, if not realized (False, P = 0.0, *P* FoR), will suffice for Iran$_i$ being obliged (positive deontic status, *Q* FoR) to trade with countries$_o$ in [other regions]$_n$ instead.

The *kama* conjunction combines in (32) with the *ha-* negation marker and the verb *patikana* 'be.available' to portray a hypothetical future *irrealis* scenario of the [European nations]$_e$ *not* diversifying their$_e$ trade strategies (*P* FoR). The inverse scenario of their$_e$ deciding to do so (positive deontic and dynamic stances, middle right FoR) is contextually underspecified for outcome (Exit node). This fact precludes a biconditional reading of (32). For instance, Iran$_i$ may decide to trade with [other regions]$_o$, but for a reason unanticipated by any of the involved nations as collective Agents. Further instances of *kama* appear in (33), (35), and (38).

4.3 *Irrealis* conditional constructions

4.3.1 Overview

Two conditional prefixes (*nge-* and *ngali-*/*ngeli-*) occur as verbal prefixes in Swahili *irrealis* conditional constructions. The *nge-* prefix usually appears in low-probability (e.g., hypothetical, imaginary) constructions but also occasionally in counterfactual constructions (e.g., see Myachina 1981: 76–77). In contrast, the *ngali-*/*ngeli-* prefix primarily appears in counterfactual constructions (Mwamzandi 2017: 157). Mwamzandi (2017) observes that, in the HCS, 96 percent of ngeli-/ngali- tokens express 'impossible/false', while only 64 percent of nge- tokens have this interpretation. Following Mwamzandi (2017) and Saloné (1983a, 1983b), this study assumes *ngali-* and *ngeli-* are allomorphs in standard Swahili (e.g., HCS 1.0 and HCS 2.0) (cf. Mohamed 2001: 166–167). Both prefixes denote P-values and have semantic scope over the conditional conjunctions that denote T-values (defeasibility) of protases.

Some linguists (e.g., Mwamzandi 2017: 164) reserve the term 'counterfactual' for impossible/false constructions (P = 0.0). Others (e.g., Givón 2011: 141–142) also use the term HYPOTHETICAL COUNTERFACTUAL to denote an event that did not or does not occur, but could, should, or would have been/would be otherwise (e.g., P = 0.3). Since doing so distinguishes between impossible and possible counterfactual FoRs, discussions in the following sections evoke this distinction where applicable.

4.3.2 *nge-* conditional prefix

The *nge-* prefix indicates low probability (i.e., P ≤ 0.4; see §3.3.2.1, Table 7; Leonard 1980) and is sometimes syntactically introduced by a conditional conjunction such as *kama* or *iwapo* (Saloné 1983b). In (33), *nge-* indicates a moderate probability (P = 0.4) of the *P* FoR and is introduced by *kama*:

(33) Mwamzandi (2017: 160)

Tanzania$_t$	*ni*	*nchi*	*kubwa*	*na*	*yenye*	*heshima*$_h$	*katika*	*eneo*$_e$	*hili,*
Tanzania	AUX	9country	9big	CONJ	has	9respect	PREP	5area	5PROX

lakini	[***kama***	*i-**nge**-zi-bana*	[*nchi*	*zi-na-zo-i-shambulia*	*Congo*]$_j$]$_P$,
but	**CONJ**	9-**COND**-10-press	10countries	10-PRS-10REL-9-attack	Congo

[*waasi*$_r$	*wa-si-**nge**-kuwa*	*na*	*nguvu*$_n$	*wa-li-zo-na-zo*	*sasa*]$_Q$.
2rebels	3PL-NEG-**COND**-AUX	with	10power	3PL-COP-10REL-with-10REL	now

'Tanzania$_t$ is a large country which has respect$_h$ in this region$_e$, but [if it$_t$ would press the [countries attacking Congo]$_a$]$_P$, [the rebels$_r$ would not have the power$_n$ they$_r$ have now]$_Q$.'

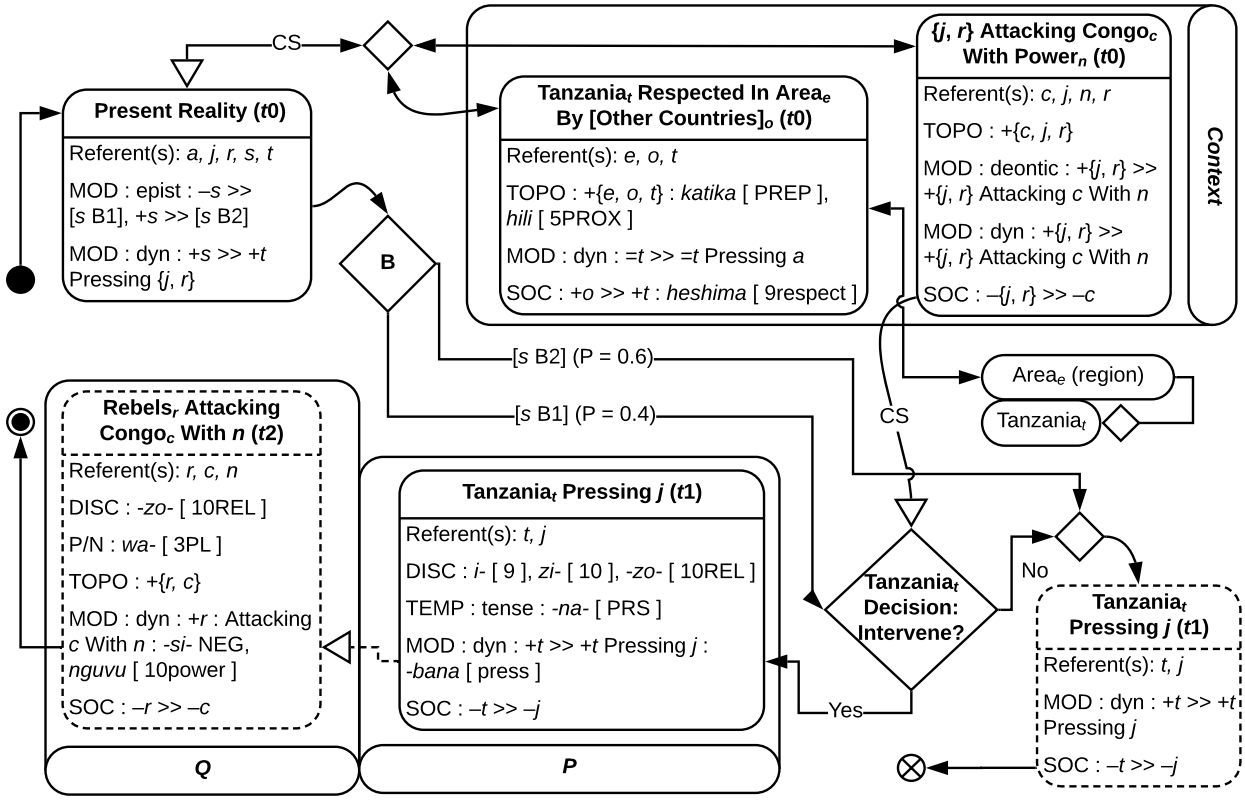

Figure 29. The *nge-* conditional prefix indicating a P-value (P = 0.4) for the protasis (*P*) (Mwamzandi 2017: 160).

Referent(s): *a* = addressee, *e* = area (region), *h* = respect, *j* = [countries attacking Congo], *n* = power, *r* = rebels, *s* = speaker, *t* = Tanzania

The speaker$_s$ in (33) takes a positive epistemic stance toward two complementary (i.e., P-values add to P = 1.0) beliefs (Figure 29, center). The speaker's$_s$ foreground belief is that Tanzania$_t$ pressing (positive dynamic stance, negative social stance, *P* FoR) the [countries attacking Congo]$_a$ *would* suffice for the *nguvu*$_n$ 'power' of the rebels$_r$ being weakened (*Q* FoR). The *nge-* marker functions to express doubt (negative epistemic stance, P = 0.4) that Tanzania$_t$ will pursue

this course of action. The speaker's$_s$ complementary background belief (positive epistemic stance) that it will *not* intervene on Congo's$_c$ behalf (P = 0.6). This doubt (negative epistemic stance) arises for the speaker because Tanzania$_t$ is taking no action at *t*0 (neutral dynamic stance, left context FoR), despite being aware of (having cognitive access to, contextual scope (CS) arrow) Congo's$_c$ need of external diplomatic or military intervention (shared encyclopedic knowledge, right context FoR). The *si-* negation marker before *nge-* in the apodosis contrasts the right contextual FoR and the logically inverse *irrealis Q* FoR with dashed borders (bottom left).

In the narrative excerpt below in (34), *nge-* denotes a low-probability *P* FoR realization:

(34) Saloné (1983b: 65–66)

Bahati$_b$	*a-li-po-rejea*	*kwao$_{\{b,\,m\}}$*	*ha-ku-m-kuta*	*mama$_m$*	*nyumba$_k$-ni.*		
Bahati	3SG-PST-16REL-return	3PL.POSS	NEG-PST-3SG-find	mother	9home-LOC		
a-li-kuwa	*a-me-kwenda*	*kwa*	*jirani$_j$*	*ku-twanga*	*mchele$_q$*	*wake$_m$*	
3SG-PST-AUX	3SG-PRF-go	to	5neighbor	INF-pound	11rice	3SG.POSS	
biashara$_v$	*ingawa*	*siku$_s$*	*zote*	*a-ki-sema*	[*kuwa*	[M*ungu$_g$*	*a-**nge**-m-jalia*]$_P$,
9business	although	10days	10all	3SG-IPFV-say	that	1God	3SG-**COND**-3SG -bless
[*a-**nge**-nunua*	*kinu$_o$*	*chake$_m$*	*mweneyewe*]$_Q$	*kwani*	*uso$_u$*	*u-me-umb-w-a*	
3SG-**COND**-buy	7mortar	3SG.POSS	her.own	since	11face	11-PRF-shape.PASS.FV	
na	*haya$_h$*,	*na-ye*	*a-me-choka*	*ku-piga*	*hadi*	*kwa*	*majirani$_j$.*
PREP	9shame	and-3SG	3SG-PRF-be.tired	INF-beat	until	to	6neighbors

'When Bahati$_b$ returned to their$_{\{b,\,m\}}$ home$_k$, she$_b$ didn't find her$_b$ mother$_m$.
She$_m$ had gone to a neighbor's$_j$ to pound her$_m$ rice$_q$ for her$_m$ business$_v$, even though every day$_s$ she$_m$ says that, [if God$_g$ were to bless her$_m$]$_P$, [she$_m$ would buy her$_m$ own mortar$_o$]$_Q$ since her$_m$ face$_u$ is disfigured by shame$_h$, and she$_m$ is tired of going to her$_m$ neighbors'$_j$.'

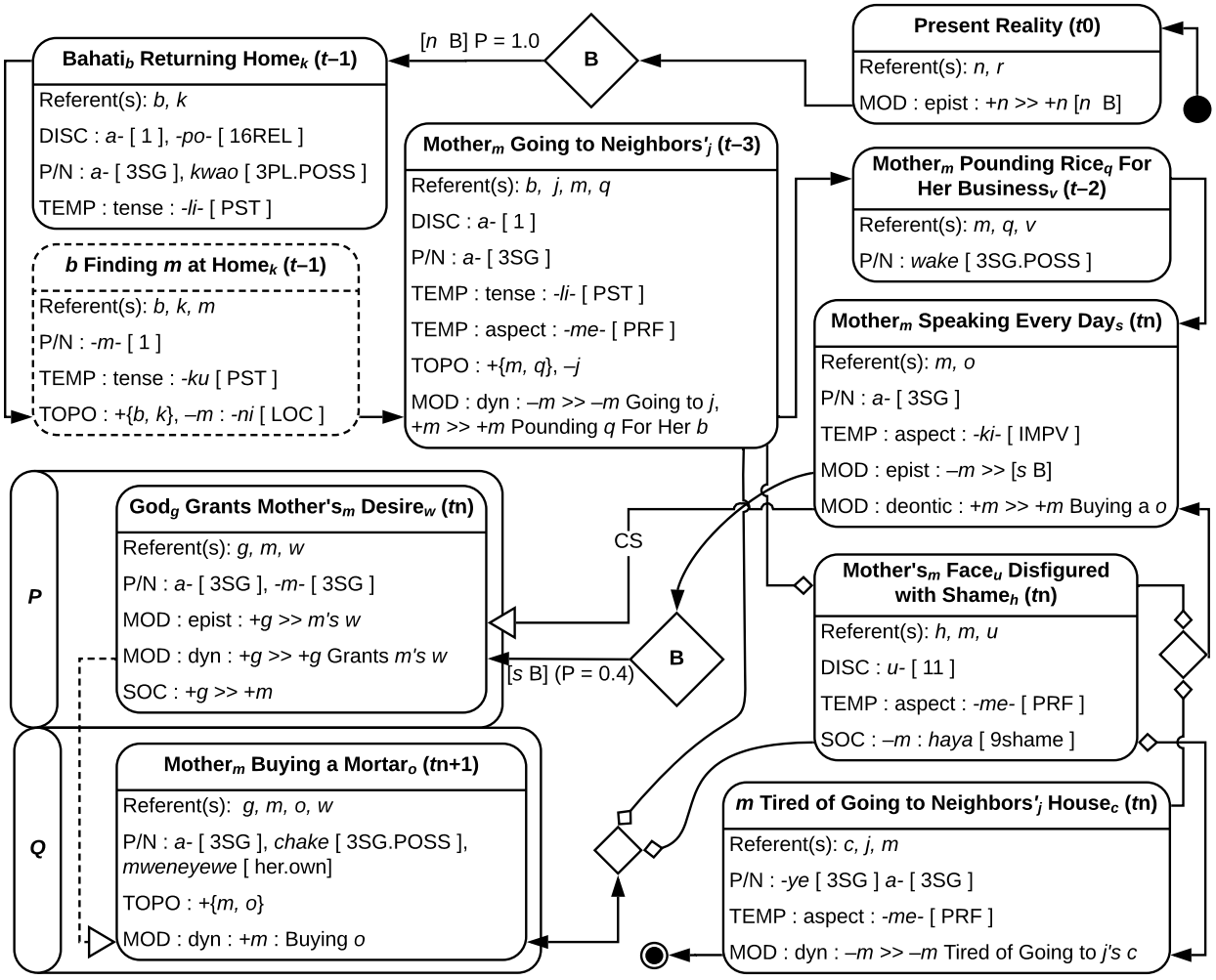

Figure 30. The *nge-* conditional prefix indicating a P-value (P = 0.4) for the protasis (*P*) (Saloné 1983b: 65–66).

Referent(s): *b* = Bahati, *c* = house, *g* = God, *h* = shame, *j* = neighbor's (house), *k* = home, *m* = [Bahati's mother], *n* = narrator, *r* = reader, *s* = day, *u* = face, *o* = mortar, *q* = rice, *v* = business, *w* = [Bahati's mother's desire]

In Figure 30 for (34) above, the reason Bahati's$_b$ mother$_m$ was away when Bahati$_b$ returned home was her$_m$ intention (positive dynamic stance, top center FoR) to pound *mchele*$_q$ 'rice' for her$_m$ *biashara*$_v$ 'business' (context FoR, second top right), despite her$_m$ distaste (negative dynamic stance, top center FoR) of going to a *jirani*$_j$ 'neighbor's (house)' to do so. The protasis and apodosis *nge-* prefixes jointly indicate Bahati's$_b$ mother's$_m$ doubt (negative epistemic stance) that God$_g$ will fulfill her wish$_w$ to have a mortar$_m$. God's$_g$ hypothetical doing so (positive dynamic and social stances, *P* FoR) would suffice for her$_m$ being able (positive dynamic status, *Q* FoR) to

purchase a mortar$_m$. The data does not contain information about whether Bahati's$_b$ mother$_m$ has already asked for the mortar$_m$ or whether she$_m$ believes doing so is a necessary and/or contributing condition (aggregation, small head arrows) to God's$_g$ fulfilling her$_m$ wish$_w$. As such, the FoR network does not model these factors.

While the data is underspecified for these details, Figure 30 for (34) also illustrates a limitation of my methodology, namely, that several backgrounded but contextually relevant features cannot be modelled for the sake of space. For instance, one instance of Bahati's$_b$ mother$_m$ going to the [neighbor's house]$_j$ alone (top center FoR) may or may not a contributing condition for her$_b$ desire to buy the mortar$_m$, but repeated instances together form a contributing condition (not shown) to her$_b$ face being filled with shame$_h$. All instances of her going (not shown), joined with her weariness, are jointly sufficient for her face being filled with shame.

In (41) below, *nge-* marks a hypothetical *P* FoR as improbable yet possible (P = 0.2):

(35) Saloné (1983b: 57)

[***Kama***	*ni-**nge**-kuwa*	*tajiri*]$_P$,	[*ni-**nge**-jenga*	*nyumba*$_n$	
CONJ	1SG-**COND**-AUX	rich	1SG-**COND**-build	9house	
nzuri	*kando*	*ya*	*bahari*$_b$]$_Q$.		
9nice	beside	of	9ocean		

'[If I$_s$ were rich]$_P$, [I$_s$ would build a nice house$_n$ beside the ocean$_b$]$_Q$.'

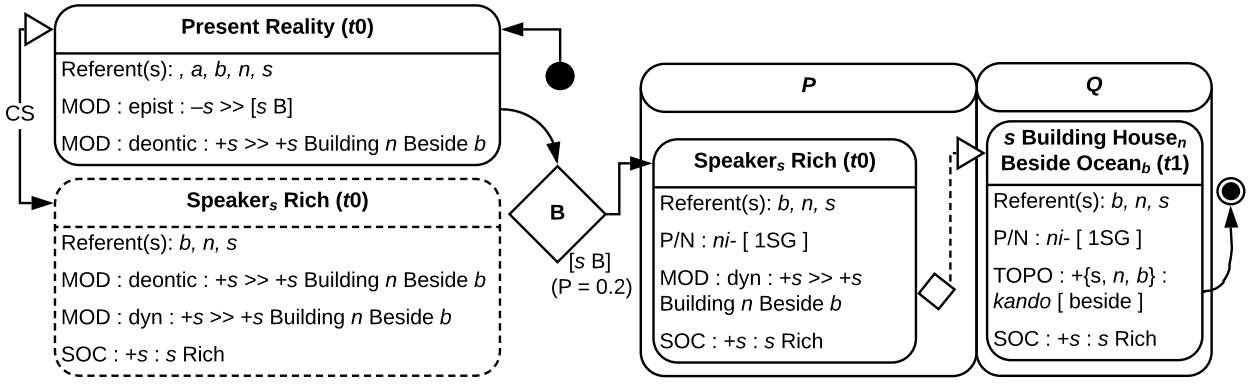

Figure 31. The *nge-* conditional prefix indicating a P-value (P = 0.2) for the protasis (*P*) (Saloné 1983b: 57).

Referent(s): *a* = addressee(s), *b* = ocean, *n* = house, *s* = speaker

In (35) and Figure 31, the speaker$_s$ desires (positive deontic stance) to build a *nyumba*$_n$ 'house' beside the *bahari*$_b$ 'ocean' (*realis Q* FoR, *t*0), but doubts (negative epistemic stance, *P* FoR) that this event is likely to occur. The *kama* conjunction introduces the protasis *nge-* (syntactic scope) and portrays the *P* FoR (*t*0) as hypothetically *realis*. The *nge-* prefix, however, has semantic scope over *kama* and depicts the logically upstream contextual FoR (bottom left) as *irrealis*. The hypothetical *P* FoR is understood as present (*t*0), even though the *na-* present marker does not appear in the protasis (Saloné 1983b: 57). Also, the *Q* FoR is understood as future (*t*1), even though the future marker *ta-* does not appear in the apodosis; one must be rich (positive dynamic status, positive social status) *before* building a house on expensive waterfront property—a logically upstream embodied contextual constraint (context FoR).

In contrast with (35), the construction in (36) below is marked for present tense (*na-*) as the writer$_w$ depicts a hypothetical counterfactual *P* FoR as *realis* (bottom left). Also, the *laiti* 'if only'[20] conjunction syntactically introduces and thus has syntactic scope over *nge-*:

(36) Hurskainen (2016)

[***Laiti***	*a-**nge**-kuwa*	*kiongozi*$_k$]$_P$,	[*basi*	*jamii*$_j$		*a-na-yo-i-ongoza*	
if.only	3SG-**COND**-AUX	7leader	then	9community		3SG-PRS-9REL-9-lead	
*i-**nge**-faidi*]$_Q$,	*sana*	*li-na-po-kuja*		*suala*$_q$	*la*	*ushirikishwaji*$_u$.	
9-**COND**-benefit	very	5-PRS-16REL-come		5issue	5of	11involvement	

'[If only he$_a$ were a leader$_k$]$_P$, [then the community$_j$ he$_a$ leads would greatly benefit]$_Q$, especially when it comes to the issue$_q$ of involvement$_u$.'

[20] The meaning of *laiti* 'if only' is not equivalent to *iff* (biconditional). See the discussion later in this section.

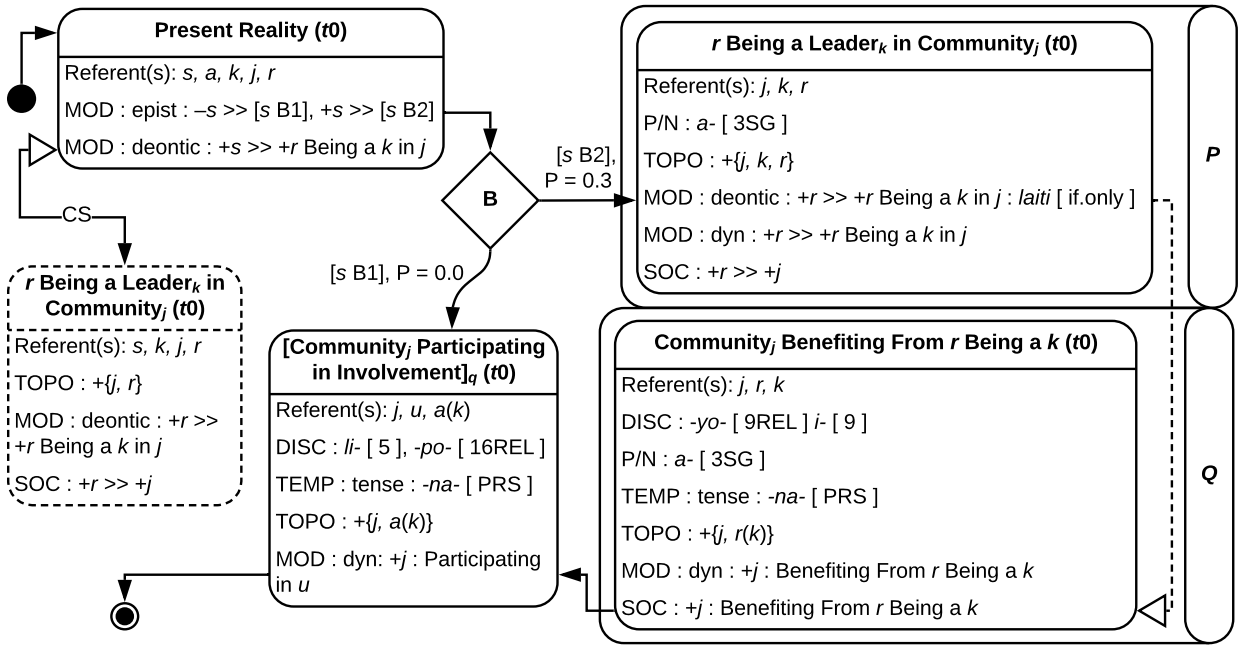

Figure 32. The *nge-* conditional prefix indicating a P-value (P = 0.3) for the protasis (*P*) (Hurskainen 2016).

Referent(s): *a* = addressee(s), *j* = community, *k* = leader, *s* = speaker, *q* = issue, *u* = involvement

The speaker$_s$ in (36) and Figure 32 above adds the protasis *nge-* to deny (negative epistemic stance, [*s* B1], P = 0.0) that the community$_j$ is presently involved (*ushirikishwaji*$_u$ 'involvment') together in events and actions (bottom center FoR). The speaker$_s$ argues that the referent *k* being a leader$_k$ (positive deontic, dynamic and social stances, *P* FoR) *would* suffice for the *jamii*$_j$ 'community' benefiting (positive social stance, *Q* FoR) by participating in involvement (positive dynamic stance, bottom center FoR). However, the speaker$_s$ is skeptical (negative epistemic stance, [*s* B2] (P = 0.3) about the *P* FoR being *realis* at any given time (*t*n). For the speaker$_s$, had it already been such, the community would now be benefiting. So, the apodosis *nge-* denotes a modal prediction in contrast with the *irrealis* contextual realities (context FoR), much as does the modal verb 'would' in future constructions.

As for the *laiti* 'if only' conjunction that introduces the protasis, no research has focused on its semantic and pragmatic functions, let alone in conditional constructions. In Arabic, from whence *laiti* was borrowed, it functions as an optative interjection ('oh, (I wish) that') (Baldi &

Toscano 2015). It has an equivalent isomorphic function in Swahili, as in *Hii ndiyo radhi ya mama yangu.* ***Laiti*** *ningemsikiliza* 'This is my mother's curse. I **wish** I had listened to her' (Wakota 2014: 52). For this study, however, its isomorphism as a clause-introducing conjunction with pragmatic implicatures is of greater interest, although space prohibits discussing it at length. A further example appears in (40) as it co-occurs with the *ngali-*/*ngeli-* conditional prefix.

The epistemic dimension of *laiti* as a conditional conjunction, as seen in (36) above, is truth-functional, in that it expresses counterfactuality (upper left FoR) while also encoding an Agent's presupposition that an interlocutor agrees regarding given (old) information (context FoR). In the deontic dimension of *laiti*, it expresses an Agent's desire for an *irrealis* action, event, or state-of-being to obtain in an inverse FoR. In (36), *laiti* denotes speaker$_s$-addressee$_a$ agreement on the referent$_a$ *not* being a leader$_k$ presently (context FoR) but also expresses the speaker's$_s$ desire (positive deontic stance) of opposite being the case (*P* FoR).

4.3.3 *ngali-*/*ngeli-* conditional prefix

To review, the *ngali-*/*ngeli-* conditional prefix usually appears in counterfactual constructions, but also in low probability constructions (i.e., $P \leq 0.4$; see §3.3.2.1, Table 7). In logic, two counterfactual types are possible: additive and subtractive (Roese & Olson 1993; Guajardo, Parker, & Turley-Ames 2009: 684). The former denotes an Agent *adding* an action, event, or embodied state-of-being as a 'difference-making' factor (Menzies 2004) to a 'fact' FoR to depict a 'counterfactual' FoR. The latter, as the logically inverse form, denotes an Agent *subtracting* a 'difference-making' factor (i.e., an event or state-of-being) from a 'fact' FoR to depict a 'counterfactual' FoR.

In (37), *ngali-* appears in both the protasis and apodosis of an additive hypothetical counterfactual:

(37) Beaudoin-Lietz (1999: 135)

Mti$_m$	*huu*	[*u-**ngali**-anguk-a*]$_P$,	[*u-**ngali**-ni-u-a*]$_Q$.
3tree	3PROX	3-**COND**-fall-FV	3-**COND**-1SG-kill-FV

'[This tree$_m$, if it$_m$ had fallen]$_P$, [it$_m$ would have killed me$_s$]$_Q$.'

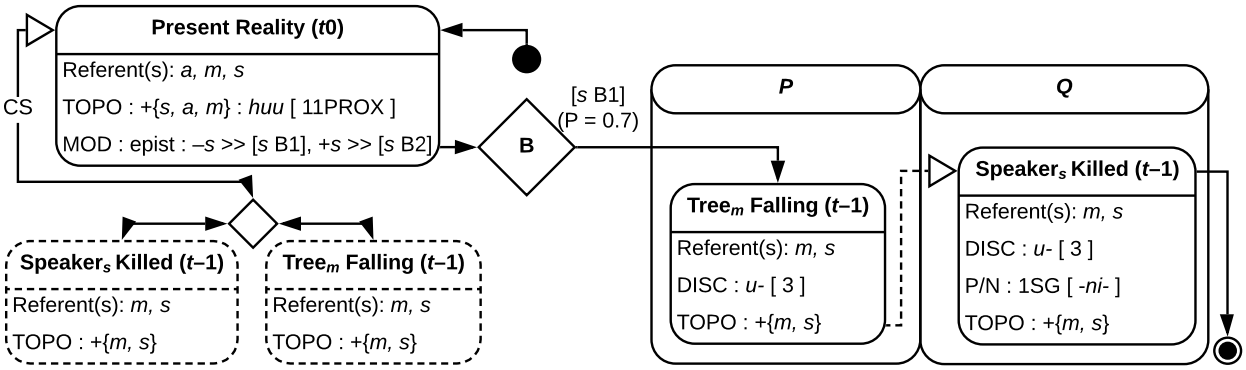

Figure 33. Additive hypothetical counterfactual. The *ngeli-/ngali-* conditional prefix indicating a contrast between a hypothetical counterfactual scenario (upper right FoRs) and an *irrealis* contextual scenario (two bottom left FoRs) (Beaudoin-Lietz (1999: 135).

Referent(s): *a* = addressee(s), *m* = tree, *s* = speaker

In (37) and Figure 33, the speaker$_s$ adds the foreground 'difference-making' factor of the tree$_m$ falling in the *irrealis* contextual FoR (*t*–1) (bottom second from left FoR, [*s* B1] P = 0.0 (False) background belief) to depict a hypothetical counterfactual scenario (*P* and *Q* FoRs). The protasis *ngali-* expresses the speaker's$_s$ negative epistemic stance toward the tree$_m$ falling at *t*–1 ([*s* B2] as her$_s$ foreground belief. As the apodosis *nge-* in (37) denoted a modally qualified prediction in contrast with the *irrealis* context FoR, so also does the apodosis *ngali-* in (37) above. A noteworthy embodied deictic property value in (37) is the speaker's$_s$ topographic proximity (*huu* '3PROX', upper left FoR) to the tree$_m$. Had the speaker$_s$ been positionally distal relative to the tree$_m$ at *t*–1, such would have sufficed for an *irrealis Q* FoR identical to the left context FoR in which he does *not* die, even if the tree$_m$ falls.

Next, (38) is an additive counterfactual construction in which T-values are bracketed within a context known to be untrue—a fictional narrative (see Semeijn 2019 on propositional attitudes toward fictional accounts in embodied social cognition):

(38) Ashton (1993 [1944]: 259; (Beaudoin-Leitz 1999: 134)

[*Wa-toto*$_w$	*hao...*	***kama***	*wa-**ngali**-kuw-a*	[*wa-ki-ka-a*	*sana*]$_h$]$_P$,	
2-2children	2REF	**CONJ**	3PL-**COND**-be-FV	3PL-IPFV-stay-FV	too.long	
[*ha-wa-**ngali**-weza*	*ku-pand-a*	*ku-rud-i*	*kwao*	*katika*	[*Nchi*	
NEG-3PL-**COND**-be.able	INF-go.up-FV	INF-return-FV	PREP	PREP	9land	
ya	*Mawingu*]$_m$]$_Q$.					
9of	6clouds					

'[If these children$_t$ had been in the [habit of staying too long]$_h$]$_P$, [they$_w$ would have been unable to go up and return [home to Cloudland]$_m$]$_Q$.'

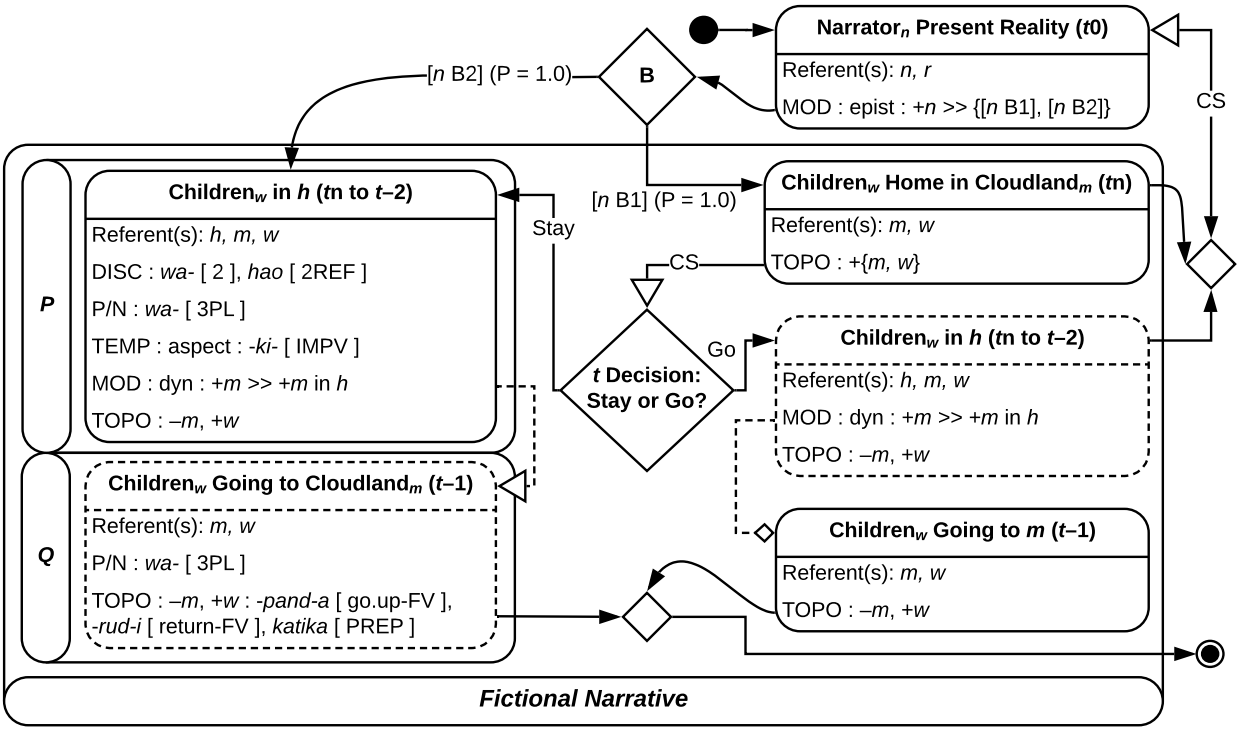

Figure 34. Additive hypothetical counterfactual. The *ngeli-/ngali-* conditional prefix indicating a contrast between a hypothetical counterfactual 'Stay' scenario (*P* and *Q* FoRs) and a *realis* contextual 'Go' scenario (middle right and bottom right FoRs) (Ashton (1993 [1944]: 259; (Beaudoin-Leitz 1999: 134).

Referent(s): *a* = addressee(s), *h* = [habit of staying too long], *m* = [children's home in Cloudland] *s* = speaker, *t* = children

The narrator$_n$ in (38) and Figure 34 holds two provisional beliefs (positive epistemic stance) for the sake of telling a children's tale, viz., (a) [*n* B1] that within the narrative, since the children's$_t$ home is in [*Nchi ya Mawingu*]$_m$ 'Cloudland' (background belief) and (b) [*n* B1] that the *P* FoR being *realis* would have sufficed for the *Q* FoR becoming *realis* since the children$_t$ did not make a habit of staying too long (*irrealis* FoR, center right). The added 'difference-making' factor to

the hypothetical *P* FoR that did not occur (contextual FoR to Narrator Present Reality *t*0) was the children$_t$ habitually staying too long (positive deontic stance, middle right *irrealis* FoR). Their reason for staying too long, where they were staying too long, and why these factors make a difference for the embodied experiences of the children are unspecified in this example. Without considering pragmatic factors and context-sensitivity, the construction in (38) is uninterpretable, and not merely because it is within a fictional narrative; without pragmatics and context, no conditional construction is interpretable.

Next, the *ngali-* in (39) below co-occurs with the negation marker *si-* to form a subtractive hypothetical counterfactual construction:

(39) Polomé (1967: 152)

[*Si-**ngali**-kuw-a*	*ni-me-chok-a*]$_P$,	*ni-**ngali**-tembe$_t$-a*	*mji-ni*]$_Q$.
1SG.NEG-**COND**-be-FV	1SG-PRF-be.tired-FV	1SG-**COND**-stroll-FV	3town$_m$-LOC

'[If I$_s$ had not been tired]$_P$, [I$_s$ would have strolled around town$_m$]$_Q$.'

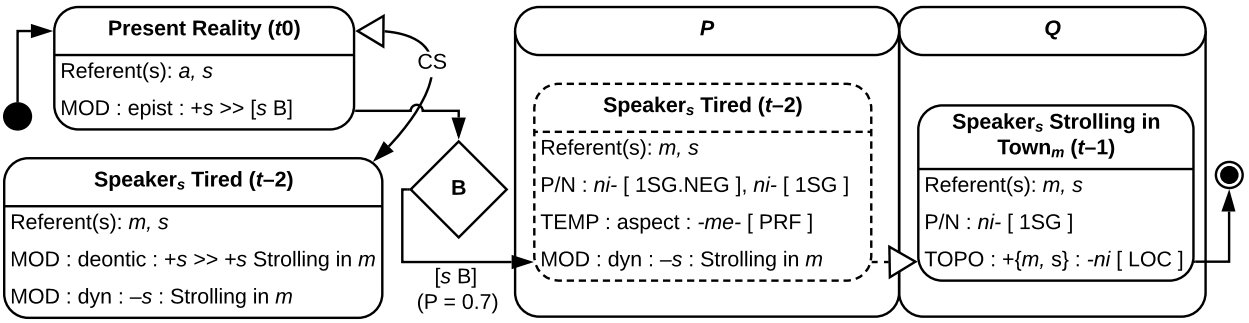

Figure 35. Subtractive hypothetical counterfactual. The *ngeli-/ngali-* conditional prefix indicating a contrast between a past hypothetical counterfactual *irrealis* scenario (*P* and *Q* FoRs) and a past *realis* contextual FoR (bottom left) (Polomé 1967: 152).

Referent(s): *a* = addressee(s), *m* = town, *s* = speaker

The speaker$_s$ in Figure 35 for (39) subtracts the embodied state-of-being of being tired (*ni-me-chok-a* 1SG-PRF-be.tired-FV) from the *realis* contextual FoR (bottom left) to create an *irrealis P* FoR. The speaker's$_s$ desire to walk (positive deontic stance) was contingent upon this embodied condition of not being tired at *t*–2. The speaker$_s$ being able and willing (positive dynamic stance, *P* FoR) to stroll in (*-ni* LOC) town$_m$ (*Q* FoR).

Earlier in (36), the *laiti* 'if only' conjunction syntactically introduced and thus had syntactic scope over the *nge-* in a counterfactual construction. In (40) below, *laiti* does so for the *ngali-*/*ngeli-* conditional prefix in a subtractive hypothetical counterfactual:

(40) Hurskainen (2016)

[***Laiti***	*i-si-**ngali**-kuwa*		*vita*$_v$]$_P$,	[*Kongo*$_c$	*i-**ngali**-beba*			*jukumu*$_j$		*kubwa*	
If.only	9-NEG-**COND**-AUX		7war	Congo	9-**COND**-carry			5influence		big	
katika	*eneo*$_e$	*hilo*]$_Q$,	*na*	*hasa*	*kutokana*	*na*	*utajiri*$_u$	*wake*	*wa*	*madini*$_m$.	
PREP	5area	5REF	CONJ	especially	deriving	PREP	11wealth	3SG.POSS	11of	6minerals	

'[If only there had not been a war$_v$]$_P$ [Congo would have had a significant influence$_j$ in this area$_e$]$_Q$, especially given its wealth$_u$ of minerals$_m$.'

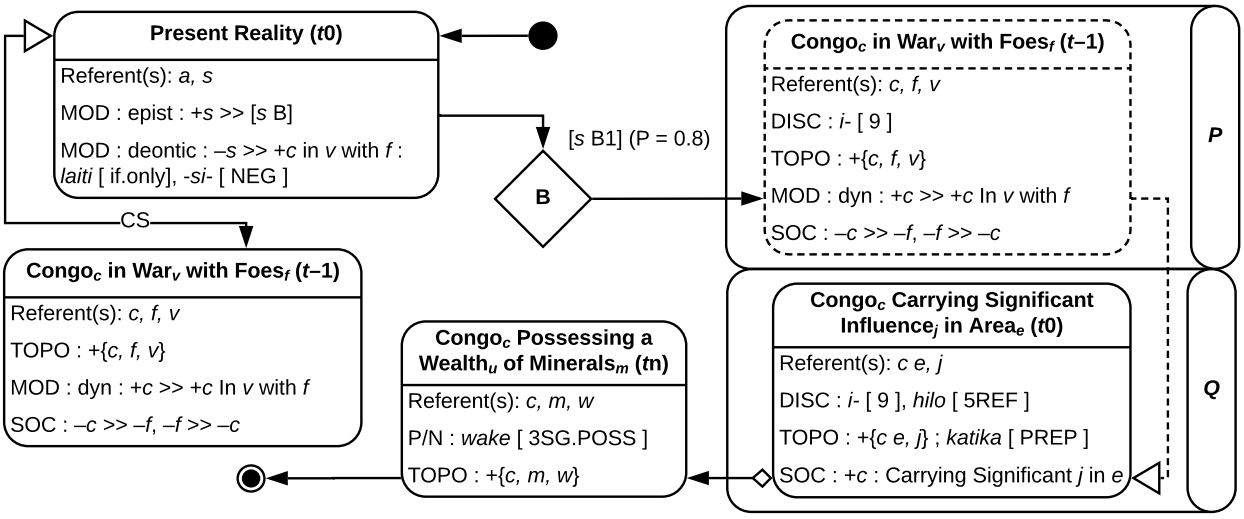

Figure 36. Subtractive hypothetical counterfactual. The *ngeli-*/*ngali-* conditional prefix indicating a contrast between a past hypothetical counterfactual *realis* context scenario (bottom left FoR) and a past *irrealis* scenario (*P* and *Q* FoRs) (Hurskainen 2016).

Referent(s): *a* = addressee(s), *c* = Congo, *e* = area (region), *j* = influence, *m* = minerals, *s* = speaker, *u* = wealth, *v* = war

The *ngali-*/*ngeli-* prefix already tends to indicate counterfactuality without *laiti*. The addition of *laiti* in (40) and Figure 36 expresses an augmented pragmatic valence (intensity) of the speaker's$_s$ desire (positive deontic stance) that the *realis* context FoR would have been *irrealis* instead (*P* FoR). The speaker$_s$ believes (positive epistemic stance, upper left FoR) that Congo$_c$ not warring with its foes$_f$—taking negative dynamic stance would have sufficed for Congo$_c$ profiting (positive social status, *Q* FoR) from its mineral$_m$ resources and political influence$_j$ (bottom middle FoR). Finally, note that the deontic stance values for Congo$_c$ in this example are

not shown since it is not clear without further context whether or not Congo$_c$ desire the referenced war$_v$ with its$_c$ enemies.

4.4 Conclusion

In this chapter, to show that the embodied FoR is a better heuristic than T-values and P-values alone, I operationalized UML mental spaces to model how epistemic, deontic, and dynamic stance as modal deictic properties have scope over P-values, which in turn have semantic scope over T-values. Furthermore, I showed how several constituents have semantic scope over the conjunctions and that context-sensitivity influences P-values and T-values. I argued from a Construction Grammar (CG) perspective that the Swahili conditional prefixes map P-values while the conditional conjunctions do the same for T-values. I also operationalized UML mental spaces to model how necessary, sufficient, and contributing conditions as the logical properties correlating with T-values and P-values were shown to obtain on the level of embodied FoR networks. The UML mental spaces also modeled how one type of modal stance is salient in some FoRs while another is in other examples. This finding suggests that the latter is as significant for linguistic analysis as the former. Next, §5 summarizes the thesis contents, outlines theoretical and practical implications, and offers recommendations for further research.

5. Conclusions, theoretical implications, and recommendations

In this thesis, I argued that the embodied FoR as a heuristic describes and explains the influences of modal stances context-sensitivity on conditional interpretations better than monotonic T-values and non-monotonic P-values alone. This chapter summarizes the contributions of this study (§5.1), examines theoretical implications of the findings (§5.2), evaluates their limitations (§5.3), and makes recommendations for further research (§5.4).

5.1 Contributions

In §2, I set out a preliminary synthesis of research across several disciplines to explore the research question, critically evaluated monotonic and non-monotonic analyses from an Embodied Cognition (EC) perspective, described the current empirical lacunae and advantages of (a) EC as the present theoretical framework and (b) Mental Space Theory (MST) as the present methodological approach, and reconceptualized modal stance in Embodied Cognition, showing how each type influences T-values and P-values. This finding concerns cognitive, communicative capacities, so it is relevant for studies of other languages.

In §3, I redesigned mental spaces for linguistic analysis in a UML ontology (i.e., the state machine diagram, excepting minor meta-model extensions), the *de facto* diagrammatic modeling protocol for disciplines ranging from computational linguistics and software engineering to systems biology. This study is not the first to do so with the UML state machine diagram (see Schalley 2004), which is useful for modeling linguistic changes across time indexes but is the first to operationalize UML diagrams as mental spaces (§3.3.1). Other applications for UML mental spaces are possible, such as for discourse analysis or in translation. If languages are complex, adaptive systems, an accordingly designed formalism such as mine that envisions and then visualizes linguistic and cognitive phenomena may be of some benefit in fieldwork.

§4 is the first cognitive-functional-descriptive analysis of Swahili conditional constructions. In taking this unconventional approach to data, I operationalized UML mental spaces to represent the embodied FoR as a heuristic. As a result, agentive modal stances in embodied FoRs and contexts were shown to influence T-values and P-values. Finally, in §4, I showed how necessary, sufficient, and contributing conditions as the logical properties correlating with T-values and P-values obtain on the level of embodied FoR networks. These contributions enable non-reductionist, coherent descriptions, and explanations of the semantics, pragmatics, and context-sensitivity of Swahili conditional constructions.

5.2 Theoretical implications

In addressing the research question, this study raised several issues regarding some theoretical implications of the findings. As such, consider the following argument. The UML mental spaces in §4 modeled how epistemic, deontic, and dynamic stance as pragmatic deictic properties (mapping positions and distance) have scope over T-values and P-values. Moreover, as the cited experimental studies in §1 and §2 show, the perception-action cycle in which stance-taking occurs is embodied, constant, and cyclical. In every instance of oral or written communication, an agent simultaneously perceives *and* acts. The act of *speaking* requires self-perception and intentionality in *production*. The act of *listening* requires auditory perception and intentionality in *comprehension*. Therefore, all utterances are speech acts in some sense, including those that only function to convey information, whether or not T-values or P-values obtain (Performative Hypothesis (PH), see McCawley 1968; Ross 1970; Lakoff 1972; Sadock 1974).

The PH and the findings of this study supporting it problematize Sweetser's (1990) three-way categorization seen in Mwamzandi (2017). For Sweetser, a conditional construction expressing defeasible confidence in the truth of *Q* given *P* is an EPISTEMIC CONDITIONAL. When a

'real-world' causal relation obtains between *P* and *Q*, the expression is a CONTENT CONDITIONAL. Finally, when no condition or causal relation obtains between *P* and *Q*, a conditional construction is a SPEECH ACT CONDITIONAL, in that an agent acts (e.g., promises) by using it.

In contrast, I argued that beliefs (epistemic stance) and 'real-world' agentive causal relations (deontic and dynamic stances) are always perceptible (e.g., able to be inferred or imagined) and active ('online') in a contextual expression about some or other content. For instance, in §4, I showed with UML mental spaces how epistemic stance is more prominent in some cases, while deontic stance or dynamic stance is in others. This finding suggests that Sweetser's (1990) three-way categorization highlights differences of degree. From this assessment, it follows that all conditional constructions relate in some manner to knowledge about content, to content about knowledge, and express embodied communicative acts.

Returning to the notion that conditional construction content, whether it be semantic or pragmatic, is always 'online,' this claim aligns with two observations in §2.3.4. The first was that modal stances (i.e., epistemic, deontic, dynamic) in conditional constructions are always *about* an Undergoer. The second was that, as an Agent takes a stance, an Undergoer (e.g., person, belief, action) is asserted to have a status value (i.e., +, =, –). The upshot of applying a Construction Grammar (CG) approach to these observations is that doing so circumvents the worry about finding a grammatical constituent that semantically encodes every modal stance-status pairing; sometimes, this is the task of several grammatical constituents. Furthermore, agentive stance is sometimes pragmatically inferred by addressees without any constituents encoding it. Regardless of which situation is the case regarding a construction, using the embodied FoR as a heuristic shows how modal stance types as deictic properties shape conditional interpretations.

5.3 Limitations of the study

Since this study is the first cognitive-functional-descriptive analysis of Swahili conditional constructions, several theoretical and descriptive limitations apply. Since this is the first study to explore 'dynamic stance' and 'dynamic status', my descriptions of them are preliminary. Section 4 is among the first analyses of deontic stance in conditional constructions (see also Polyzou 2012; Nissi 2015, 2016; Humă, Stokoe, & Sikveland 2018). As such, examining modal status as the complementary category would have distracted from arguing for modal stance having scope over T-values and P-values. In addition, since this is the first study to explore the concept of 'dynamic stance', I leave open the question of its precise formulation as a linguistic category.

Moreover, at least since Höfler (1917 [1885], see Chisholm 1982), deontic modality studies map scalar values (e.g., Frantz, Purvis, Nowostawski, & Savarimuthu 2014; Lassiter 2011, 2017; cf. Deal 2011; Verstraete 2005), including those in corpus linguistics (e.g., Kilicoglu, Rosemblat, Cairelli, & Rindflesch 2015; Sakyi 2019). Dynamic stance (ability, volition) is arguably scalar as well since levels of ability and willingness are ubiquitous embodied experiences. Regrettably, space prohibits exploring these issues in depth or also the intriguing interplay of social stance and status with deontic stance and status.

Given its theoretical focus (§2), a descriptive limitation of this study is that the small data set in §4 is not representative of the morphosyntactic distributions of all Swahili conditional prefixes and conjunctions. Consider, for example, the *iwapo*, *endapo*, *kama*, and *laiti* conditional conjunctions in their respective collocation patterns with negation markers, modal verbs (e.g., *-wezekana* 'be.possible', *elekea* 'be.probable'), the conditional prefixes, and adverbs (e.g., *hakika* 'certainly', *bila shaka* 'without doubt', *labda* 'perhaps', *pengine* 'possibly') that increase or reduce constructional P-values. A set of corpus studies would be beneficial for such a purpose.

5.4 Recommendations for further research

Each of the limitations described above is a beginning point for further research. Two other noteworthy foci of exploration are how deictic projection and deictic shift relate to T-values, P-values, and context-sensitivity. DEICTIC PROJECTION is a deictic property mismatch (e.g., present and past tense) between actual FoRs and depicted FoRs (see discussion of SoAs in Herman 1999: 523; see Gibbons 2012: 26–45 as a neurolinguistic study). DEICTIC SHIFT involves discourse-level changes in deictic property values (e.g., proximal and distal, see Rapaport, Segal, Shapiro, Zubin, Bruder et al. 1989: 2–5; Duchan, Bruder, & Hewitt 2012 [1995]; see Mizuno, Liu, Williams, Keller, Minshew et al. 2011 as a neurolinguistic study). As a point of departure on these two foci, consider Sanders & Krieken (2019) as a cognitive discourse analysis that systematically examines both as they correlate with conditional semantics and pragmatics (see also Crouch 1993, 1994; Chilton 2014, and Hartman 2019). Amuzadeh & Rezaei (2012) also explore the connections between deictic projection, modality, and tense in a mental spaces analysis of Persian *realis* and *irrealis* conditional constructions.

In §4, I attempted to show that UML mental spaces are optimal interdisciplinary diagrammatic ontologies for cognitive-functional-descriptive studies. However, they can also aid field linguists in recognizing deictic properties (e.g., deontic stance) and patterns (e.g., deictic projection and shift) that otherwise might have been under-described or unnoticed (see Hanks 1993, 2009 on fieldwork on deixis). To complete the picture of how deictic properties impinge on conditional semantics and pragmatics, exploring the effects of temporal deixis (e.g., tense and aspect) and social deixis (social stance-status pairings) on T-values and P-values is necessary. Close attention to perspectives in other disciplines is crucial as well. Cognitive, descriptive, and functional linguists, philosophers of language, cognitive psychologists, and cognitive

neuroscientists often do not consider the implications of findings in other disciplines (see Butler 2008: 4). This bleak appraisal is verified by searching for citation overlaps for these disciplines on conditional semantics and pragmatics, although these circumstances are improving.

This study is primarily designed to inspire research on conditional semantics and pragmatics in non-Indo-European languages. However, more remote applications of UML mental spaces are conceivable. Regardless of the research field of application, recognizing the centrality of embodied FoR networks in language as a complex, adaptive system with emergent properties (e.g., modal stance as modal deixis) mitigates interdisciplinary gaps in methodologies, terminology, and theory (see Grimaldi 2012; Grimaldi & Craighero 2012). UML mental spaces are a viable diagrammatic interface for this interdisciplinary cross-fertilization.

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