Some Thoughts on the "Vehicle" of Concepts

Kow KURODA, Jae-Ho LEE, Yoshikata SHIBUYA, Hajime NOZAWA & Hitoshi ISAHARA

National Institute of Information and Communications Technology, Japan

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Two Underlying Themes of this Talk

- From *taxonomic* relations to *thematic* relations
  - This is compatible with the slogan "From thesaurus to Ontology", which is an apparent theme of this conference.
- From *lexical* meanings to *super-lexical* meanings
  - This may not be compatible with the theme of this conference.
  - The meanings of sentences, or even of phrases, are not necessarily given as compositions of lexical meanings.
  - They need to be specified directly.

Our Points

- Developers of language resources/lexical ontologies need to:
    - pay due attention on the (semantics of) *superlexical* units as well as the (semantics of) *lexical* units
    - paying due attention to *collocational* units at *phrasal* or *sentential* levels
        - No reason not to treat *regular* phrases like *idioms*
    - without assuming that words (or morphemes) are the "vehicle" of concepts.
        - Do verb really *denote* concepts? — Who knows?
        - Where do concepts, both in terms of *types* and *roles*, come from?

Our View on Formal Ontology

- To us, formal ontology serves as a set of *heuristics*
  - It is useful if it provides us with *precise definitions* of lexical concepts, or guide us to do so.
  - But if it requires *strict formalization*, it is hard to use and can be useless in the end,
  - unless it captures actual meanings of words in use and it becomes clear how it is applied to *superlexical* and concepts (to be defined later), even *ad hoc* ones.
- Actual meaning of words are not simply concepts: they are also "values" of words used as *tokens* in *language game* (Wittgenstein); and they are *negotiable* (Wenger) probably for this reason.

Beyond a Thesaurus

On the Fist Theme

- Most of us wanted to shift over from *taxonomic* relations to *thematic* relations.
  - *is-a* relation (e.g. *penguin* is-a *bird* (against its unprototypicality), *bird* is-a *animal*) is an example of a taxonomic relation.
  - *is-used-for* relation (*knife* is-used-for *cutting with*, *pen* is-used-for *writing with*) and *is-made-of* relations (*chair* is-made-of *wood* or *metal*)

Any Theory of Thematic Relations?

- But *is there a good theory of thematic relations*?
- which
  - has a good precision?
    - Thematic relations are not mere associations.
  - has a good coverage?
  - is effective to deal with granularity issues?
    - thematic roles themselves are on hierarchy.

Go beyond Qualia Structure

- *Generative Lexicon Theory* (Pustejovsky 1995) with a subtheory of *qualia* structure is a good candidate.
  - GLT resulted in the SIMPLE database employing *extended* qualia structure (Busa, et al. 2001; Ruimy, et al. 2001)
- But we want to go further, in that it is unlikely that thematic relations are confined to only four qualia roles of:
  - (1) formal (for *is-a*), (2) constitutive (for *is-made-of*), (3) agentive (for *is-product-of*), (4) telic (for *is-used-for*)

What is the Qualia Structure of

- *replacement* relation exemplified by in X and Y in
  - X replace Y; Z replaced X with Y (X を Y に取り換える)?

- *substitute* relation exemplified by X and Y in
  - use X {(as a substitute) for; instead of; in place of} Y (XをYの代わりにする; Y(のところ)を Xで代用する)?

    - This is required to account for a sense of *artificial*: why *artificial leather* can mean *leather substitute* (but *artificial life* can't mean *life substitute*)?

- *sacrifice* relation exemplified by in X and Y in
  - X is {sacrificed; a sacrifice} for Y; Z sacrifice X for Y (X を犠牲に Y を得る/する)?

How Replacement, Substitute, & Sacrifice Are Different?

Case	X is a replacement of Y	X is a substitute for Y	X is a sacrifice for Y
Value	$X > Y$ or $X = Y$	$X < Y$ or $X << Y$	$X = Y$ (but on different measures)
Availability	$X > Y$	$X >> Y$ or $X > Y$	$X = Y$ or $X > Y$
Temporal co-existence potential	No	No	Yes
Sense of improvement	Slightly positive	Strongly negative	Neutral or slightly negative
Emotional commitment	No	No	Yes

FS/FrameNet as a Theory of Taxonimic Relations

- We assume that *Frame Semantics* (FS) (Fillmore 1985) recently implemented by *Berkeley FrameNet* (BFN) (Fontenelle, ed. 2003) serves as a foundation for a theory of thematic relations, in that

  - Most of BFN frames characterize more or less concrete "situations" (encoding *who did what for what purpose*) that correspond to "units" of human understanding, at different degrees of granularities.

  - BFN frames cover Schank's *memory organization packets* (MOPs) (Schank 1983, 1999).

  - Frames describe "cases" in the sense of *Case-based Reasoning* (Kolodner 199x)

Our Premises

- Understanding of an expression *E* consists in identification of a situation *S* "evoked" by *E*
  - *S* is the specification of human's conception of what happened, or what's happening.
  - *Frame evocation by linguistic expression* is a kind of what Schank (1983, 1999) called *reminding*.
- Words are not efficient units to determine *S*'s.
  - They only "evoke" (a set of) situations.
- Collocational units (if not multi-word units *per se*) do this more efficiently.
  - confirmed by a lot of evidence from research into word sense disambiguation.
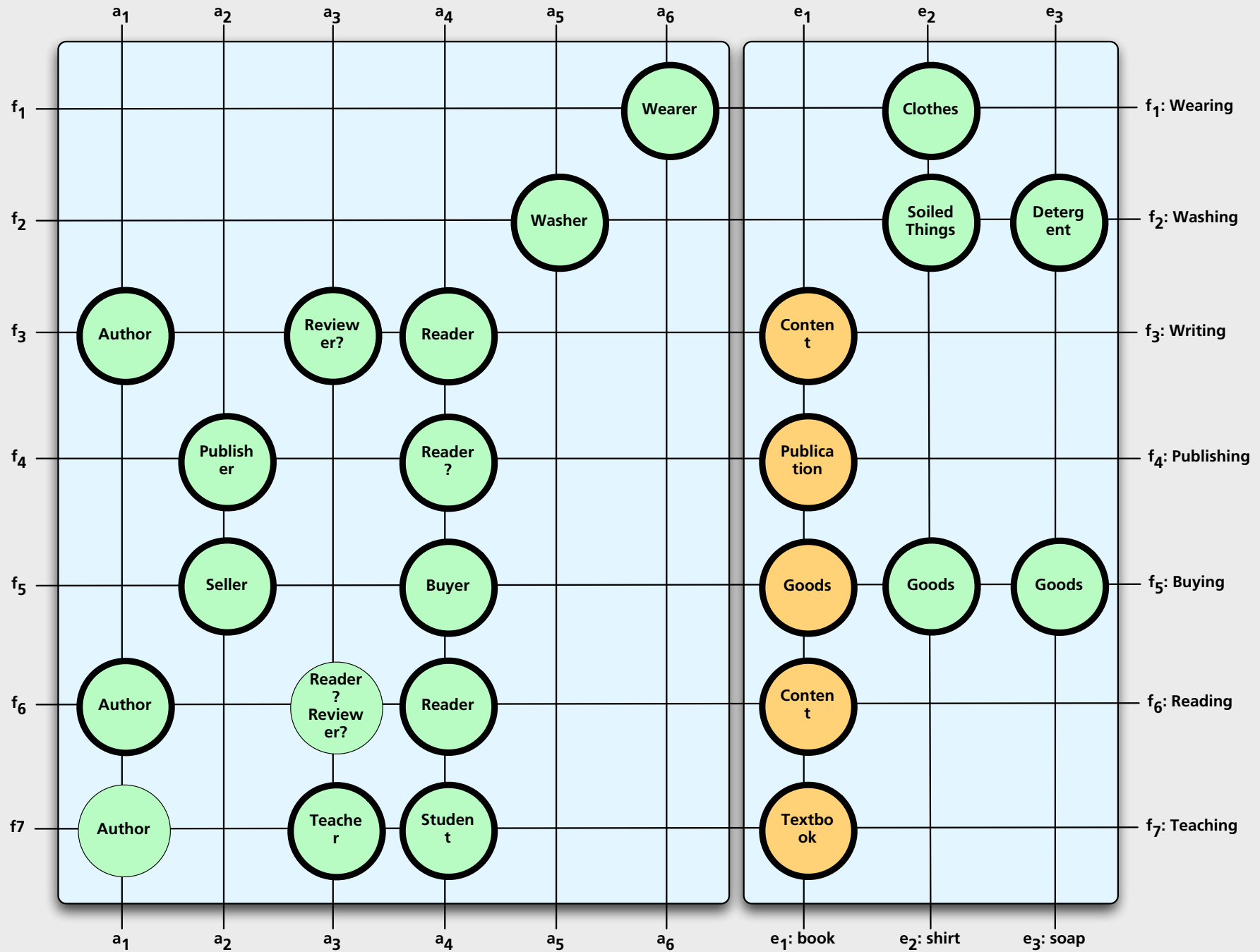
Benefits

- Fundamental questions:
  - What defines *roles* as differentiated from *types*?
  - Where do *qualia structures*, or *extended qualia structures* (that look even daunting) come from?
    - These are not easy questions.
- FrameNet/Frame Semanitics suggests an answer

Roles Are Mediators

- The relationship between the set E of "entities" (as types) and the set S of "situations" (as types) orthogonal, as indicate by the FE-grid (frame-element grid) in the next slide, where
  - Entities are arranged horizontally
  - Situations are arranged vertically
- Situation-specific (semantic) roles (aka frame elements in BFN term) at the intersection of E and S are *mediators* of E and S.

Agents

Objects

	a₁	a₂	a₃	a₄	a₅	a₆	e₁	e₂	e₃	
f_1						Wearer		Clothes		f_1: Wearing
f_2					Washer			Soiled Things	Detergent	f_2: Washing
f_3	Author		Reviewer?	Reader			Content			f_3: Writing
f_4		Publisher		Reader?			Publication			f_4: Publishing
f_5		Seller		Buyer			Goods	Goods	Goods	f_5: Buying
f_6	Author		Reader? Reviewer?	Reader			Content			f_6: Reading
f7	Author		Teacher	Student			Textbook			f_7: Teaching

e₁: book   e₂: shirt   e₃: soap

But

- We can't talk about this due to space consideration.
- See the appendix of this slides available at
  - http://clsl.hi.h.kyoto-u.ac.jp/~kkuroda/papers/on-vehicle-of-concepts-nlc07.pdf

On the Second Theme

- Many language resources have been developed to describe the semantics of *lexical* units, monolingually or multilingually.
  - Lexical resource is just *a kind of* language resource.
- How about the semantics of *superlexical* units, e.g.,
  - "constructions" (Fillmore et al. 1988).
  - "multi-word expressions" (MWEs) (Sag et al. 199x)
  - "nonlinear expressions" (Ikehara et al. 2005).

Theory of Superlexical Semantics [1]

- It's getting clearer and clearer that the meanings of sentences *as understood by human* are not given as simple compositions of lexical meanings; rather, it is better to think of them as *superlexical* in nature.
  - This is confirmed by idioms, which is not a minor portion of language.
- Many people claim that idioms are fixed in number and fixed in form, but it is very likely to be a myth.
  - It is not obvious at all how to distinguish non-idioms from idioms unless an *operative* definition of superlexical meanings is given.

Definition of Superlexical Meaning

- Meaning, $m(u)$, of a multi-word unit, $u = w_1+w_2+ +w_n$, is superlexical iff
  - $m(u)$ cannot constructed from the set of $M = \{m_1, m_1, ..., m_n\}$ where $m_i = m(w_i)$ using a *trivial* function $F(M)$.
- We need to avoid *compositionalist* bias on meaning because
  - It encourages (usually unrewarded) attempts to reduce the meaning of a collocational unit into a function of lexical meanings.
  - It blocks objective evaluation of F for complexity.

Japanese Examples of Idioms

- Some nouns can be used only within idiomatic expressions.

- Some examples of Japanese nouns 気 (ki)

Theory of Superlexical Semantics [2]

- MWUs, constructions, nonlinear expressions are far from minor and negligible; rather, they are pervasive and important.

- Difficulties
  - We lack a theory of superlexical semantics that helps us to describe with collocations effectively
  - N.B. Linguistics (still) lacks a precise definition of collocations.

Examples from Japanese

ID	Japanese example containing 気 (ki)	Near word-by-word transliteration into English	English translations	word-by-word English translates for 気	Is the <…> phrase idiomatic?	Is it lexicalized?	Is the sense of 気 transparent?
(1)	HUMAN(x)は <気まぐれ> だ	for HUMAN(x), his/her interest is unstable.	HUMAN(x) is capricious, HUMAN(x) has unpredictable/wild interests.	interests?	Yes	Yes	No
(2)	HUMAN(x)が STATUS(y)を <気取る>	HUMAN(x) puts STATUS(y) on his/her mood?	HUMAN(x) tries to appear as STATUS(y)	mood?	Yes	Yes	No
(3)	HUMAN(x)は <気違い> だ	for HUMAN(x), his/her temper is different.	HUMAN(x) is crazy.	temper?	Yes	Yes	No
(4)	HUMAN(x)が PHENOMENON(y)に <気づく>	HUMAN(x) place his/her notice/sense on PHENOMENON(y)	HUMAN(x) {sense, take notice of} PHENOMENON(y)	sense? notice?	Yes	Yes	No
(5)	HUMAN(x)は (TIME(z)は) ACTIVITY(y)に <気が 乗らない>	for HUMAN(x), his/her mood will not be on ACTIVITY(y) (at,on) TIME(z).	HUMAN(x) is not inclined to ACTIVITY(y) (at,on) TIME(z).	mood?	Yes	No	No?
(6)	HUMAN(x)が PHENOMENON(y)に <気が つく>	HUMAN(x) place his/her notice/sense on PHENOMENON(y)	HUMAN(x) {sense, take notice of} PHENOMENON(y)	sense? notice?	Yes	No	No?
(7)	HUMAN(x)は HUMAN(y) に <気が ある> [x, y are opposite sexes]	for HUMAN(x), his/her notice/sense is at HUMAN(y)	HUMAN(x) is attracted to HUMAN(y) [x, y are opposite sexes]	sense? notice?	Yes	No	Yes
(8)	HUMAN(x)は <気が 長い>	for HUMAN(x), his/her temper is long.	HUMAN(x) is patient.	temper?	Yes	No	Yes
(9)	HUMAN(x)は <気が 短い>	for HUMAN(x), his/her temer is short	HUMAN(x) is impatient.	temper?	Yes	No	Yes
(10)	HUMAN(x) は <気が 多い>	for HUMAN(x), his/her interests are multiple.	HUMAN(x) is inconstant, fickle, mobile, mercurial (especially in woman).	interest?	Yes	No	Yes
(11)	HUMAN(x)が BEHAVIOR-OF(y)で <気を 悪くする>	for HUMAN(x), his/her feeling/mood goes bad by BEHAVIOR-OF(y).	HUMAN(x) gets offended by BEHAVIOR-OF(y). BEHAVIOR-OF(x) hurts HUMAN(x)'s feeling.	feeling? mood?	Yes	No	Yes
(12)	(JUDGE(z)には) (ACT(y)をする/した) HUMAN(x)の <気が 知れない>	for HUMAN(x) to have done/do ACT(y), his/her ideas are not understandable to JUDGE(z).	JUDGE(y) has no idea why HUMAN(x) is going to do/did ACT(y).	ideas?	Yes	No	Yes

What Idioms with 気 Suggest [1/2]

- Criteria to distinguish non-idioms from idioms are essentially unclear.
  - *Transparency* parameter is just one of the many factors that contribute to idiomaticity.
  - *Lexicalization* parameter is just another factor.
- There are many collocational units with relatively transparent meanings that show idiom-like behavior.
  - Conventional metaphors (Lakoff & Johnson 1980, 1999) are virtually *weak idioms*.
  - Against common belief, it is hard to say that idioms are not finite in number.

- How much do we gain even if we come to know exactly what concept each instance of 気 refer to if the exact meaning of *each phrase as a whole* remains unclear?

  - Even for (7)-(12), where 気 has a relatively transparent meaning, *ultra-lexicalist* expectation for reducing it to a *single, generic* and *basic* meaning is either ungrounded or vacuous if successful.

- This suggests that precise knowledge of lexical meanings does not always bring us to our goal, *specification of the content understood via language*.

Moral

- Most of phrases (VPs, NPs), which are believed to have *regular*, *compositional* semantics, can (and actually do) have *irregular*, *not truly compositional* semantics,
  - let alone sentences.
- Thus, we can claim that
  - semantic descriptions of larger units are useless, unless they are indexed against concrete *situations* (or parameterized) *state of affairs*).
  - (formal) ontology is useful as far as it helps us specify the set of situations.

Metaphor is a Big Challenge, Still

- Natural texts have a lot of *deviant* expressions including metaphor.

- Dynamic identification of creative metaphors is still a big challenge.

  - Compared to creative metaphor, conventional metaphors (Lakoff & Johnson 1980) are easier to handle.

How to Cook a Husband

- A good many husbands are utterly spoiled by mismanagement in cooking and so are not tender and good.

- Some women keep them constantly in hot water; others let them freeze by their carelessness and indifference. Some keep them in a stew with irritating ways and manners. Some wives keep them pickled, while others waste them shamefully.

- It cannot be supposed that any husband will be tender and good when so managed, but they are really delicious when prepared properly.

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How to Cook a Chicken

- A good many chickens are utterly spoiled by mismanagement in cooking and so are not tender and good.

- Some women keep them constantly in hot water; others let them freeze by their carelessness and inattentiveness. Some keep them in a stew with cursory ways and manners. Some wives keep them pickled, while others waste them shamefully.

- It cannot be supposed that any chicken will be tender and good when so managed, but they are really delicious when prepared properly.

Terminology Matters

- The problem boils down to context identification, which boils down to terminology/usage type detection.

- So, the general problem is if we can predict/detect what people talk about based on
  - *the way they use a language,* or
  - *how particular words are used in a particular way.*

Japanese Weather Report Language

- Which sentences, with right prosody, are likely to be said by a weather reporter on TV or radio, and which are not?

  (1) 明日は{晴れ; 曇り; 雨; ...}でしょう.

  (2) 明日は {晴れ; 曇り; 雨; ...} だろう.

  (3) 明日は全国的に {晴れ; 曇り; 雨; ...} でしょう.

  (4) 明日は全国的に {晴れ; 曇り; 雨; ...} だろう.

- Native Japanese would not expect (3) and (4) to be uttered by weather reporter.

Another Moral

- We clearly need a theory of superlexical semantics
  - or lexical pragmatics (Blutner 2002).
- It will depends on a good (formal) ontology.

Need for a Theory of Superlexical Semantics

Are Idioms Special and Exceptional?

- Probably not.
  - To what degree are "regular" cases compositional?
    - Aren't we just too insensitive to noncompositionality?
- Labeling difficult cases "idioms" isn't no solution.
  - The idiom/non-idiom distinction isn't really obvious
    - Our view is likely to be influenced by our compositionalist bias.
  - Any way, no proper identification procedure is defined yet for idioms.

More Notes on Idioms

- Idioms are not a coherent class.
  - Different subclasses of idioms show different degrees of variabilities
  - (1) John *kicked the bucket*.
  - (2) *The bucked* was *kicked* (?*by John).
    - The wide-spread belief that the form of idioms is fixed is obviously false for certain cases.
- "Conventional" metaphors (Lakoff & Johnson 1980) are virtually a weak form of idioms.
  - (1) We're at the cross-road. [Relationship Is A Journey]

Are Word Meanings (Really) Concepts?

- Idioms are easier cases. Normal texts are full of *nonlinear expressions* (Ikehara, et al. 2005) that are cannot be treated as idioms, posing other kinds of problems:

    - It is not rare that an *array* of concepts is assigned to a single word.

    - It is not rare that a single concept is distributed over multiple, often discontinuous, elements of a sentence.

        - can be revealed with *Multilayered Semantic Frame Analysis* (MSFA) (Kuroda & Isahara 2005; Kuroda, et al. 2006)

- These cases run counter to the simplistic view of *word meanings as concepts*.

Simple Sample MSFA

- MSFA is a form of dynamic lexicon, N. Calzolari mentioned, in which sense description is
  - strongly instance based, and
  - made against not only words but also multiword units, or collocational patterns, of any length
- A sample MSFA of the following example will be given in the next few slides.
  - He spilled the *political* beans
    - due to C. Fellbaum's talk I heard at DGfS at Bielefeld

Nearly Full MSFA

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Frame ID	G1	G2	F4	F1	F3	F2	F6	F7	F8	F10	F11	F5	F9
2	Frame-to-Frame relations	elaborates G2		constitutes F2	constitutes F2	constitutes F2	elaborates F6; targets F7	presupposes F10; fails F10	presupposes F5; elaborates F8	presupposes F5,F9	targets F5		?elaborates F11	realizes F5,F10
3	Frame Name	~Stating~	~Speaking~	Description of Object	~Referring~[1]	~Referring~[2]	Spilling	Scattering	Leaking= Failing to Keep Secret	Failing	Holding	Hiding	Keeping Secret	Trying
4	*	Stater	Speaker	Describer										
5	*				Target[+person]									
6	*					Target								
7	*												GOVERNOR	Tried Act(ivity)
8	He	Statement	Speech		EVOKER = GOVERNOR: Reference Source		Spiller	Scatterer	Leaker	Failer	Holder	Hider	Keeper[+potential]	Trier
9	spilled						GOVERNOR	EVOKER	EVOKER[1,3]	EVOKER[1,3]				Result
10	the			Attribute[1,2]		EVOKER = GOVERNOR	Object[1,3] = Object.Attribute[1,2]	Object[1,3] = Object.Attribute[1,2]	EVOKER[2,3]: Secret.Attribute[1,2]	EVOKER[2,3]	Object.Attribute[1,2]	Object.Attribute[1,2]	Secret.Attribute[1,2]	
11	political			EVOKER: Attribute[2,2] as Domain Specifier		Referenced Entity.Attribute	Object[2,3] = Object.Attribute[2,2]	Object[2,3] = Object.Attribute[1,2]	Secret.Attribute[2,2]		Object.Attribute[2,2]	Object.Attribute[2,2]	Secret.Attribute[2,2]	
12	beans			Object		Referenced Entity	Object[3,3]	Object[3,3]	EVOKER[3,3]: Secret	EVOKER[4,3]	Object to be Held	Object to be Hidden	Secret	

Simplified MSFA (just relevant ones)

		A	G	H	I	M
1		Frame ID	F2	F6	F7	F5
2		Frame-to-Frame relations	elaborates F6; targets F7	presupposes F10; fails F10	presupposes F5; elaborates F8	?elaborates F11
3		Frame Name	Spilling	Scattering	Leaking= Failing to Keep Secret	Keeping Secret
8		He	Spiller	Scatterer	Leaker	Keeper[+potential]
9		spilled	GOVERNOR	EVOKER	EVOKER[1,3]	EVOKER?
10		the	Object[1,3] = Object.Attribute[1,2]	Object[1,3] = Object.Attribute[1,2]	EVOKER[2,3]: Secret.Attribute[1,2]	Secret.Attribute[1,2]
11		political	Object[2,3] = Object.Attribute[2,2]	Object[2,3] = Object.Attribute[1,2]	Secret.Attribute[2,2]	Secret.Attribute[2,2]
12		beans	Object[3,3]	Object[3,3]	EVOKER[3,3]: Secret	Secret

Simplified MSFA (just relevant ones)

	A	G source sense	H	I	M
1	Frame ID	F2	F6	F7	F5
2	Frame-to-Frame relations	elaborates F6; targets F7	presupposes F10; fails F10	presupposes F5; elaborates F8	?elaborates F11
3	Frame Name	Spilling	Scattering	Leaking= Failing to Keep Secret	Keeping Secret
8	He	Spiller	Scatterer	Leaker	Keeper[+potential]
9	spilled	GOVERNOR	EVOKER	EVOKER[1,3]	EVOKER?
10	the	Object[1,3] = Object.Attribute[1,2]	Object[1,3] = Object.Attribute[1,2]	EVOKER[2,3]: Secret.Attribute[1,2]	Secret.Attribute[1,2]
11	political	Object[2,3] = Object.Attribute[2,2]	Object[2,3] = Object.Attribute[1,2]	Secret.Attribute[2,2]	Secret.Attribute[2,2]
12	beans	Object[3,3]	Object[3,3]	EVOKER[3,3]: Secret	Secret

Simplified MSFA (just relevant ones)

	A	G (source sense)	H	I (targeted sense)	M
1	Frame ID	F2	F6	F7	F5
2	Frame-to-Frame relations	elaborates F6; targets F7	presupposes F10; fails F10	presupposes F5; elaborates F8	?elaborates F11
3	Frame Name	Spilling	Scattering	Leaking= Failing to Keep Secret	Keeping Secret
8	He	Spiller	Scatterer	Leaker	Keeper[+potential]
9	spilled	GOVERNOR	EVOKER	EVOKER[1,3]	EVOKER?
10	the	Object[1,3] = Object.Attribute[1,2]	Object[1,3] = Object.Attribute[1,2]	EVOKER[2,3]: Secret.Attribute[1,2]	Secret.Attribute[1,2]
11	political	Object[2,3] = Object.Attribute[2,2]	Object[2,3] = Object.Attribute[1,2]	Secret.Attribute[2,2]	Secret.Attribute[2,2]
12	beans	Object[3,3]	Object[3,3]	EVOKER[3,3]: Secret	Secret

Examples from Aesop's Fables [1/3]

- (1) conveys the sense of *idolizing* and *worship* (憧れ), but where does it come from? Or which words or collocations convey it?

  (1) ロバはキリギリスの歌声に魅了され，自分もあんな風に歌ってみたいものだと考えた．

  (1) An Ass having heard some Grasshoppers chirping, was highly enchanted; and, desiring to possess the same charms of melody, demanded what sort of food they lived on to give them such beautiful voices.

- (3) conveys the sense of *fasting* (断食), but where does it come from?

  (2) そこでロバは、キリギリスたちに、どんなものを食べるとそんなに素敵な声が出るのかと尋ねてみた。キリギリスたちは答えた。「水滴だよ」

  (3) それで、ロバは、水しか摂らないことに決めた。

  (2) AN ASS having heard some Grasshoppers chirping, was highly enchanted; and, desiring to possess the same charms of melody, demanded what sort of food they lived on to give them such beautiful voices. They replied, "The dew."

  (3)The Ass resolved that he would live only upon dew,

- Why does sentence (4) mean what it means?

    (3) 笛の上手な漁師が、笛と網を持って海へ出掛けた。彼は、突き出た岩に立ち、数曲、笛を奏でた。

    (4) と言うのも、魚たちが笛の音に引き寄せられて、足下の網に、自ら踊り入るのではないかと考えたからだった。

    (3) A FISHERMAN skilled in music took his flute and his nets to the seashore. Standing on a projecting rock, he played several tunes

    (4) in the hope that the fish, attracted by his melody, would of their own accord dance into his net, which he had placed below.

MSFAs

- See MSFAs at
  - http://www.kotonoba.net/~mutiyama/cgi-bin/hiki/hiki.cgi?c=view&p=msfa-aesop03-s01
  - http://www.kotonoba.net/~mutiyama/cgi-bin/hiki/hiki.cgi?c=view&p=msfa-aesop03-s05
  - http://www.kotonoba.net/~mutiyama/cgi-bin/hiki/hiki.cgi?c=view&p=msfa-aesop11-s03
- for more details.
  - But they are made in Japanese. Sorry for non-Japanese speakers.

Notes

- It is no solution to explain that their meanings are *matters of pragmatics*. This makes sense only under the assumption that
  - Semantics can dispense with pragmatics (Is this really more than our *hope*?)
  - Pragmatic meanings can be inferred with a proper mechanism (How much is known about inferences?).
- This cannot be guaranteed as far as we want to build a wide-coverage knowledge base of superlexical meaning.

Summary

- In this talk, I presented
  - arguments for the need for a (better) theory of thematic relations a well as taxonomic relations
  - arguments for the need for a theory of superlexical meaning
- and suggested
  - for both cases, approaches based on, or derived from, FrameNet/Frame Semantics can provide some insights

Acknowledgements
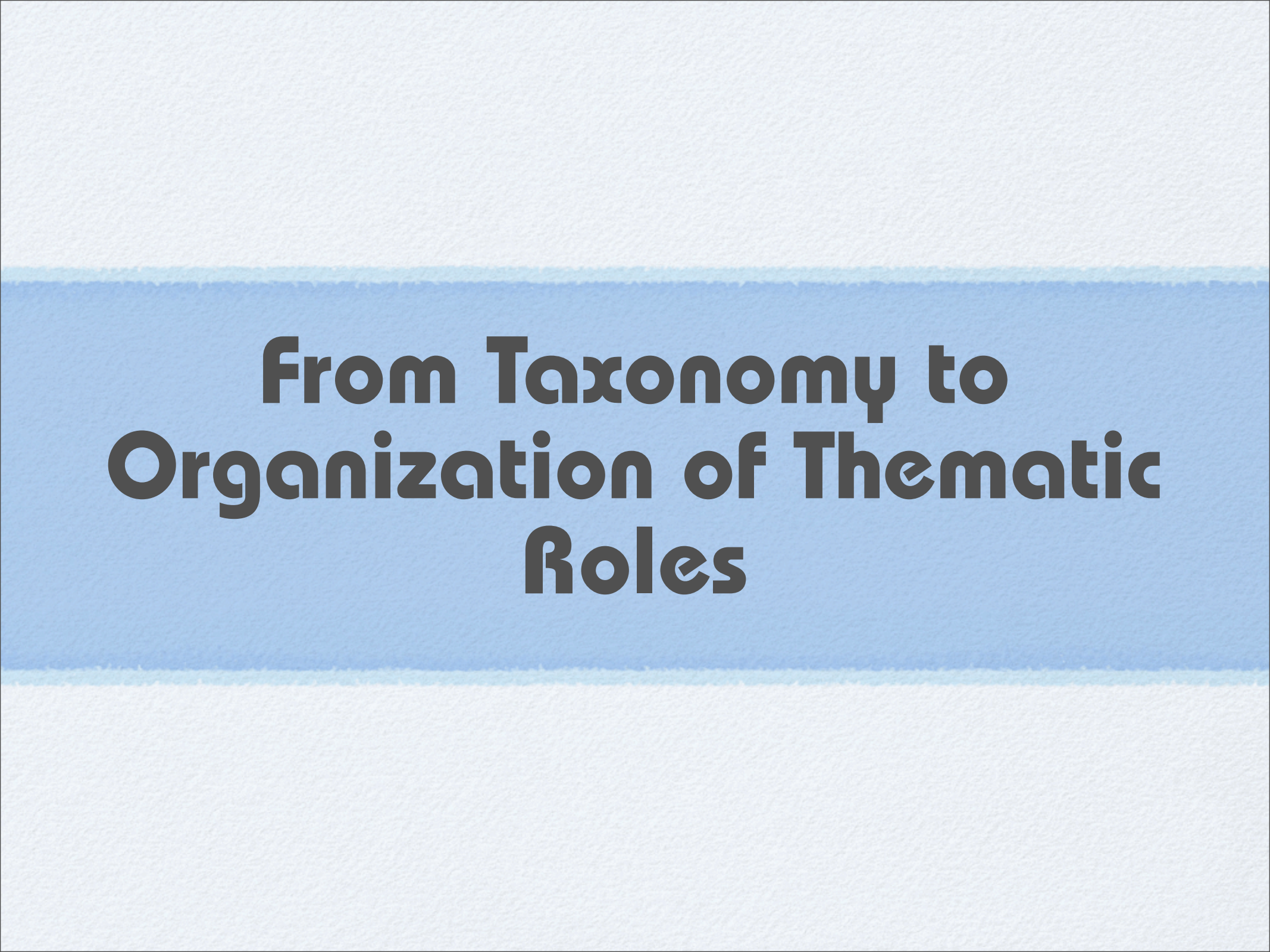
Thank You

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Appendices

From Taxonomy to Organization of Thematic Roles

Hierarchies of Semantic Roles/FEs

- FrameNet/Frame Semantics allows us to expect semantic roles/frame elements form hierarchies.

Given "Murder IS-A Intended Activity (IS-A Event)," we have:

- Victim IS-A Patient

- Weapon IS-A Instrument

- Death IS-A Product

- Victim's being Dead IS-A Result

- etc
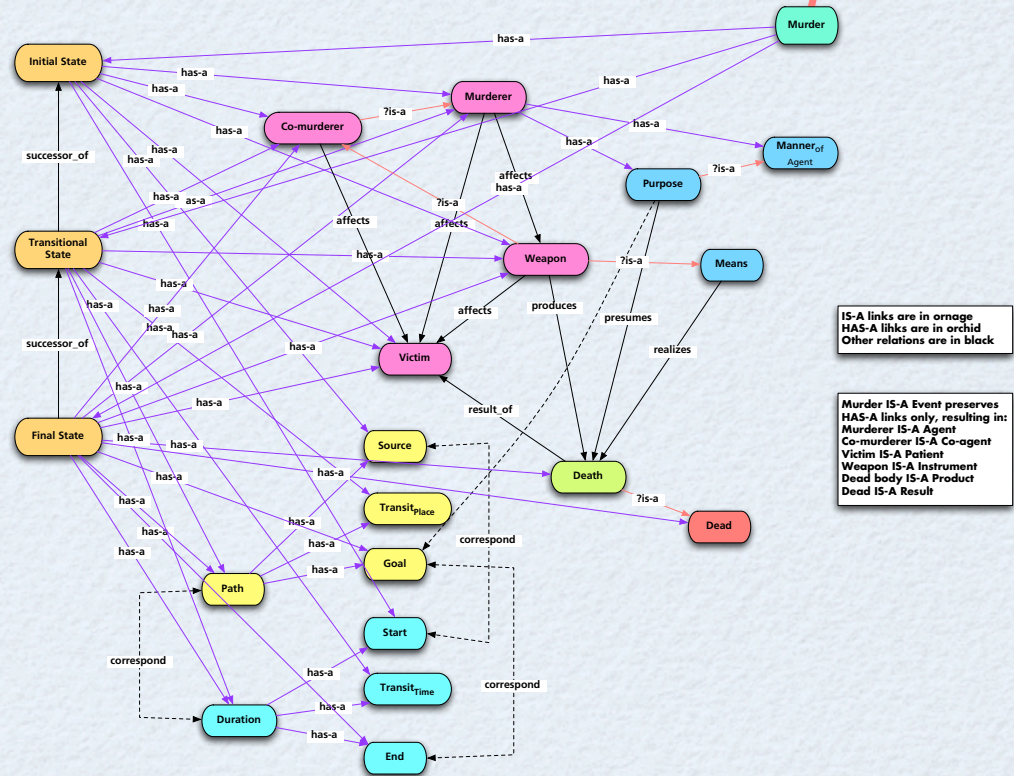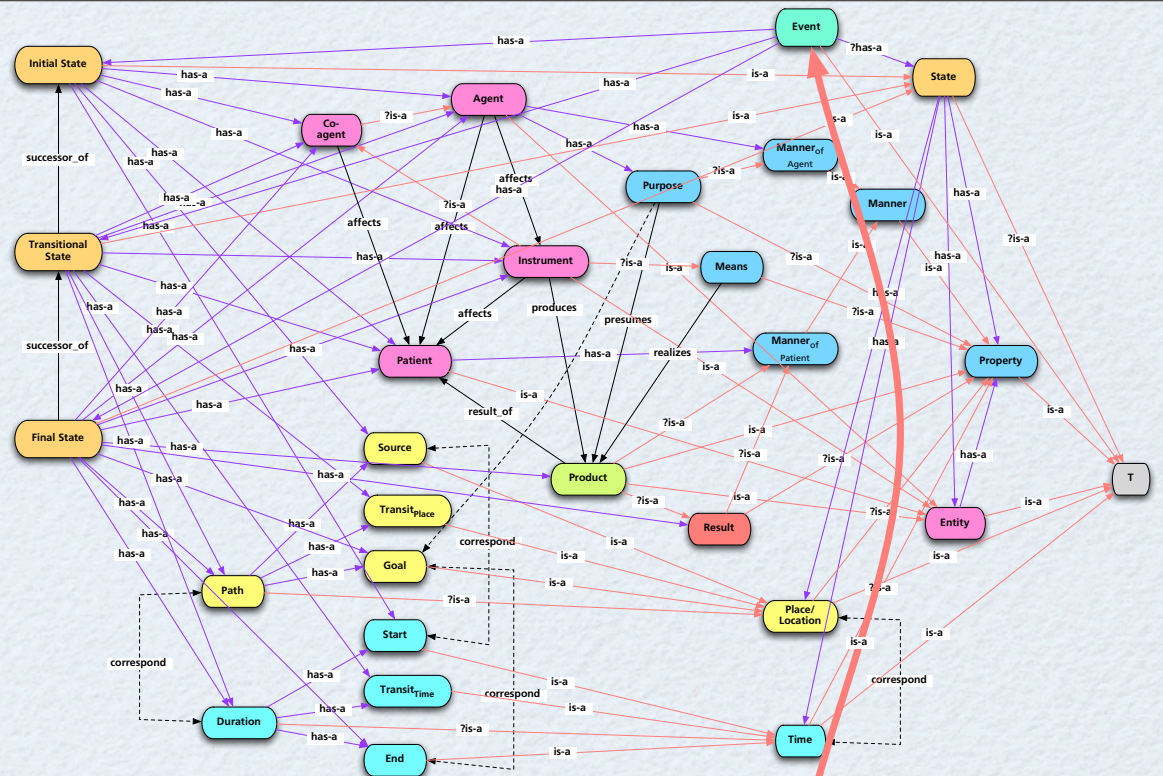
Diagram contains the subnet for HAS-A relations only.
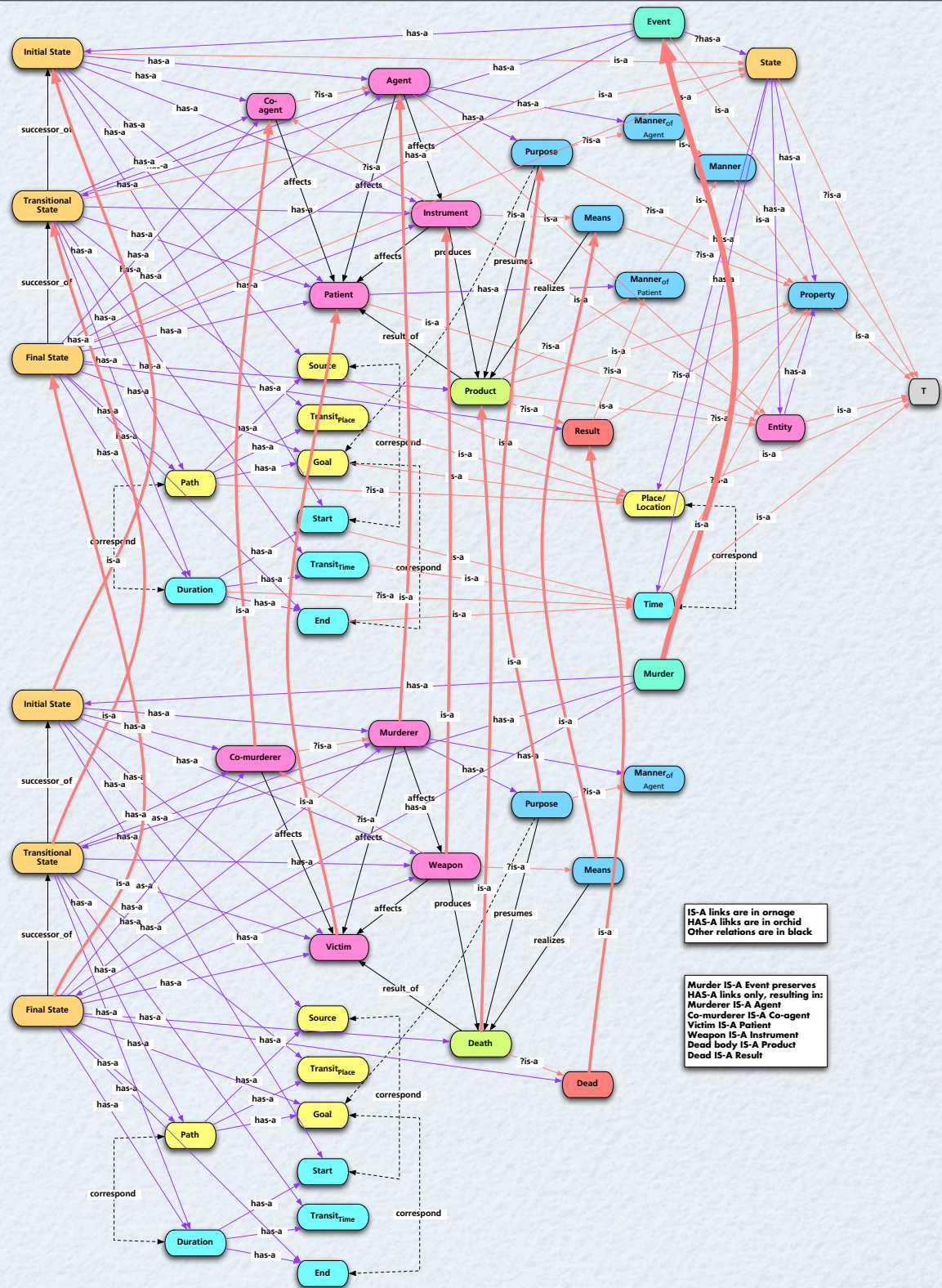
IS-A links are in ornage
HAS-A lihks are in orchid
Other relations are in black

Murder IS-A Event preserves
HAS-A links only, resulting in:
Murderer IS-A Agent
Co-murderer IS-A Co-agent
Victim IS-A Patient
Weapon IS-A Instrument
Dead body IS-A Product
Dead IS-A Result

- Given "Murder IS-A Intended Activity (IS-A Event)," we have:

  - Victim IS-A Patient

  - Weapon IS-A Instrument

  - Death IS-A Product

  - Victim's being Dead IS-A Result

  - etc

- Diagram contains the subnet for HAS-A relations only.

Ontology of Thematic Roles
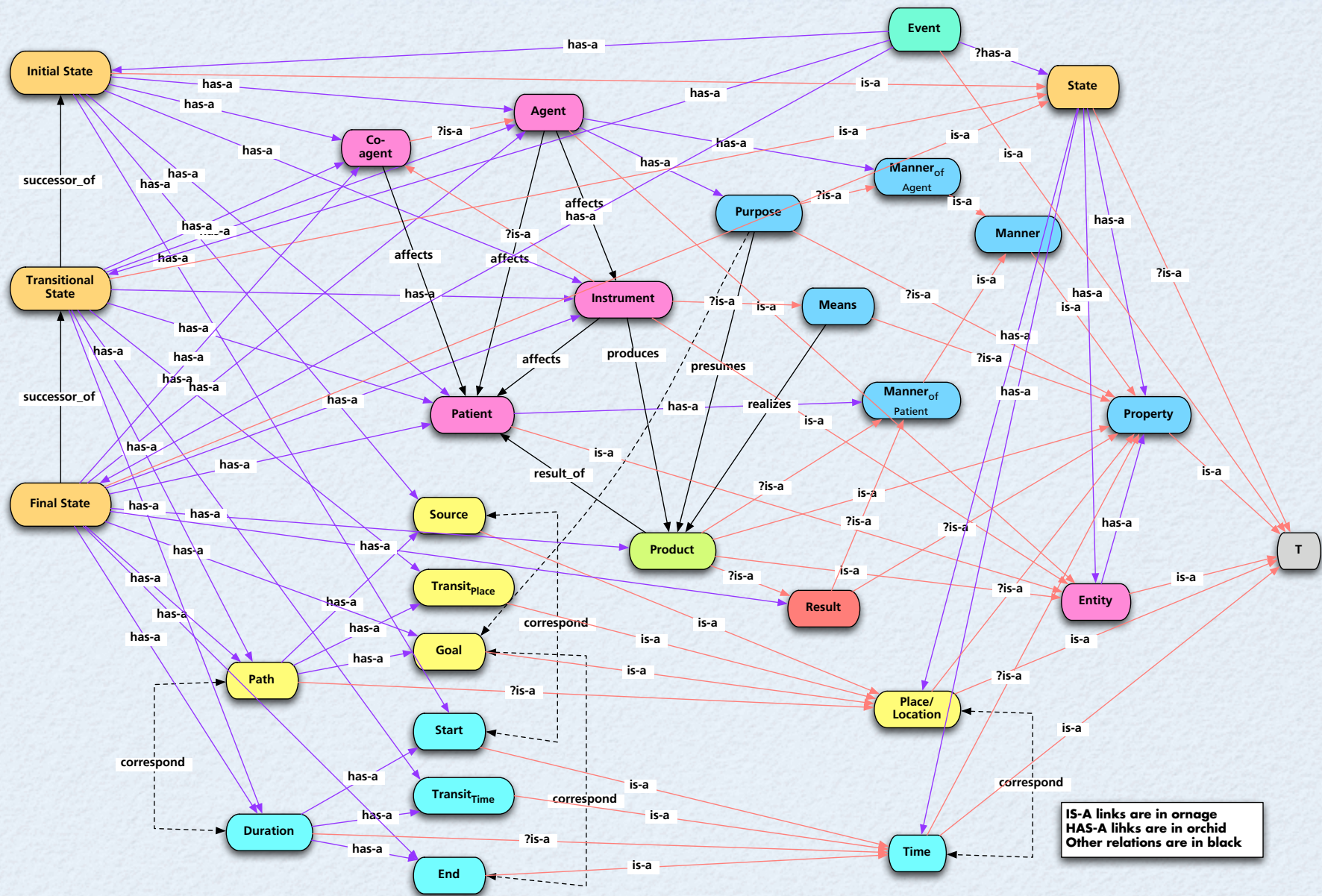
IS-A関係はダイダイ色で，HAS-A関係は紫で，それ以外の関係は黒で表わした

Firstness, Secondness, & Thirdness

- Can we derive the following Peicean distinction from the FE-grid?
  - *Firstness* of "entities"
  - *Secondness* of "situations" (especially "actions")
  - *Thirdness* of "roles"
- But the ordering of secondness and thirdness looks arbitrary, because they cannot be given independently.

Upper Ontology of Situations

- The upper ontology of events provides a template for situations.

- More precisely, it can be thought of (at least) three layers of:
  - relations among states
  - relations among participants
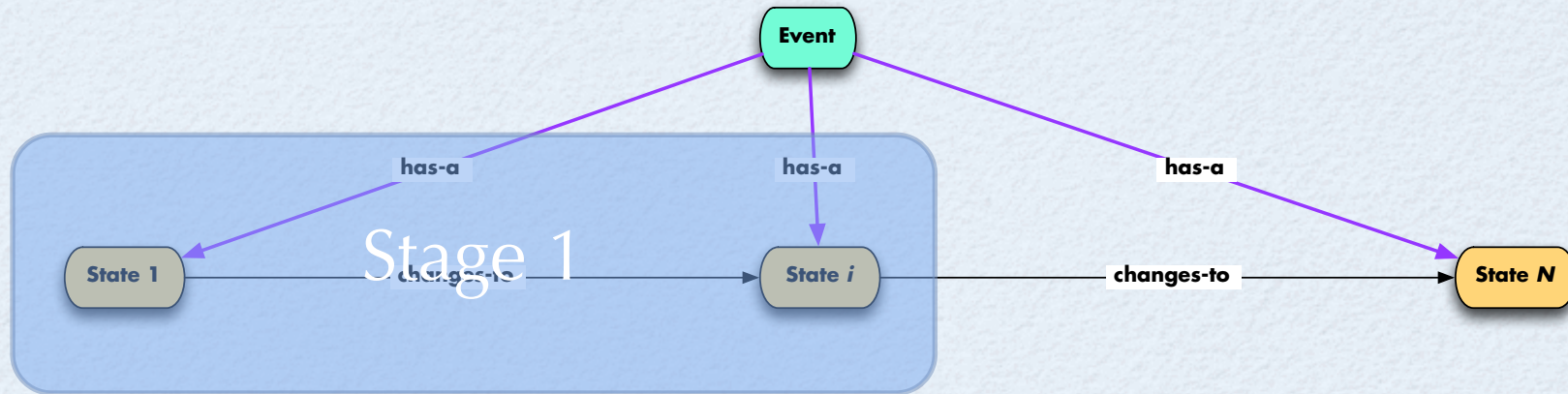 - relations among attributes

Definitions

- Relation of a "state" *s* to an "event" *e* is one of *part-of* (equated with *has-a* relation)
    - Seamless stream of "states" is a "stage" or "phase."
- Relation of a "participant" *p* to a "state" *s* is one of *part-of*.
    - cf. Relation of a "semantic role" *r* to a "situation" *s* is one of *part-of*.
- Relation of an "attribute" (aka "property") *a* to a "participant" *p* is one of *part-of*.
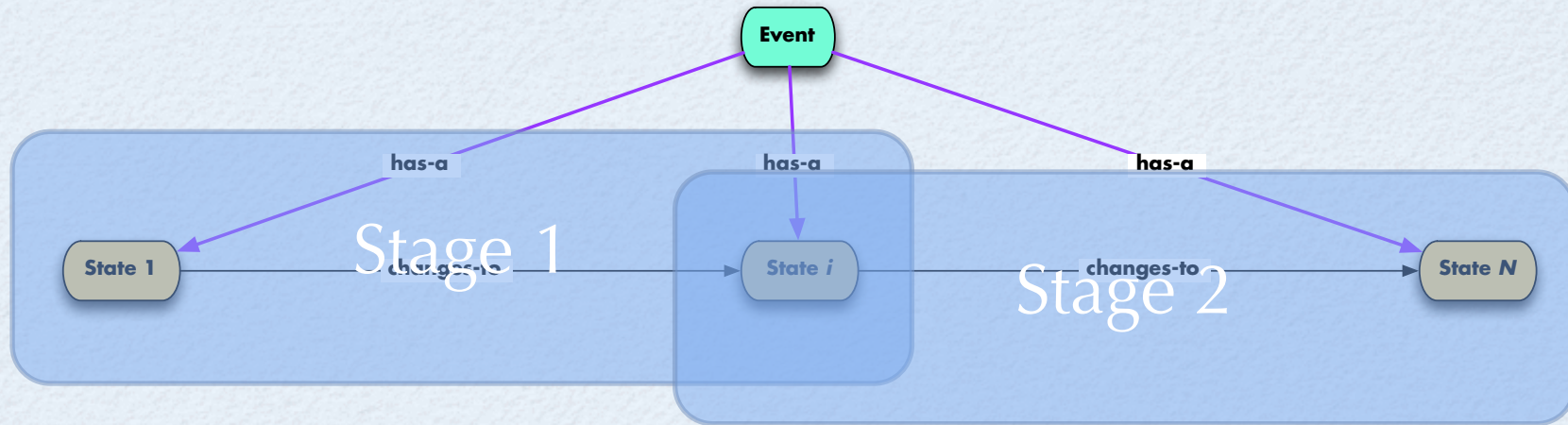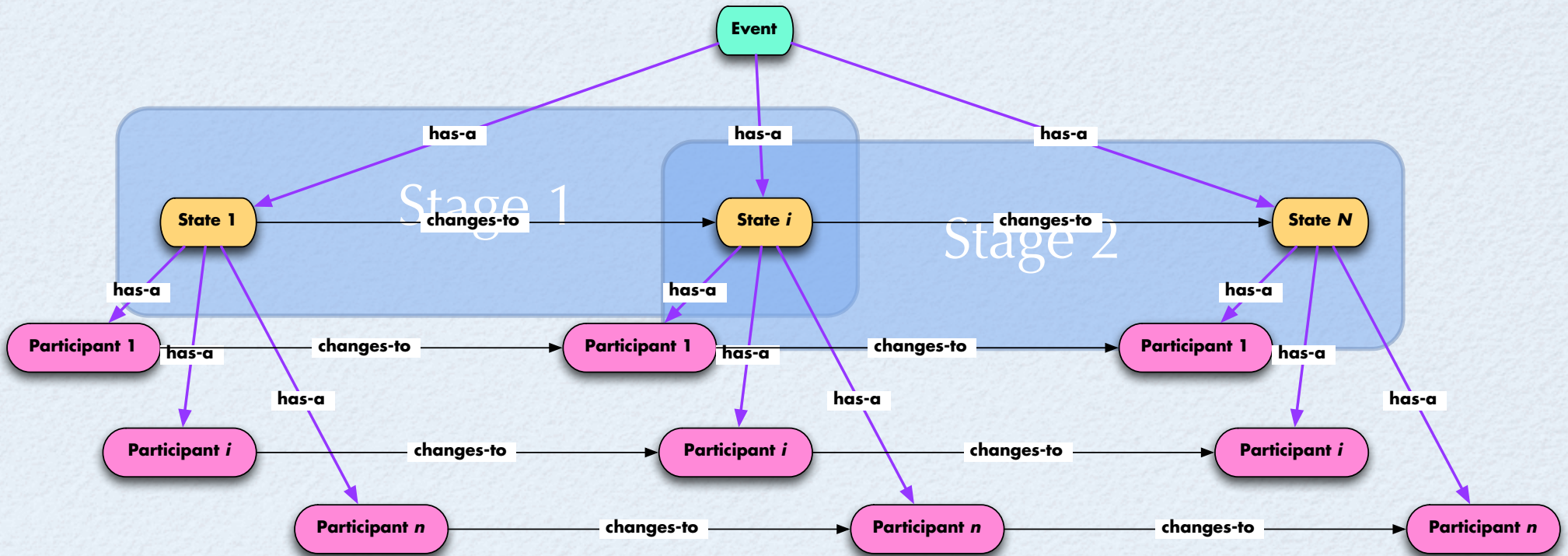
Layered Structure of Event
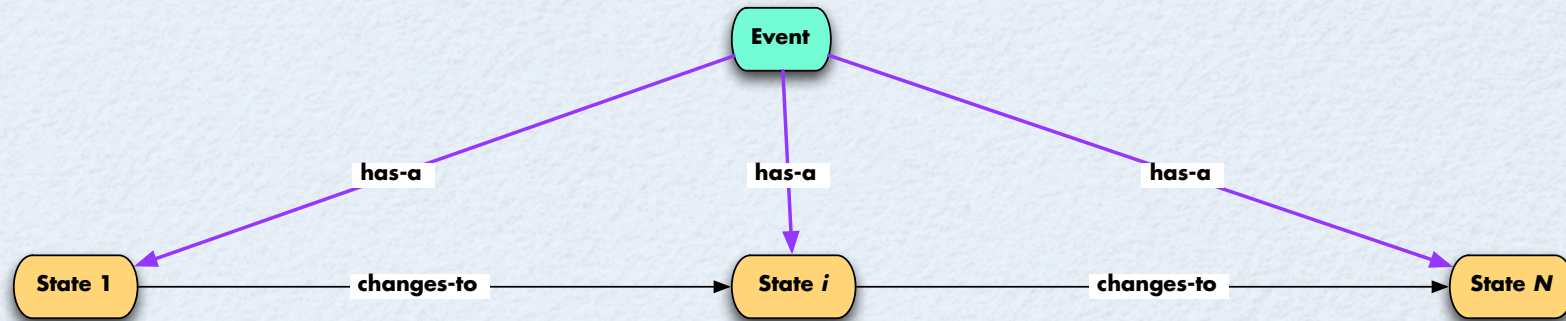
HAS-A relation is indicated by purple link; others by black links.

Layered Structure of Event

HAS-A relation is indicated by purple link; others by black links.

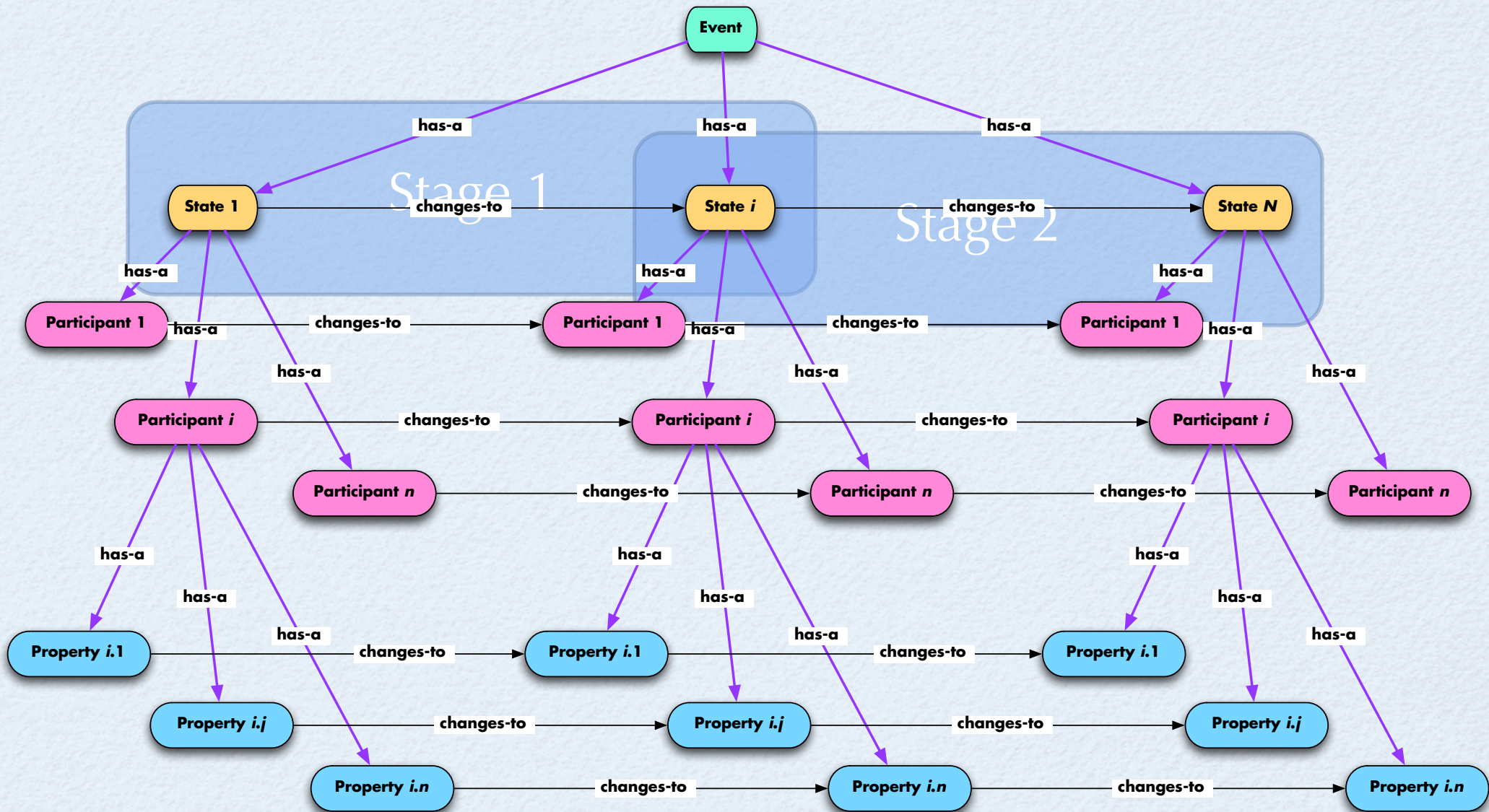# Layered Structure of Event

HAS-A relation is indicated by purple link; others by black links.

Layered Structure of Event

HAS-A relation is indicated by purple link; others by black links.

Layered Structure of Event

HAS-A relation is indicated by purple link; others by black links.

From Interpretation to Understanding

Ontology of Event/Situation Participant

- FrameNet/Frame Semantics defines a "situation" as an organization of situation-specific variables, called "frame elements" (*aka* semantic roles).
  - By and large, ontology of nominals are derived from the hierarchy of situations, if not by-product.
- If semantic roles are participants of events, it is desirable to:
  - define concepts with reference to a specific situation
  - provide a systematic classification of semantic types and roles
- How to implement it?

Notes

- No serious attempt is made to construct a formal ontology (Guarino 1998; Gruber 1994)
  - The distinction between *subtype-of* and *instance-of* relations, argued for by Guarino (1998, among others) under the name of *is-a* overloading, is hard to make on the *usage* basis rather than on the *lemma* basis.
- We know such relations *need* to be distinguished but we need an *operative* definition, not a *theoretical* definition, without which we can't deal with word senses in a real text.
  - It boils down to word sense disambiguation procedure, to which no quick answer is known.

Assumptions

- Situations (as *typed* structures) are not only *first class* objects of ontological/conceptual system, but *basic* objects.
  - By and large, classification of nominals, except purely natural kinds, is by-product of situation classification.
    - This is true of functional classes such as roles
- Detailed descriptions of lexical meanings are sometimes superfluous.
  - Part of polysemy is a side effect.
- Usefulness of upper ontology is limited, as far as lower ontogies are specified.

Competitive Theory of Frame Selection

- All words in a sentence $s = w_1\ w_2\ \cdots\ w_n$ evoke a set of frames independently.
  - No upper limit to the number, causing a competition, yielding a "selectional" process
    - Generative Lexicon Theory's "co-composition" is another name for this selectional process.
  - Of course, nouns and adjectives do this, too (cf. qualia structure (Pustejovsky 1995))
- Thus, a set of frames $F(s) = \{f_1, f_2, …, f_n\}$ is assigned to s (via independent evocations), w_i usually receives an *array* of "frame elements" (aka "semantic roles").

Sample MSFA with PMA

	A	B	C	D	E	F	G
1	INDEX	WORD	I**	saw**	a man**	with**	a telescope**
2	p1	I	I*	V			
3	p2	saw	S	saw*	O		
4	p3	a man	S	V	a man*		
5	p4	with	(S)	V		with*	O
6	p5	a telescope	(S)	V		P	a telescope*

Frame ID (local)	F1	F2	F3	G1
Frame-to-Frame relations (global)	elaborates F3		elaborates G1	
Frame Name	Perception_active[+visual]	*Perception_active	*Using	*Intentionally_act
I	Perceiver[+visual]	*Perceiver_agentiv	*Agent	*Agent
saw	GOVERNOR?	GOVERNOR?	*Purpose	*Act
a man	Object	*Phenomenon		
with	Instrument.MARKER	*Means	GOVERNOR?	
a telescope	Instrument		Instrument	