Pictorial Narratives and Temporal Refinement

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Abstract

Pictorial narratives and their semantics have recently been investigated by Dorit Abusch and Mats Rooth, among others (Figure 1). To read two successive pictures p, p' by default as p *and then* p', I propose refinements based on the Aristotelian dictum

no time without change

and the principle of inertia

no change without force

guided by the adage

a picture's worth a thousand words.

Words describing pictures are formalized as predicates, some stative and some non-stative (expressing forces), and interpreted (in either case) over strings qua models, subject to finite-state projections supporting variable granularity.

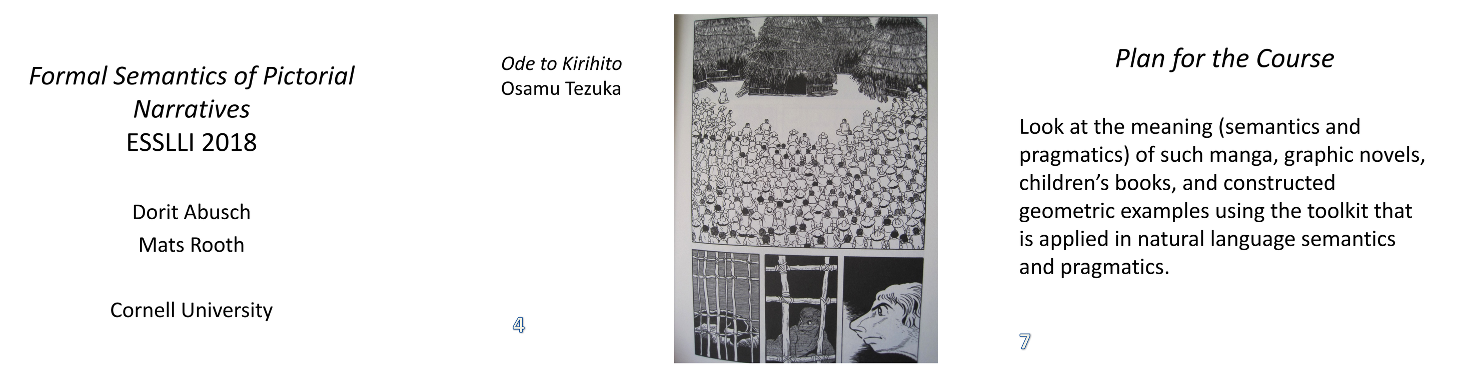

Figure 1: `http://conf.ling.cornell.edu/mr249/esslli-pictorial-overview.pdf`

The Problem

Two pictures in succession, p_i and p_{i+1}, have a default reading (**D**), specifying two stretches of time, one with p_i, followed by one with p_{i+1}.

(**D**) $\boxed{p_i}\boxed{p_{i+1}}$ 'p_i *and then* p_{i+1}' (default progression)

Under an alternative reading (**N**), p_i and p_{i+1} describe one and the same stretch of time — or one box.

(**N**) $\boxed{p_i, p_{i+1}}$ 'p_i *and simultaneously* p_{i+1}' (no progression)

Now, if we assume that p_i and p_{i+1} are stative, as Abusch 2014 does, then the inertiality of statives suggests that in the default reading (**D**) where there is *no* force, p_i persists forward to the next box, and p_{i+1} backward to the previous box, yielding (**I**).

(**I**) $\boxed{p_i, p_{i+1}}\boxed{p_i, p_{i+1}}$ (stutter)

(**I**) consists of two boxes, with the same content, p_i and p_{i+1}. As states are cumulative, these two boxes merge into one (effectively deleting a *time without change*). Progression by default, (**D**), has turned into *no* progression, (**N**). This is welcome only in cases where the default should be overriden (not where the default applies). Where have we gone wrong? Should we put (**D**), (**N**) and (**I**) away?

Main Claims

1. The derivation of (**N**) from (**D**) above rests on the absence of forces at play — an assumption unwarranted in cases of change (for progression), but appropriate for portraying a static background.
2. Forces are suggested, if not depicted outright, in a picture or a succession of pictures.
3. Inertia is *not* all-or-nothing: some pieces of a picture may persist, others may not.
4. Breaking a picture p up into a finite set α of predicates facilitates a separation of stative pieces from non-stative ones (expressing forces).
5. Granularity can be varied via projections that recognize gaps between boxes and the difference between statives and non-statives (blocking the step from (**I**) to (**N**) when p_i or p_{i+1} is non-stative).

A picture as a thousand words, sorted and possibly embedded

A pixelmap encoding a picture p amounts to a finite set α of formulas $c(z)$ classifying a region z of space as c (yielding, for instance, Figure 2).

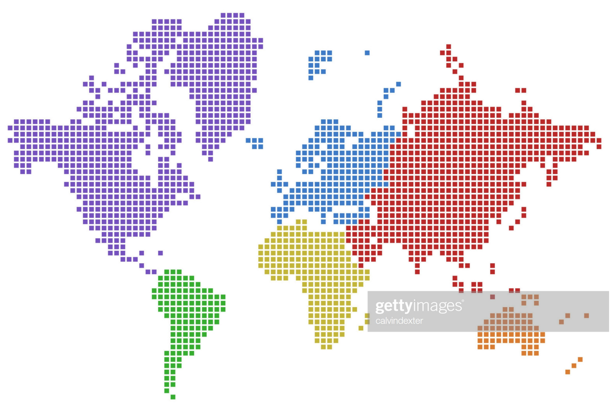

Figure 2: `https://www.gettyimages.ca`

The projective model of a picture

$$p = \pi(w, v, I, M) \qquad (1)$$

leads to a proposition p^v centered around a viewpoint v that (I, M)-generates the $c(z)$'s.

A symbol a in a set α (drawn as a box) may be $c(z)$ or a higher-level item of information such as p^v or even a formula *see*(x, p) that embeds what$_p$ an agent$_x$ sees (as in free perception hidden operators, Abusch & Rooth 2017).

Consistency is imposed on a box α via some reflexive symmetric relation $\frown$ of compatibility, relative to which α is required to be a clique

$$a \frown a' \quad \text{for all } a, a' \in \alpha$$

with (1) built into $\frown$, if desired.

Bounded granularity is imposed by requirig that α be a subset of some finite set Σ.

A symbol a in Σ names a predicate P_a that is either stative, in which case P_a holds of stretches of time, or non-stative a, in which case P_a happens just before succeeding stretches.

As Σ varies over finite sets, granularity is coarsened or refined, using projections that differentiate stative from non-stative predicates.

Statives vs non-statives

a basic aspectual distinction widely adopted (e.g. DRT, Kamp & Reyle)

stative	non-stative
still-life	motion picture
static	dynamic
holds/be	happens/do. . . $\rightsquigarrow$

	atomic	*extended*
	ACHIEVEMENT	ACCOMPLISHMENT
+conseq	*culmination*	*culminated process*
STATE a	$\boxed{\overline{a}}\boxed{a}$	$\boxed{\overline{a},\text{ap}(f)}\boxed{\overline{a},\text{ap}(f),\text{ef}(f)}\boxed{\text{ef}(f), a}$
	(semelfactive)	ACTIVITY
−conseq	*point*	*process*
f	$\boxed{\text{ap}(f)}\boxed{\text{ef}(f)}$	$\boxed{\text{ap}(f)}\boxed{\text{ap}(f),\text{ef}(f)}\boxed{\text{ef}(f)}$

No change without border left border $l(a)$ as '*make a true*'

$$b : (2^{\Sigma})^* \to (2^{\Sigma_\bullet})^*, \alpha_1 \cdots \alpha_n \mapsto \beta_1 \cdots \beta_n \text{ where}$$
$$\Sigma_\bullet := \{l(a) \mid a \in \Sigma\} \cup \{r(a) \mid a \in \Sigma\}$$
$$\beta_i := \{l(a) \mid a \in \alpha_{i+1} - \alpha_i\} \cup \{r(a) \mid a \in \alpha_i - \alpha_{i+1}\} \text{ for } i < n$$
$$\beta_n := \{r(a) \mid a \in \alpha_n\} \qquad (r(a) \text{ as } \textit{last } a)$$

$$\text{e.g.} \quad b(\boxed{}\boxed{a}\boxed{a, a'}\boxed{a'}) = \boxed{l(a)}\boxed{l(a')}\boxed{r(a)}\boxed{r(a')}$$

Unary predicate P_a over string positions, with successor relation S (Monadic 2nd Order, MSO)

$$P_{l(a)}(x) \equiv \neg P_a(x) \wedge (\exists y)(xSy \wedge P_a(y)) \qquad (2)$$

From border to force Under a construal of $l(a)$ as a force for a, (2) suggests inertia

$$\text{persistence without force: } xSy \wedge \neg P_a(x) \wedge \neg P_{l(a)}(x) \supset \neg P_a(y)$$
$$\text{force from clash: } xSy \wedge \neg P_a(x) \wedge P_a(y) \supset P_{l(a)}(x).$$

$\boxed{l(a)}\boxed{a}$	`break`	result a
$\boxed{\text{ap}(f)}\boxed{\text{ef}(f)}$	`hit`	manner f
	Fillmore	Levin & Rappaport Hovav

Let us generalize $l(a)$ to a force $f(a)$ that competition may render ineffectual

$$xSy \wedge P_{f(a)}(x) \supset (P_a(y) \vee P_{f(\overline{a})}(x)) \quad \text{where } P_a(x) \supset P_{\overline{a}}(x)$$

without requiring $P_{f(a)}(x) \supset \neg P_a(x)$ (admitting forces against change).

Finitary projections

Just as any set X is the union of the set *Fin*$(X) := \{\Sigma \subseteq X \mid \Sigma \text{ is finite}\}$ of its finite subsets, any linear order $<$ on X is isomorphic to the inverse limit

$$\varprojlim \{<_\Sigma\}_{\Sigma \in Fin(X)} \text{ where for any finite chain } x_1 < \cdots < x_n,$$
$$<_{\{x_1,\ldots,x_n\}} \text{ is the string } x_1 \cdots x_n.$$

Difference here: form $<$ from *Fin*$(\Theta)^+$, given some infinite set Θ of predicates

$$\Sigma\textit{-reduct } \rho_\Sigma(\alpha_1 \cdots \alpha_n) := (\alpha_1 \cap \Sigma) \cdots (\alpha_n \cap \Sigma)$$

$$\boxed{}\boxed{a}\boxed{a,a'}\boxed{a,a',a''}\boxed{a',a''}\boxed{a''}\boxed{} \overset{\rho_{\{a,a'\}}}{\rightsquigarrow} \boxed{}\boxed{a}\boxed{a,a'}\boxed{a,a'}\boxed{a'}\boxed{}\boxed{} \overset{bc}{\rightsquigarrow} \boxed{}\boxed{a}\boxed{a,a'}\boxed{a'}\boxed{} \quad \text{no stutters}$$

$\downarrow b$ border translation

$$\boxed{l(a)}\boxed{l(a')}\boxed{l(a'')}\boxed{r(a)}\boxed{r(a')}\boxed{r(a'')}\boxed{} \overset{\rho_{\{l(a),r(a),l(a'),r(a')\}}}{\rightsquigarrow} \boxed{l(a)}\boxed{l(a')}\boxed{}\boxed{r(a)}\boxed{r(a')}\boxed{}\boxed{}$$

$$\overset{\mathsf{d}_\square}{\rightsquigarrow} \boxed{l(a)}\boxed{l(a')}\boxed{r(a)}\boxed{r(a')} \quad \text{no empty boxes}$$

forces	statives (in Σ)
$\mathsf{d}_\square(s) := s$ without $\square$	$bc(s) := s$ without stutters
$s\square s' \rightsquigarrow ss'$	$s\alpha\alpha s' \rightsquigarrow s\alpha s'$

$$\{bc(s)\} = b^{-1}(\mathsf{d}_\square(b(s))\square) \quad \text{for } s \in (2^{\Sigma})^*\square$$

$$\Sigma\text{-projection} := \Sigma\text{-reduct; compress} = \begin{cases} \rho_\Sigma; bc & \text{for statives} \\ \rho_\Sigma; \mathsf{d}_\square & \text{for non-statives} \end{cases}$$

Conclusions

The link between default progression (**D**) and no progression (**N**) forged through inertia and destuttering (**I**) can be refined to account for forces behind change (necessitating time). The key is to decompose a picture p into finitely many predicates, packaged in a box α. Given a finite set Σ of observable predicates (specifying a bounded granularity), we can then analyze a sequence $p_1 \cdots p_n$ of pictures as a string $\alpha_1 \cdots \alpha_n$ of subsets α_i of Σ. The level of detail can be raised by enlarging Σ. Granularity is coarsened through projections that compress strings in a manner dependent on whether or not the predicates are stative. The usefulness of breaking a picture p into a thousand pieces α is an argument for interpreting MSO$_\Sigma$ by strings over the alphabet 2^Σ, as opposed to Σ (the custom in formal language theory and finite-state methods).

Disclaimer: beyond pictorial narratives

Treating temporal progression as a default is questionable outside narratives. Rhetorical relations have, for instance, been claimed to shape temporal interpretation, overturning simple temporal progression (e.g. SDRT, Asher & Lascarides). That said, I argue elsewhere that the finite-state system of projections here is useful for understanding temporality and events in natural language semantics.