# Intensity of desire is monotonic

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LSA 2018 Annual Meeting
Salt Lake City, UT (well, for some of us...)
January 6th, 2018

# The main takeaway

In the model(s) used for semantic interpretation, the intensity of a state of desire tracks its part-whole structure.

In other words, a more intense desire state is "bigger" than a less intense one.

The trick then becomes integrating this mereology with a broadly Hintikkan semantics for *want*.

# Some measurements track part-whole structure...

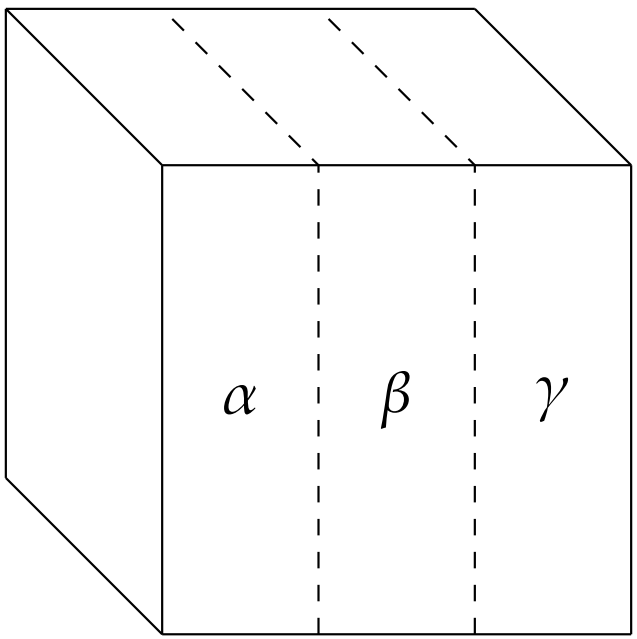
- **Weight** of a piece of gold: necessarily greater than that of its (proper) parts.
- **Volume** of a collection of water: necessarily greater than that of its (proper) parts.

# . . . some don't. . .

- **Purity** of a piece of gold: **not** necessarily greater than that of its (proper) parts.
- **Temperature** of a collection of water: **not** necessarily greater than that of its proper parts.

# . . . and sometimes it depends on the choice of part-whole structure.

- **Depth** of snow:




$$\text{depth}(\alpha \oplus \beta) \not> \text{depth}(\alpha),$$
$$\text{depth}(\alpha \oplus \beta \oplus \gamma) \not> \text{depth}(\alpha \oplus \beta),$$
etc.

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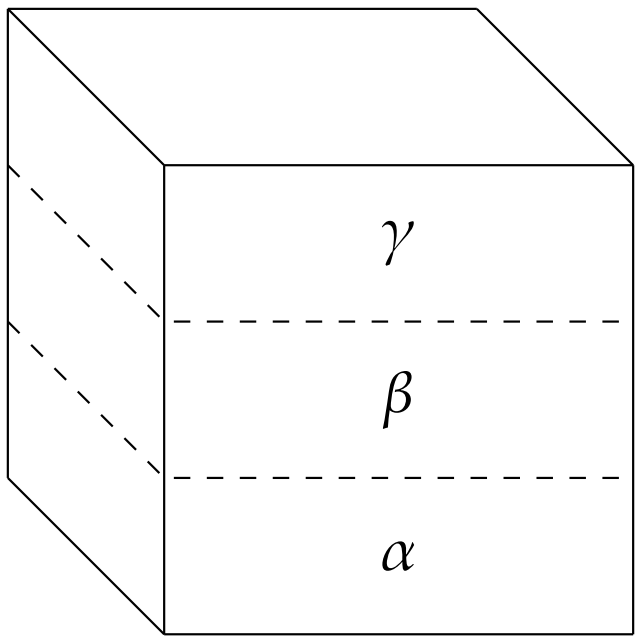


$$\text{depth}(\alpha \oplus \beta) > \text{depth}(\alpha),$$
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etc.

# Drawing the line

Various ways of distinguishing weight, volume, and depth from purity and temperature:

**extensive measure functions** (Krifka 1989)
**stratified reference** (Champollion 2015)
**monotonicity** (Schwarzschild 2002, 2006)

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⇒ **monotonicity** (Schwarzschild 2002, 2006)

# Defining monotonicity

Given measure function $\mu$, domain $A$, and contextually-determined part-whole relation $\sqsubseteq^c$,

$\mu$ is **monotonic on $\sqsubseteq^c$ in $A$**
iff for all $x, y \in A$, if $x \sqsubset^c y$, $\mu(x) < \mu(y)$.

(Note: Technically, this defines a *strictly increasing* monotonic (partial) function, in contrast to *weakly increasing* (in which one replaces $\sqsubset^c$ and $<$ with $\sqsubseteq^c$ and $\leq$). I'll stick to simply "monotonic", since that's the terminology I'm inheriting.)

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purity and temperature are **not** monotonic on salient $\sqsubseteq^c$ in $[\![\text{gold}]\!]$ or $[\![\text{water}]\!]$.

# Constructions with monotonicity requirements

Some measurement-related constructions impose requirements that the measure functions be monotonic:

- Pseudopartitives
- Adverbial measure phrases
- Nominal comparatives
- Verbal comparatives

# Pseudopartitives

(1) a. Louise bought twelve ounces of gold.
b. # Louise bought eighteen carats of gold.

(2) a. Max poured three liters of water into the tub.
b. # Max poured 30°C of water into the tub.

(3) a. Baltimore got two feet of snow.
b. # Baltimore got 20°F of snow.

(Krifka 1989; Schwarzschild 2002, 2006)

# Vague degree phrases and the *in terms of* test

(4) a. In terms of {volume/??darkness}, Nevin bought a lot of coffee.
b. In terms of {depth/??coldness}, Baltimore got a ton of snow.
c. In terms of {weight/??viscosity}, Owen ate a great deal of pudding.

# Adverbial measure phrases

(5) Mary swam a lot yesterday.

**T:** Mary swam a long distance, or for a long time.

**F:** Mary swam a short distance in a small amount of time, but very quickly.

(6) In terms of {distance/??speed}, Mary swam a lot yesterday.

# Nominal comparatives

(7) Pauline ate more pudding than Owen did.

**T:** Pauline's pudding had a greater volume or mass.

**F:** Pauline's pudding had a lesser volume and mass, but greater viscosity.

(8) In terms of {weight/??viscosity}, Pauline ate more pudding than Owen did.

(Schwarzschild 2002, 2006; Nakanishi 2007; Wellwood et al. 2012; Wellwood 2014, 2015)

# Verbal comparatives

(9) Dee ran more than Evan did.

**T:** Dee ran a greater distance or for a longer time.

**F:** Dee ran a shorter distance in less time, but faster.

(10) In terms of {distance/??speed}, Dee ran more than Evan did.

(Nakanishi 2007; Wellwood et al. 2012; Wellwood 2014, 2015)

# All can be used to measure intensity of desire!

**Pseudopartitive:**

(11) There is **a lot of desire** on Maria's part for a change in leadership.

**Adverbial measure phrase:**

(12) At the end of the meeting, Maria wanted the CEO to be fired, and she **wanted it a lot**.

**Nominal comparative:**

(13) There is **more desire** on Maria's part than on Kurt's part for a change in leadership.

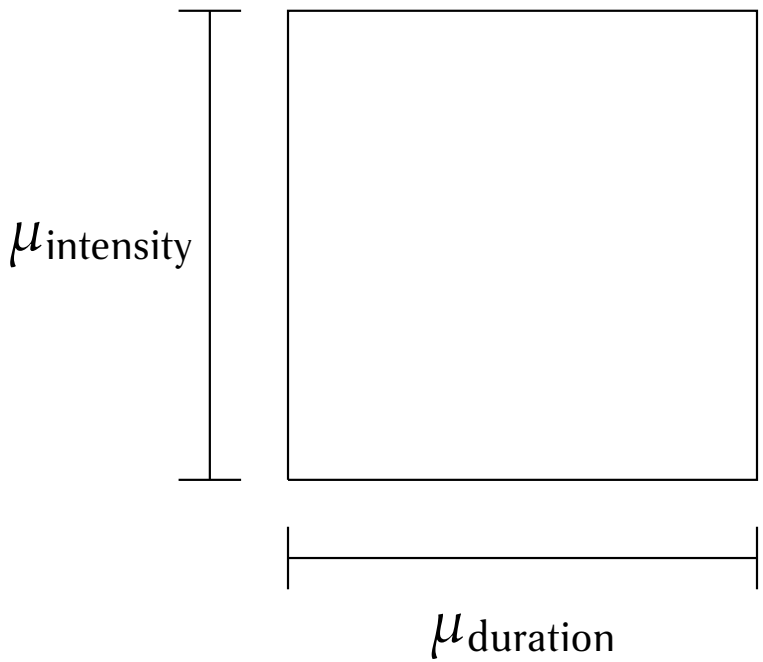
**Verbal comparative:**

(14) Ben **wants** the CEO to be fired **more** than Jen does.

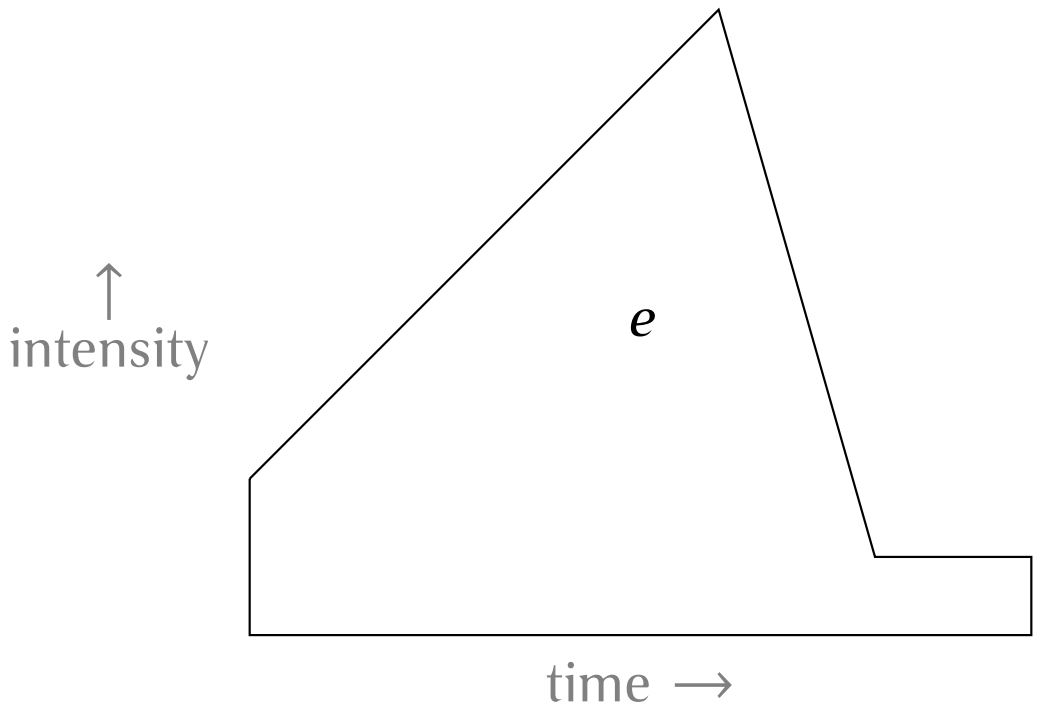
# 2D desire states

Intensity of desire is monotonic $\Longrightarrow$ desire states extend in (at least) two dimensions:

- "horizontally" (**time**)
- "vertically" (**intensity**)



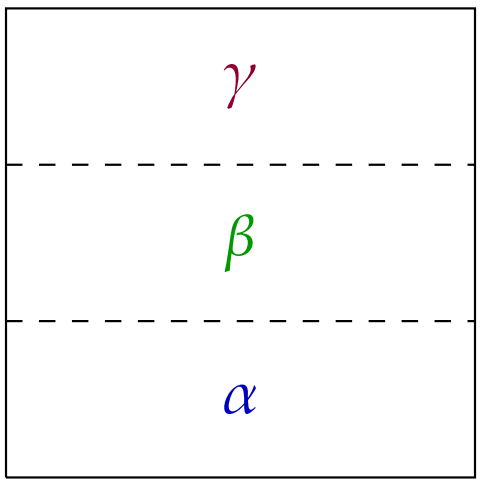
# Illustration




Desire state *e* gets gradually more intense, then suddenly drops off and levels at a “low hum”.

# This makes intensity monotonic

Salient part-whole relations akin to layers of snow:




$$\mu_{\text{intensity}}(\alpha \oplus \beta \oplus \gamma) > \mu_{\text{intensity}}(\alpha \oplus \beta) > \mu_{\text{intensity}}(\alpha)$$

# An informal template for verbal comparatives

(15) $[\![\alpha \text{ VP}_1 \text{ more than } \beta \text{ VP}_2]\!]^c \approx$

a. **Assertion:** There is an event/state of $\alpha$ $\text{VP}_1$ing that exceeds by $\mu^c$ any event/state of $\beta$ $\text{VP}_2$ing.

b. **Presupposition:** $\mu^c$ is monotonic on $\sqsubseteq^c$ in $[\![\text{VP}_1]\!]$ and $[\![\text{VP}_2]\!]$.

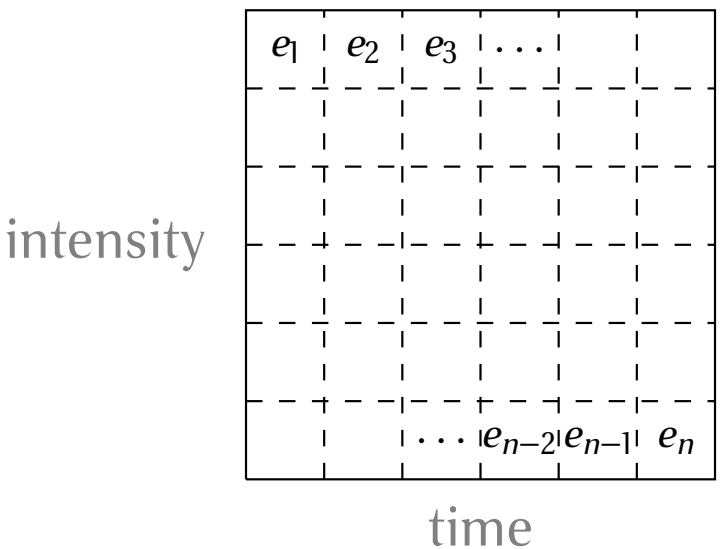
(16) Ron wants to learn Russian more than he wants to visit Quebec.

- Assertion of $[\![(16)]\!]$, assuming $\mu^c$ is $\mu_{\text{intensity}}$: there is a state of Ron wanting to learn Russian that exceeds in intensity any state of Ron wanting to visit Quebec.
- $\mu_{\text{intensity}}$ is monotonic on $\sqsubseteq^c$ in domains of desire states, so presupposition is satisfied.

# ⟦want⟧ and part-whole structure

- WANT = Hintikkan part of ⟦want⟧ (next slide)
- ⟦want⟧ divides state into tiny parts (*point-states*) and ∀-quantifies:

(17) $[\![\text{want}]\!] = \lambda p \lambda e.\ \forall e' \in \text{PT}(e)[\text{WANT}(p)(e')]$




$$\text{PT}(e) = \{e_1, e_2, e_3, \ldots, e_{n-2}, e_{n-1}, e_n\}$$

(See Pasternak 2017 for independent evidence of such quantification over point-states)

# Defining WANT

WANT = von Fintel's (1999) Kratzerian *want*, event-ized:

(18) $\text{WANT} = \lambda p \lambda e.\ \forall w \in \text{Best}(\text{Dox}(e), \lesssim_e)[p(w)]$

- $\text{Dox}(e)$: set of worlds compatible with beliefs of $\text{Exp}(e)$
- $\lesssim_e$: bouletic ordering over worlds
- $\text{Best}(A, \lesssim) = \{w \in A \mid \neg\exists w' \in A[w' \prec w]\}$

  (i.e., best worlds in $A$ according to $\lesssim$)

(**NB:** This definition ignores a requirement von Fintel adopts from Heim (1992), that $\text{Dox}(e)$ must be compatible with, but not entail $p$ (i.e., $\text{Dox}(e) \cap p \notin \{\text{Dox}(e), \emptyset\}$).)

# ⟦want⟧: the whole thing

(19) $[\![\text{want}]\!] = \lambda p \lambda e.\ \forall e' \in \text{PT}(e)[\forall w \in \text{Best}(\text{Dox}(e'), \precsim_{e'})[p(w)]]$

**Plain English:** $e$ is a state of wanting $p$ iff in all point-states of $e$, $p$ holds in all bouletically ideal belief-worlds.

# The Ron problem

(16) Ron wants to learn Russian more than he wants to visit Quebec.

- $q$ = Ron visits Quebec, $r$ = Ron learns Russian
- **Intuition:** if Ron believes $q$ and $r$ to be mutually compatible, then both hold in all bouletically ideal worlds.
- But then how can Ron want one more than the other? All ⟦want⟧ cares about is bouletically ideal worlds.

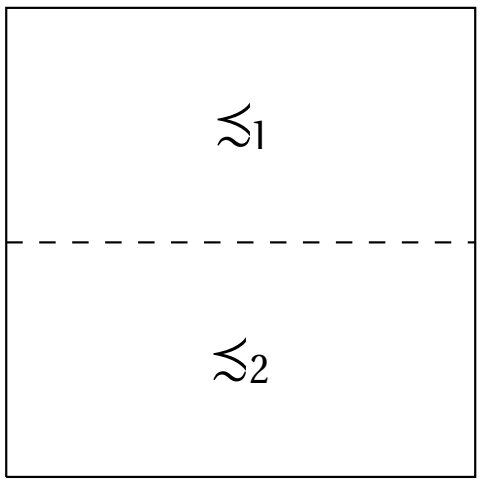
# Differentiating Russian and Quebec

- **Proposal:** On an abstract level, we can think of one's bouletic ordering over worlds as generated *in steps*.
- Say $w_{qr}$ is a world in which $q$ and $r$ both hold, $w_q$ one where just $q$ holds, etc.
- Step 1 ($\lesssim_1$): $r$ worlds are ranked higher than $-r$ worlds

  $w_{qr}, w_r \prec_1 w_q, w_\emptyset$
- Step 2 ($\lesssim_2$): $q$ breaks ties

  $w_{qr} \prec_2 w_r \prec_2 w_q \prec_2 w_\emptyset$

# Ordering generation in the mereology

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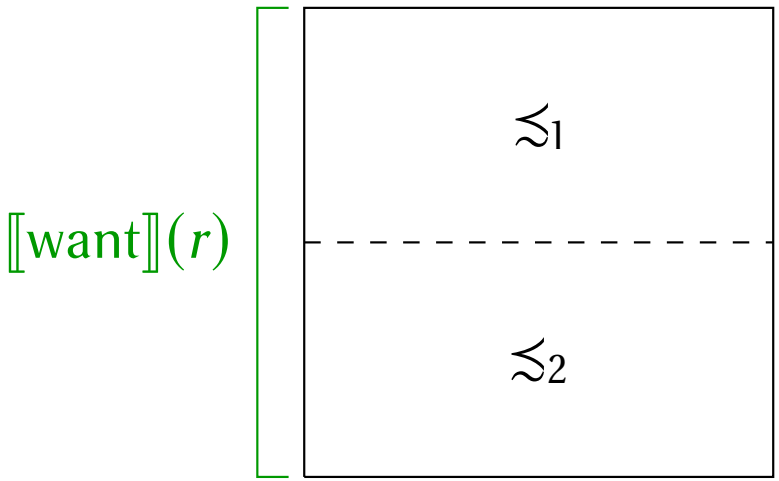


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All $\lesssim_1$- and $\lesssim_2$-ideal worlds are $r$-worlds.

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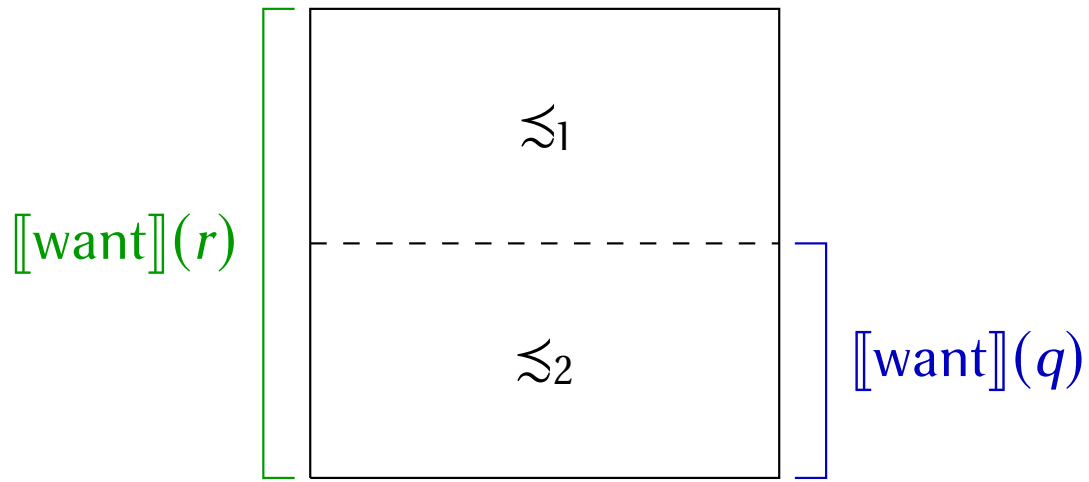


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All $\lesssim_1$- and $\lesssim_2$-ideal worlds are $r$-worlds.

All $\lesssim_2$-ideal worlds, but **not** all $\lesssim_1$-ideal worlds, are $q$-worlds.

# Success!

**Result:** As desired, Ron wants to learn Russian more than he wants to visit Quebec, and the intensity of these desires correlates with the part-whole structure of his desire state (i.e., is monotonic).

# Thank you!

Special thanks to Gregory Ward, David Robinson, and Masha Esipova for helping make this talk happen in spite of the snowpocalypse. For helpful discussion, many thanks to:

- Lucas Champollion, Masha Esipova, Kai von Fintel, Thomas Graf, Sabine Iatridou, Angelika Kratzer, Richard Larson, Maša Močnik, Friederike Moltmann, Milo Phillips-Brown, Roger Schwarzschild, and Ildikó Emese Szabó
- Audiences at the UMass Semantics Workshop and the MIT Syntax-Semantics Reading Group (LFRG)

For more on this project, see my 2017 manuscript ("A lot of hatred and a ton of desire: Intensity in the mereology of mental states")...

- http://semanticsarchive.net/Archive/WVmMzYwO/

...and my forthcoming Stony Brook University dissertation (*The Mereology of Attitudes*).