Countability in the nominal and verbal domains

Chierchia and the Vagueness of Mass Nouns
&
Rothstein on the Semantic Atomicity and the Role of Context

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Chierchia and the Vagueness of Mass Nouns

Chierchia (1998): Mass Ns are Inherently Plural

- Denotations of Mass Nouns are whole sub-lattices
- Inherently plural
- "For a mass noun the difference between singular and plural is quite literally neutralized." (p. 69)

furniture$_w$ 

- Vagueness is: "...orthogonal to the mass/count distinction" (Chierchia 1998, p. 68)
  - Complete revision in Chierchia (2010)

The Semantic Triad

$$\begin{tikzcd}
c \arrow[d, bend right, "\cup"'] \\
\mathrm{CAT}_w \arrow[u, bend right, "\cap"'] \arrow[d, bend right, "\mathrm{AT}"'] \\
\mathrm{cat}_w \arrow[u, bend right, "*"']
\end{tikzcd}$$

c	type $\langle s, e\rangle$	the cat kind
CAT_w	type $\langle e, t\rangle$	number neutral property
cat_w	type $\langle e, t\rangle$	atomic property

- Cats are common.
- Those are cats.
- Felix is a cat.

- Rice is common.
- I ate some rice yesterday.
- # That is a rice.

The Semantic Triad

$$
\begin{tikzcd}
c \arrow[d, bend right, "\cup"'] & \text{type } \langle s, e\rangle & \text{the cat kind} \\
\mathrm{CAT}_w \arrow[u, bend right, "\cap"'] \arrow[d, bend right, "\mathrm{AT}"'] & \text{type } \langle e, t\rangle & \text{number neutral property} \\
\mathrm{cat}_w \arrow[u, bend right, "*"'] & \text{type } \langle e, t\rangle & \text{atomic property}
\end{tikzcd}
$$

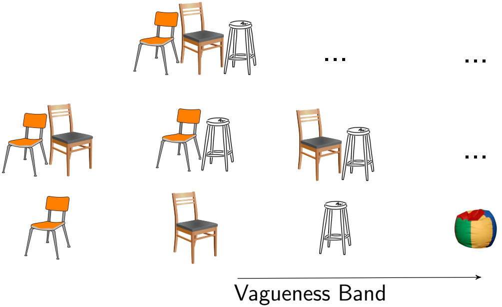
- $AT(CAT_w) = \{x \in CAT_w : \forall y \in CAT_w[y \sqsubseteq x \rightarrow x = y]\}$
- ${}^{*}cat_w = \lambda x.\exists Q.[Q \subseteq cat_w \wedge x = \sqcup Q]$
- ${}^{\cap}CAT_w = \lambda w'.[\iota x.CAT_{w'}(x)]$
- ${}^{\cup}c = \lambda w.\lambda y.[y \sqsubseteq c_w]$

Chierchia (1998): Semantic Parameter

N $\Rightarrow$ [+arg, −pred] e.g. Chinese, Ns of type $\langle e\rangle$
N $\Rightarrow$ [+arg, +pred] e.g. English, Ns of type $\langle e\rangle$ and $\langle e, t\rangle$
N $\Rightarrow$ [−arg, −pred] e.g. French, Ns of type $\langle e, t\rangle$

Stable Atoms

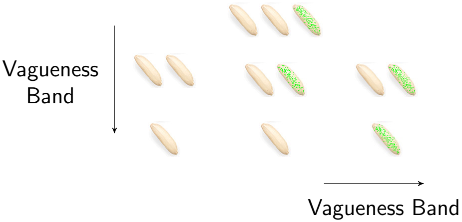
- "Stable atomicity" of any count N sanctions counting
  - I.e. Any count N has at least some elements that are atomic across all admissible precisifications



Unstable Entities

Vagueness about what minimal elements are (single indivisible atoms)

- Vagueness in mass Ns blocks counting
  - Mass Ns have *unstable individuals* in their denotation
  - I.e., atoms (minimal entities) on some precisifications are not minimal on others



Contextual Variation

We don't have any cats.
(always false)

vs.

I've eaten (all) my rice.
(sometimes true)

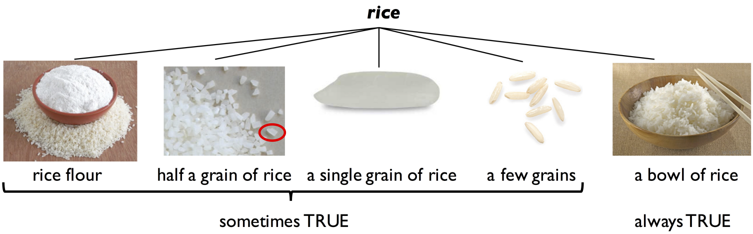
I've cleaned (all) the mud off my boots.
(sometimes true)

Main idea: This kind of contextual variation patterns with mass nouns.

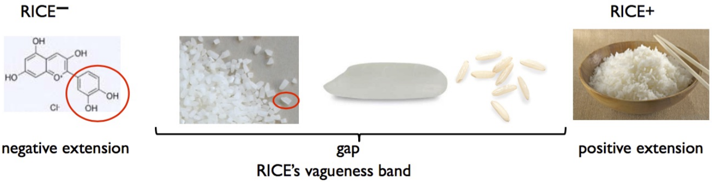
- Counterexamples (Grimm & Levin pc.)
  - Single defeating contexts
  - More on this later

Contextual Variation and Vagueness of Rice

- Contextual variation:



- Translates into vagueness:



Contextual Variation and Vagueness of Rice cont.

For some (...) purposes, we might consider a grain of rice, rice [allergy testing, cereal cultivation, HF]. But, then that applies to half grains as well. And to quarters of grains. In certain cases, we may regard rice flour as rice (as when we say there is rice in this cake). The point is that there is no systematic basis for deciding which rice amounts qualify as rice atoms" (p.117-8).

"rice has contextually supplied smallest parts, but lacks stable atoms (because the vagueness of the smallest rice parts will be resolved differently in different precisifications) (p. 123).

Chierchia's Unstable Entities

On a supervaluationist semantics, vague predicates have a positive and negative extension, and also an extension gap. (Defined as a partial model)

- A schematic example:
  - $\mathbf{D} = \{a, b, c, d, a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\}$
  - ${}^{+}P = \{a \sqcup b \sqcup c\}$ (This is the *"Ground Context"*)
  - ${}^{-}P = \{d\}$
- But P can be precisified to include smaller sums/quantities. (Partial model is extended by classical completions of the model)
- In this case, there are three possible precisifications:

$$
\begin{array}{ll}
P_{c_0} = \{a \sqcup b \sqcup c\} & At(P_{c_0}) = \{a \sqcup b \sqcup c\} \\
P_{c_1} = \{a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\} & At(P_{c_1}) = \{a \sqcup b, a \sqcup c, b \sqcup c\} \\
P_{c_2} = \{a, b, c, a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\} & At(P_{c_2}) = \{a, b, c\}
\end{array}
$$

Chierchia's Unstable Entities cont.

$$At(P_{c_0}) = \{a \sqcup b \sqcup c\}$$
$$At(P_{c_1}) = \{a \sqcup b, a \sqcup c, b \sqcup c\}$$
$$At(P_{c_2}) = \{a, b, c\}$$

- A 'Definitely' operator, D:
  - $[\![D(\phi)]\!]^{M,c,g} = 1$ iff for all c' of c, $[\![\phi]\!]^{M,c',g} = 1$
- Stable Atoms
  - $\mathbf{AT}(P) = \lambda x.D[AT(P)(x)]$
- There are no entities x in $At(P_{c_1})$, $At(P_{c_0})$, $At(P_{c_2})$ that make $D[AT(P)(x)]$ true.

There are no entities that are atoms relative to all precisifications, so the are no *Stable Atoms* to form a counting base.

Mass and Count N Denotations

- Ns map onto Number Neutral properties (or Kinds)
- Count Ns are built from STABLE ATOMS
  - If N is count, $[\![\mathbf{AT}(N)]\!]_{M,g,c} \neq \varnothing$
    - Count Ns have stable atoms (adjusted defn.)
- Mass Ns are built from UNSTABLE ENTITIES
  - If N is mass, $[\![\mathbf{AT}(N)]\!]_{M,g,c} = \varnothing$
    - Mass Ns lack stable atoms

Direct Numeral Attachment: Example

Simple idea: Restrict Number Phrase interpretations to apply only to interpretations of Ns with stable atoms

- $[_{\text{NumP}}\text{n[cats]}] = \lambda x[\mu_{\mathbf{AT},cats}(x) = n]$
  - For any x and any P, $\mu_{\mathbf{AT},P}$ is defined only if:
    i. $P(x)$
    ii. P has stable atoms.
  - $\mu_{\mathbf{AT},P}$ = the number of stable P-atoms that are part of x (if defined)
- Three cats are purring
- $\exists x[\mu_{\mathbf{AT},cats}(x) = 3 \ \wedge \ purring(x)]$

Count/Mass Variation

Why a problem?

- If only vagueness explains MASS, then how could there be variation?

Intralinguistic Variation: *rope vs.rope*

- Assume 'primary' reading of *rope* is Mass. Derive Count reading of *rope* via a partition on $^{+}Rope$ in terms of "standardized bounded units"

Crosslinguistic Variation: $\textit{kichenware}_{[-C]}$ *vs* $\textit{Küchengerät-e}_{[+C]}$

- "fake mass" Ns arise from a 'copycat' effect in number marking languages

Crosslinguistic Variation: $\textit{lentil-s}_{[+C]}$ *vs.* $\textit{čočka}_{[-C]}$

- "standardized partitions are more readily available" in some languages (e.g. English) than others (e.g. Czech)

But now we have 3 different explanations for [+COUNT]/[-COUNT] variation...

Problem: Equivocation, substance and ‘granular’ Ns

Recall: *cat* versus *rice* / *mud*

We don’t have any cats. (always false)

I’ve eaten (all) my rice. (sometimes true)

I’ve cleaned (all) the mud off my boots. (sometimes true)

But: *rice* versus *mud*

- We CAN and DO distinguish minimal salient elements in the denotation of Ns denoting GRANULAR (*rice, lentils*) and FIBROUS (*hair*) entities
  - And these nouns vary wrt COUNT and MASS
- “Substance” nouns are different: e.g. *water*, *blood*
  - And these nouns are stably MASS
- Formal atomicity insufficient. Need something more like INDIVIDUATION (‘counting as one’)

Problem: Supervaluationism

- There are contexts e.g. in which having 1 cat does not count as 'having cows' (Grimm & Levin pers. comm.)
  - The large-scale dairy farmer: Having one cow does not count as 'having cows'
  - But then there is one context c' in which $AT(COW_{c'})$ excludes singles cows.
  - But that would mean that *cow* is mass!
- Generalized: Requires only one defeating context to make a noun mass

- However, this is an artifact of supervaluationism, not of a vagueness-based approach
- Solution: Go for gradience
  - Either degree supervaluationism.
  - Or, e.g. probabilistic (Sutton and Filip 2016a,b,c)

Summary

- A significant departure from Chierchia (1998)
- The first detailed proposal to follow intuitions in Chierchia (1998); Rothstein (2010) that there is something vague about (some) count Ns
- Addresses the question of where and why to expect [+C]/[-C] variation within and across languages.
  - Explanation not very parsimonious
  - (As we'll see with Landman (2011)), doesn't explain all 'fake' mass noun behaviour.
- Problems:
  - Supervaluationism and single 'defeating' contexts
  - Equivocation between granular and substance nouns

Overview of Chierchia (2010)

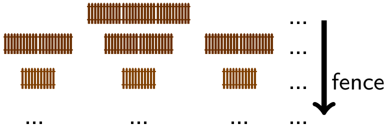
Proposal	Main Idea	Strengths	Weaknesses
Chierchia (2010)	Mass Ns are vague	Why *rice, mud* is mass	Fake mass Ns (*furniture*)
	Count Ns have stable atoms	Why *cat, chair* is count	Vague count Ns (*lentils*)

Rothstein on the Semantic Atomicity and the Role of Context

Recap: Divisivity & Problems with Divisivity

- Divisivity not necessary for mass (*pea soup, fruitcake* etc.).

- Divisivity not sufficient for mass. (*fence, line* etc.).



Types of Atoms and the Inadequacy of Natural Atomicity

Rothstein distinguishes three types of atoms:

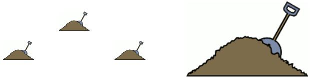
- Natural Atoms: Inherently individuable entities
- Formal Atoms: $\forall x[At(x) \leftrightarrow \neg\exists y[y \sqsubset x]]$
- Formal P-Atoms: $\forall x[At(P)(x) \leftrightarrow \neg\exists y[P(x) \wedge P(y) \wedge y \sqsubset x]]$

- Natural Atomicity is neither necessary not sufficient for being a count N:
  - Not sufficient: Some naturally atomic Ns are mass (*furniture*)
  - Not necessary: Some non-naturally atomic Ns are count (*fence*).

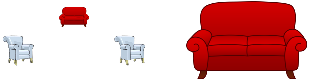
What Barner and Snedeker's (2005) Results Show

Comparison Qs with *more* can trigger either CARDINALITY or MEASURE comparisons:

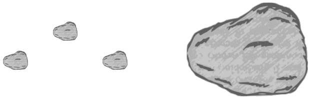
Who has more dirt?



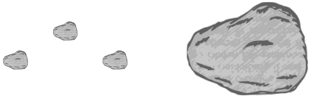
Who has more furniture?



Who has more stone?



Who has more stones?



"You can say 'B has more furniture than A', but not 'B has two more furnitures than A'. This means that what is relevant for counting judgments is not relevant for linguistic expressions of counting. In other words, the conceptual apparatus of individuation and the grammatical mechanism that allow direct counting are distinct." (Rothstein 2010, p. 358)

- The count/mass distinction is grammatical not ontological or purely conceptual

Rothstein's Observations and Conclusions (Summary)

(O1) Salient 'countable' entities $\nrightarrow$ grammatically countable.

(O2) Grammatical countability $\nrightarrow$ natural atomicity.

(C1) Cannot define the mass/count distinction in terms of denotations (alone) or a presumption of atomicity.

(C2) Natural atomicity is neither necessary nor sufficient for being a count noun.

(C3) Explanation must be in terms of how Ns refer. The mass/count distinction is grammatical not ontological.

Object Mass, Substance Mass, and Count: Informal outline

Object Mass (*furniture*)

- Naturally atomic (inherently individuable entities).
- Choice of atoms may be vague/context sensitive.
- Atomic elements not lexically accessible (as in Chierchia (1998))

Substance Mass (*mud*)

- Not Naturally atomic (no inherently individuable entities).
- Choice of atoms (always?) vague/context sensitive.
- Atomic elements not lexically accessible (as in Chierchia (1998))

Count (*fence*)

- Not necessarily naturally atomic (may have inherently individuable entities).
- Choice of atoms context sensitive, but DETERMINED IN CONTEXT.
- Atomic elements are lexically accessible (albeit contextually determined).

Mass N Denotations

Mass N denotations are Root N denotations (Rothstein 2010)

- $N_{\text{mass}} = N_{\text{root}} \subseteq M$
- e.g. a sub-lattice lattice of the domain (cf. Chierchia 2010)

$\text{furniture}_{\text{root},w} = \{$

$\}$

A more recent proposal:

Mass Ns denote Kinds (Oliveira and Rothstein 2011)

- $N_{\text{mass}} = MASS(N_{\text{root}}) = \lambda w. \sqcup_M (N_{\text{root,w}})$
- e.g. The supremum of the sub-lattice (albeit intensionalised)

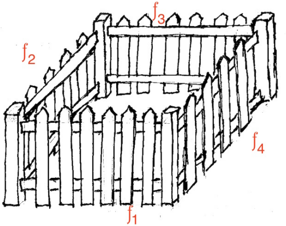
$MASS(\text{furniture}_{\text{root},w}) = \{$

$\}$

$[+\textsc{count}]$ means semantically atomic

Singular count N denotations:

- $N_k \subseteq M \times \{k\}$
- Atomicity relative to a context k, where k is a set of entities that 'count as one' in a given context.



$$F = \left\{ \begin{array}{ccccccc} & & & f_1 \sqcup f_2 \sqcup f_3 \sqcup f_4 & & & \\ & f_1 \sqcup f_2 \sqcup f_3 & & f_1 \sqcup f_2 \sqcup f_4 & & f_2 \sqcup f_3 \sqcup f_4 & \\ f_1 \sqcup f_2 & f_1 \sqcup f_3 & f_1 \sqcup f_4 & & f_2 \sqcup f_3 & f_2 \sqcup f_4 & f_3 \sqcup f_4 \\ f_1 & & f_2 & & f_3 & & f_4 \end{array} \right\}$$

- $N_{count} = COUNT_k(N_{root})$
  - $COUNT_k(F) = \{\langle d, k \rangle : d \in F \cap k\}$
  - $k_1 = \{f_1, f_2, f_3, f_4, g_1, g_2, ...\}$, $\quad k_2 = \{f_1 \sqcup f_2 \sqcup f_3 \sqcup f_4, g_1, g_2, ...\}$
  - $COUNT_{k_1}(F) = \{\langle f_1, k_1 \rangle, \langle f_2, k_1 \rangle, \langle \{f_3, k_1 \rangle, \langle f_4, k_1 \rangle\} \quad \Rightarrow$ *Four fences*
  - $COUNT_{k_2}(F) = \langle f_1 \sqcup f_2 \sqcup f_3 \sqcup f_4, k_2 \rangle \quad \Rightarrow$ *One fence*

Mass Ns and Count Ns differ typally

Mass Ns

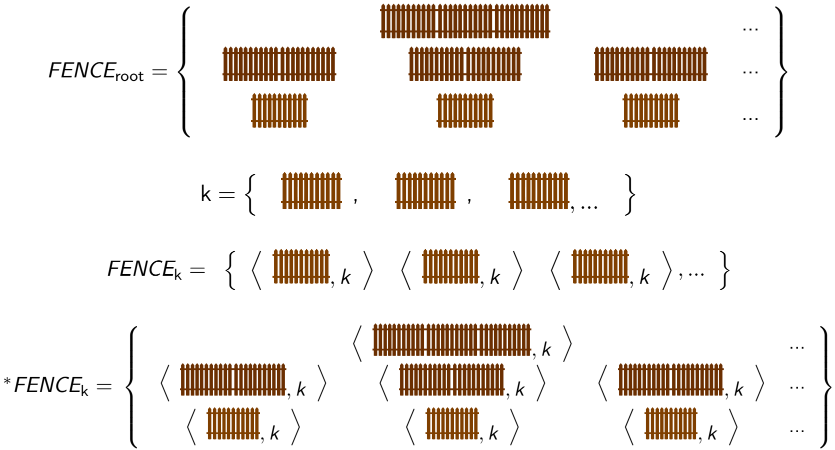
- $\langle d, t \rangle$
- Mass Ns (at a world) denote functions from entities in the domain to truth values

Count Ns

- $\langle d \times k, t \rangle$
- Count Ns (at a world) denote functions from pairs of entities in the domain AND CONTEXTS to truth values

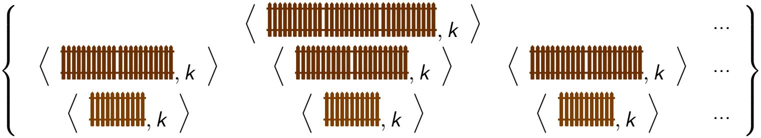
Direct Numeral Attachment: Example

First, pluralise the count N:



Direct Numeral Attachment: Example

Then apply the Numeral.

$^*FENCE_{\mathrm{k}} =$ 

Where x is of type $\langle d \times k \rangle$:

$$[\![\text{Two}_{\langle\langle d\times k,t\rangle,\langle d\times k,t\rangle\rangle}]\!] = \lambda P \lambda x[P(x) \ \wedge \ |\pi_1(x)|_{\pi_2(P)} = 2]$$

$[\![\text{Two}]\!](^*FENCE_k) =$ 

Cross- and Intralinguistic Variation I

A Puzzle about Cross- and Intralinguistic Variation

- Rothstein rejects salience as sufficient criteria for lexical accessibility of atoms.
- But then what's the difference between *furniture*$_{\text{mass}}$ and *huonekalu-t*$_{\text{count, PL}}$ (furniture, Finnish)?
  - Rothstein: A difference in semantic type
- But why should some languages encode this as count and others as mass?
  - Seems to be decided by fiat (in the lexicon) when an N is encoded as $\langle d, t \rangle$ and when as $\langle \langle d, k \rangle, t \rangle$
  - It would be preferable to have a semantic and/or cognitive criterion for when a N will/can be mass/count.
  - However, this is recognised by Rothstein (p. 394)

Cross- and Intralinguistic Variation II

Looks like context sensitive Ns are also display MASS/COUNT variation within languages.

fence	*fencing*	*carpet*	*carpeting*
rope	*rope*	*hair*	*hair-s*
- (Pseudo) mathematical expressions (*line, plane*) always count?

But there are other Ns display variation even though they are not context sensitive in the relevant sense

shoes	*footwear*
meubel-s	*meubilair* (furniture, Dutch)

Coming up next: Landman (2011)

- Maybe object mass nouns, *furniture, footwear* etc. are more context sensitive that Rothstein supposes
- How many items of furniture are there in each picture?

Summary

- Rothstein addresses and explains the behaviour of a class of count Ns that were previously inadequately analysed (*fence, hedge, wall*).
- The notion of a counting context is an intuitive one (And will come up again tomorrow!)
- But, arguably misses the connection between context-sensitive count Ns (*fence, rope*) and superordinate Ns (*furniture, footwear*).

Chierchia and Rothstein: Coverage and Comparison

Proposal	Main Idea	Strengths	Weaknesses
Chierchia (2010)	Mass Ns are vague Count Ns have stable atoms	Why *rice, mud* is mass Why *cat, chair* is count	Fake mass Ns (*furniture*) Vague count Ns (*lentils*)
Rothstein (2010)	Count Ns are indexed to counting contexts. (Difference in semantic type.)	Context Sensitive Count Ns (*fence, hedge*)	Type-based distinction is too weak to predict count/mass variation

References

David Barner and Jesse Snedeker. Quantity judgments and individuation: evidence that mass nouns count. *Cognition*, 97:41–66, 2005.

Gennaro Chierchia. Plurality of mass nouns and the notion of "semantic parameter". In *Events and Grammar: Studies in Linguistics and Philosophy Vol. 7*, pages 53–103. Kluwer, 1998.

Gennaro Chierchia. Mass nouns, vagueness and semantic variation. *Synthese*, 174:99–149, 2010.

Brendan Gillon. Toward a common semantics for english count and mass nouns. *Linguistics and Philosophy*, 15:597–640, 1992.

Manfred Krifka. Thematic relations as links between nominal reference and temporal constitution. In I. Sag and A. Szabolsci, editors, *Lexical Matters*, pages 29–53. CSLI, 1995.

Fred Landman. Count nouns – mass nouns – neat nouns – mess nouns. *The Baltic International Yearbook of Cognition*, 6:1–67, 2011.

Anita Mittwoch. Aspects of englishaspect: On the interaction of perfect, progressive, and durational phrases. *Linguistics and Philosophy*, 11:203–254, 1988.

Roberta Pires de Oliveira and Susan Rothstein. Bare singular noun phrases are mass in Brazilian Portugese. *Lingua*, 121:2153–2175, 2011.

Susan Rothstein. *Structuring Events: A Study in the Semantics of Lexical Aspect*. Wiley-Blackwell, 2004.

Susan Rothstein. Counting and the mass/count distinction. *Journal of Semantics*, 27(3): 343–397, 2010. doi: 10.1093/jos/ffq007.

Peter Sutton and Hana Filip. Vagueness, overlap, and countability. *Proceedings of Sinn und Bedueutung 20*, 2016a.

References

Peter Sutton and Hana Filip. A probabilistic, mereological account of the mass/count distinction. Forthcoming in the proceedings of TbiLLC, Tbilisi 2015), 2016b.

Peter Sutton and Hana Filip. Probabilistic mereological type theory and the mass/count distinction. Under review for *JLM* (proceedings of Type Theory and Lexical Semantics (TYTLES) workshop at ESSLLI 2015), 2016c.

Sandro Zucchi and Michael White. Twigs, sequences and the temporal constitution of predicates. In Teresa Galloway and Justin Spence, editors, *Proceedings of SALT 6*, pages 223–270. Linguistic Society of America, 1996.

Sandro Zucchi and Michael White. Twigs, sequences and the temporal constitution of predicates. *Linguistics and Philosophy*, 24(2):223–270, 2001.