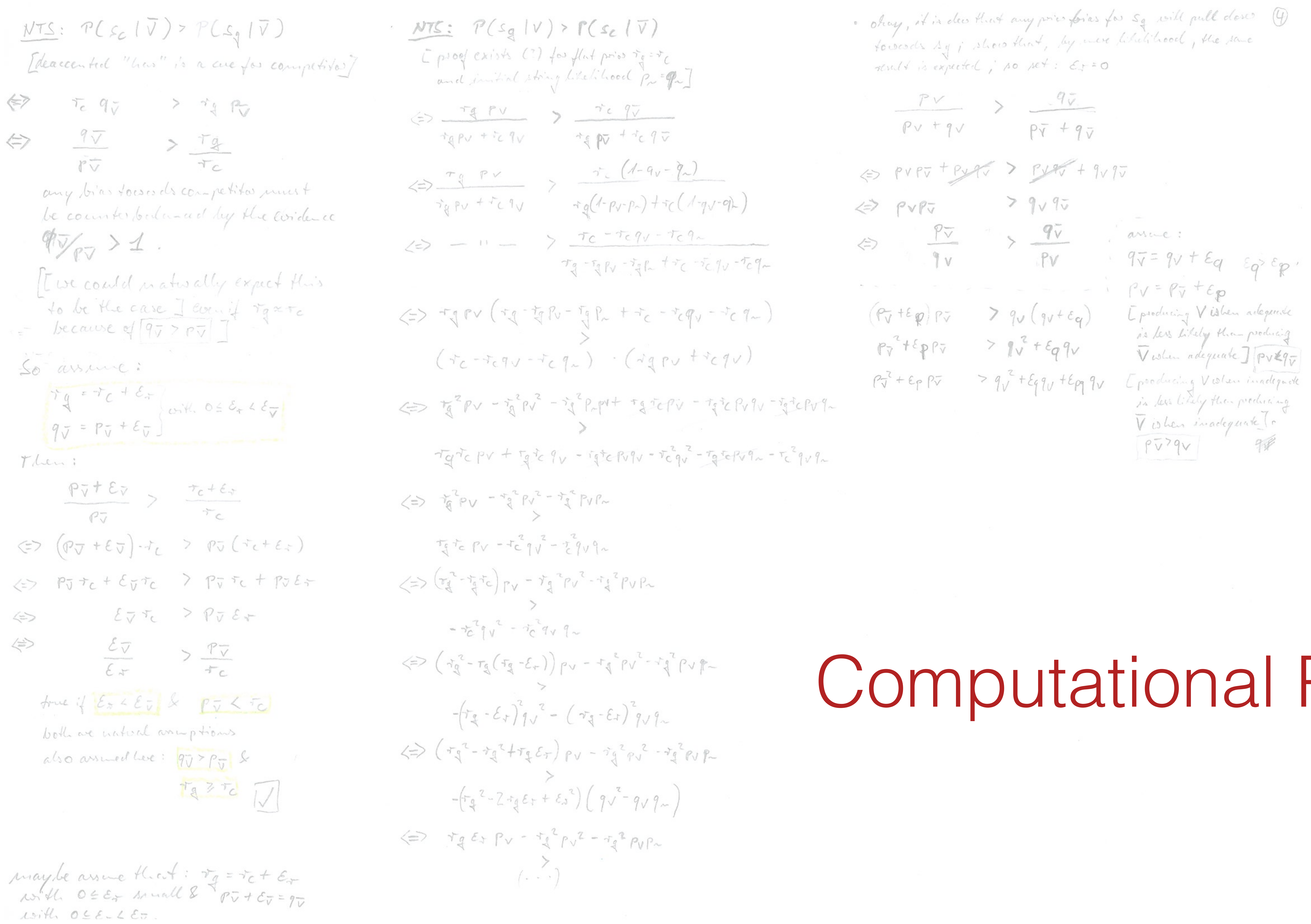
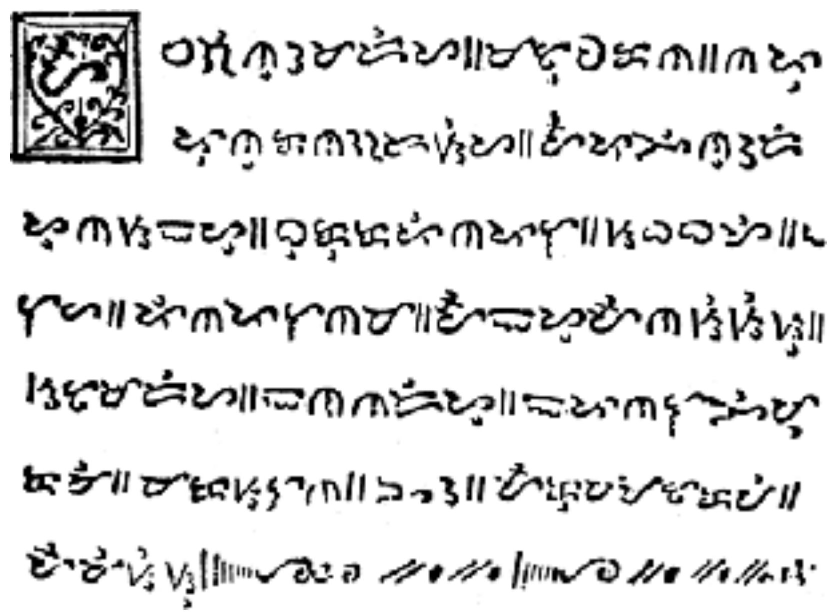
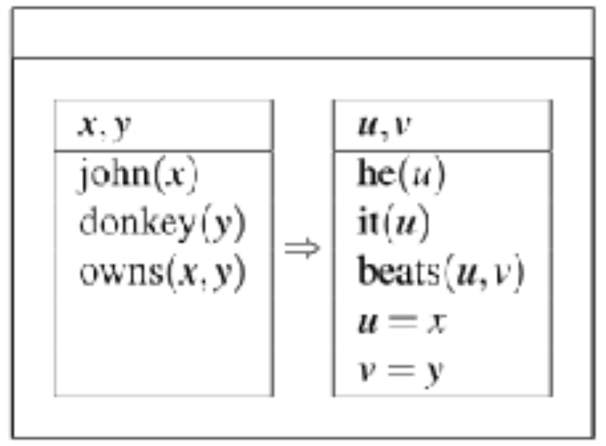


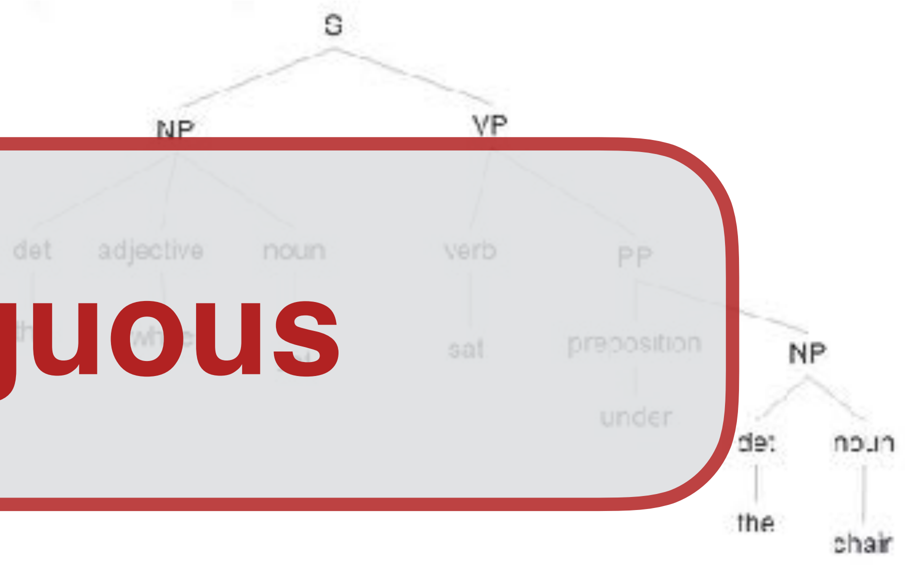
Computational Pragmatics

Michael Franke

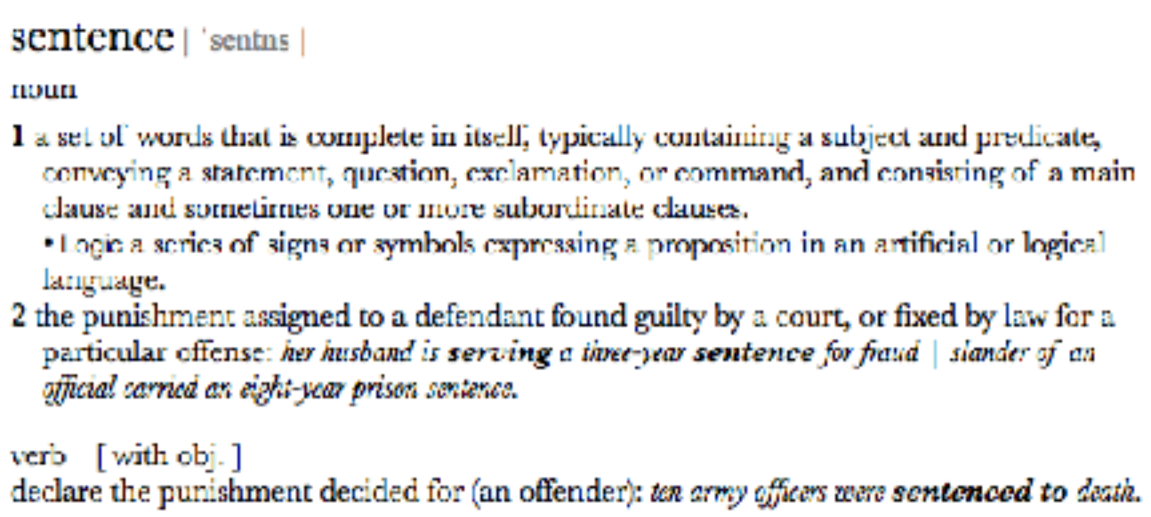
Two views of language







ambiguous

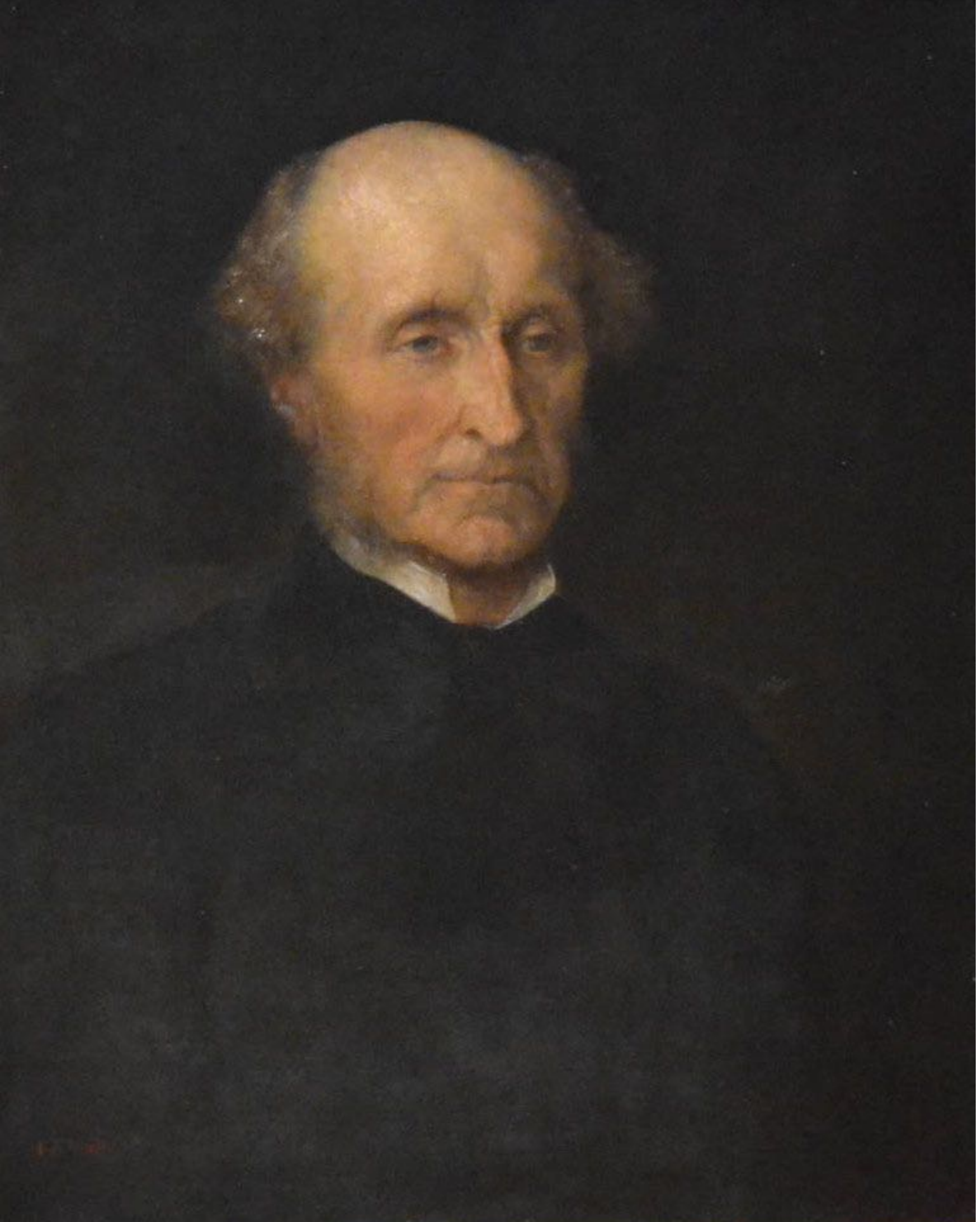


sentence | ˈsentns |
noun
1 a set of words that is complete in itself, typically containing a subject and predicate, conveying a statement, question, exclamation, or command, and consisting of a main clause and sometimes one or more subordinate clauses.
• Logic a series of signs or symbols expressing a proposition in an artificial or logical language.
2 the punishment assigned to a defendant found guilty by a court, or fixed by law for a particular offense: *her husband is* ***serving*** *a three-year* ***sentence*** *for fraud* | *slander of an official carried an eight-year prison sentence.*
verb [with obj.]
declare the punishment decided for (an offender): *ten army officers were* ***sentenced to death.***

structure

disambiguated by pragmatic reasoning

function

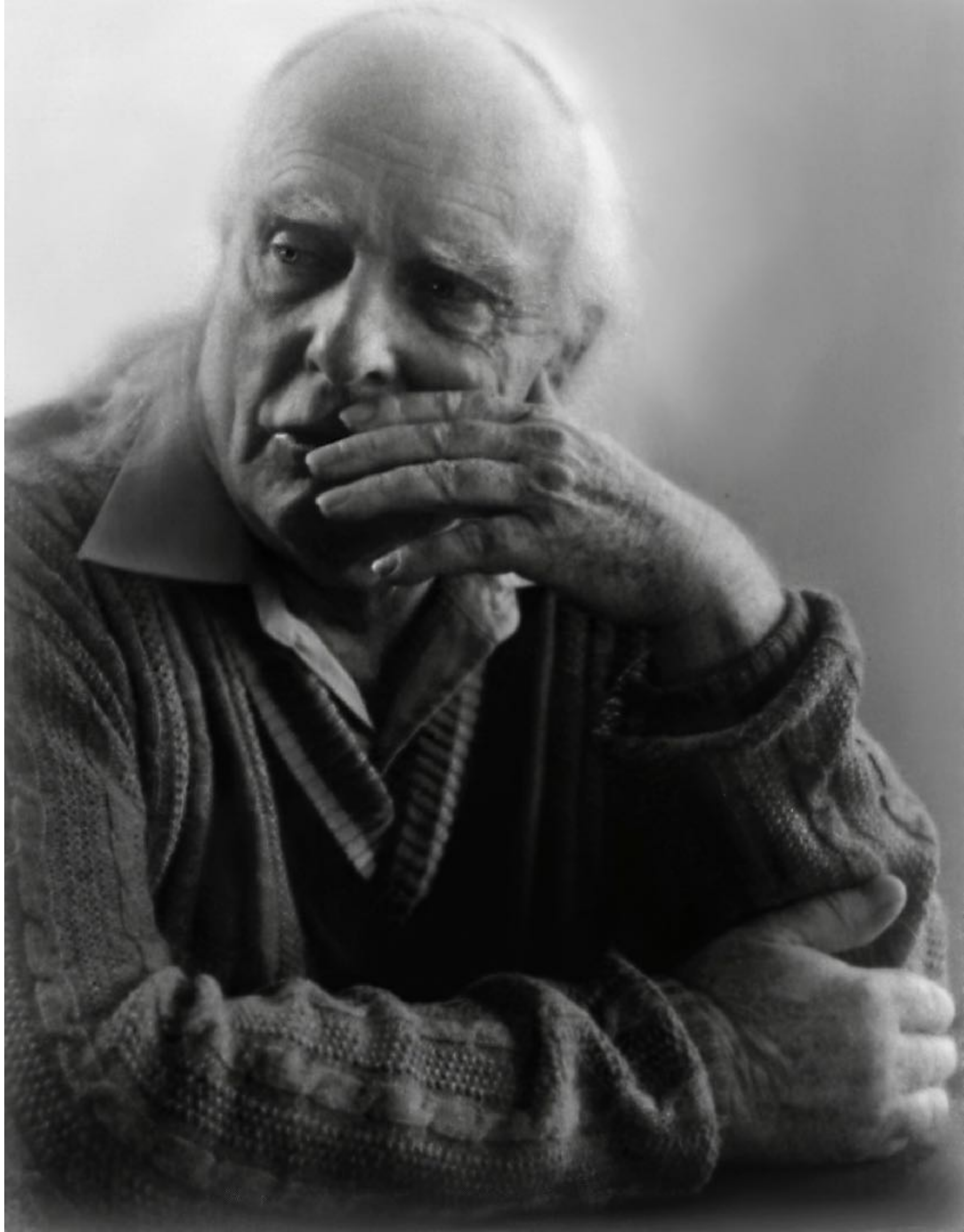


"If I say to any one, **'I saw some of your children to-day'**, he might be justified in inferring that I did not see them all, not because the words mean it, but because, if I had seen them all, it is most likely that I should have said so."

(Mill 1867)

“[O]ne of my avowed aims is to see talking as a special case or variety of purposive, indeed rational, behaviour.”

(Grice 1975)



Maxim of Quality

Try to make your contribution one that is true.

(i) Do not say what you believe to be false.
(ii) Do not say that for which you lack adequate evidence.

Maxim of Quantity

(i) Make your contribution as informative as is required for the current purposes of the exchange.
(ii) Do not make your contribution more informative than is required.

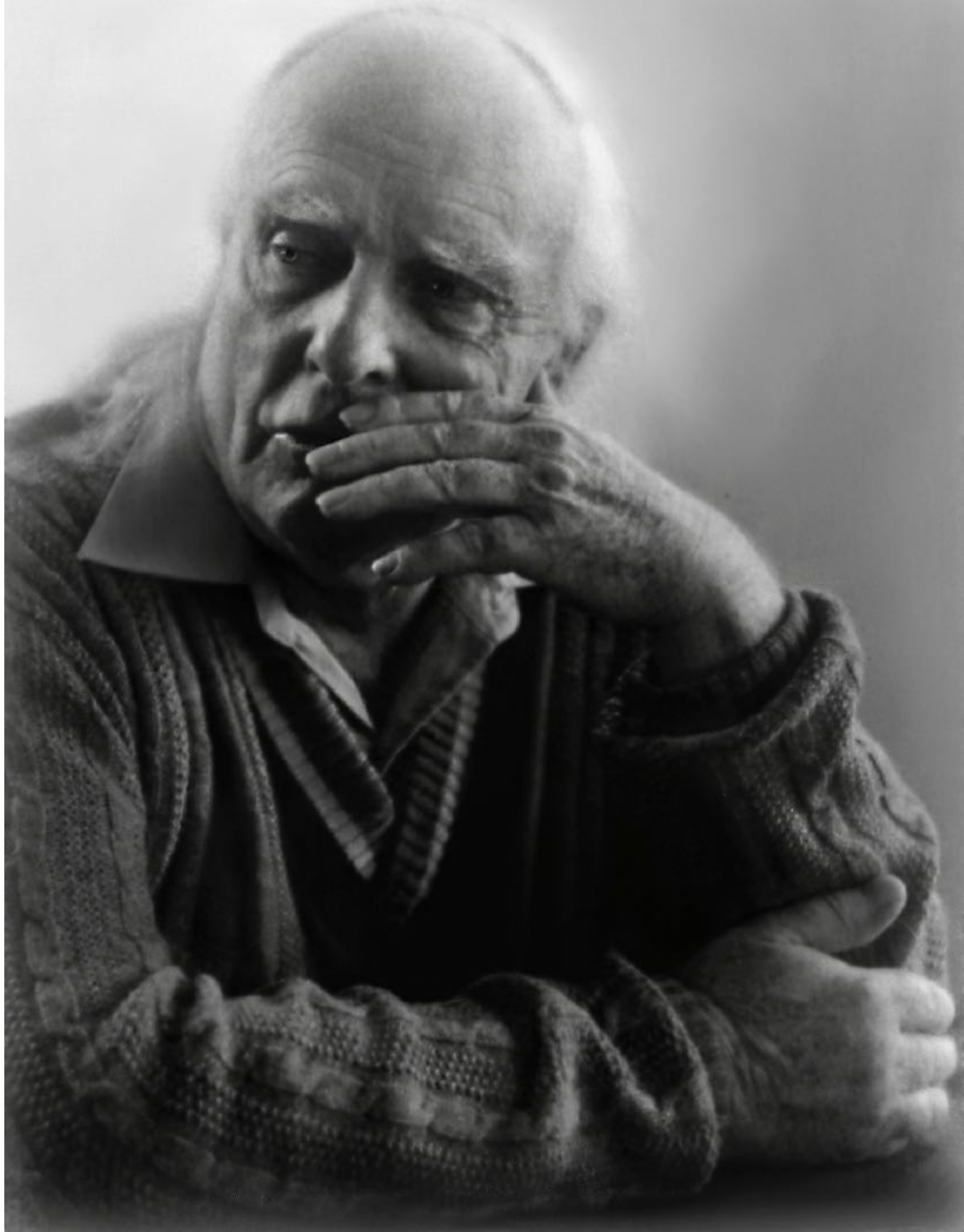
Maxim of Relation

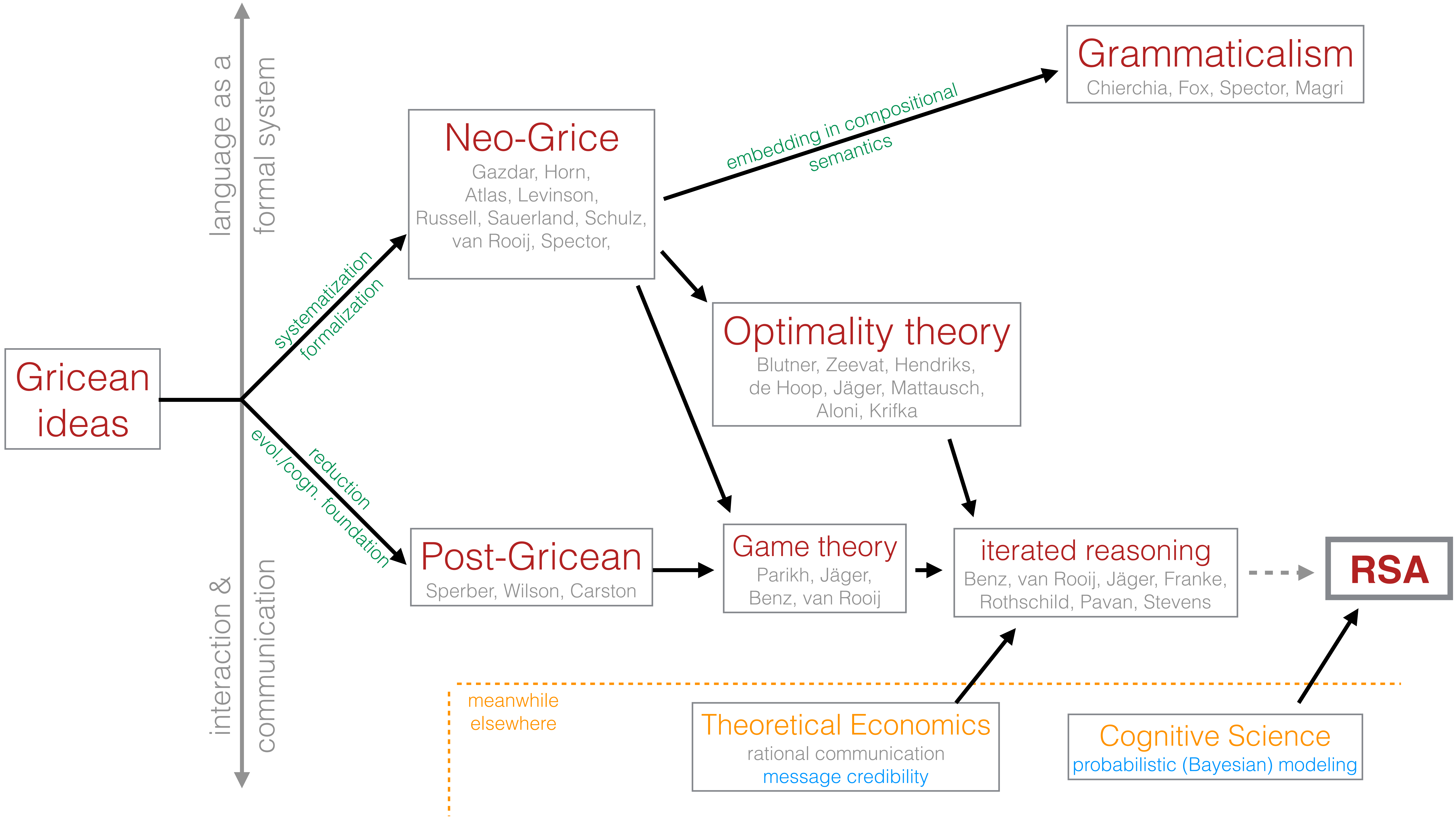
(i) Be relevant.

Maxim of Manner

Be perspicuous.

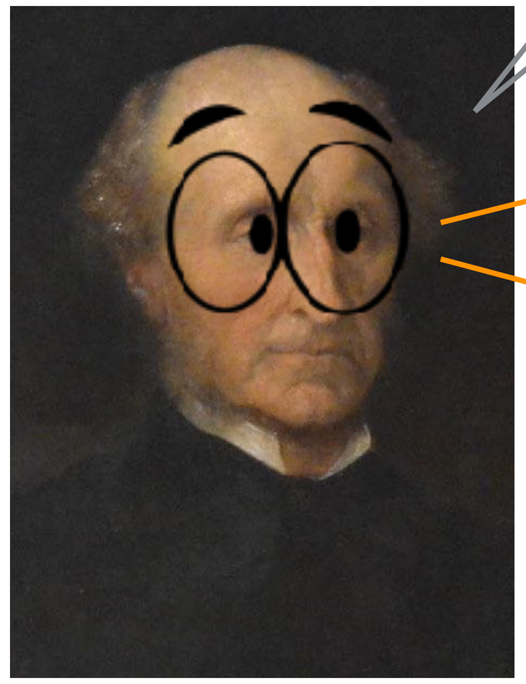
(i) Avoid obscurity of expression.
(ii) Avoid ambiguity.
(iii) Be brief (avoid unnecessary prolixity).
(iv) Be orderly.





language as a formal system
interaction & communication
Gricean ideas
systematization
formalization
reduction
evol./cogn. foundation
Neo-Grice
Gazdar, Horn, Atlas, Levinson, Russell, Sauerland, Schulz, van Rooij, Spector,
embedding in compositional semantics
Grammaticalism
Chierchia, Fox, Spector, Magri
Optimality theory
Blutner, Zeevat, Hendriks, de Hoop, Jäger, Mattausch, Aloni, Krifka
Post-Gricean
Sperber, Wilson, Carston
Game theory
Parikh, Jäger, Benz, van Rooij
iterated reasoning
Benz, van Rooij, Jäger, Franke, Rothschild, Pavan, Stevens
RSA
meanwhile elsewhere
Theoretical Economics
rational communication
message credibility
Cognitive Science
probabilistic (Bayesian) modeling

Pragmatics from rational social reasoning

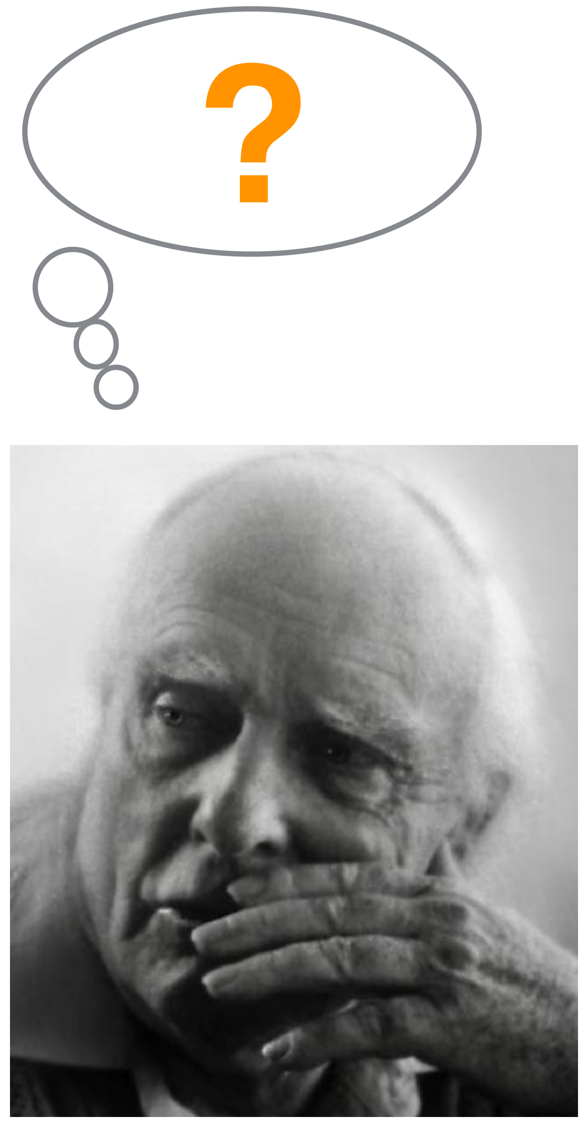


"I saw some of your children today."

?

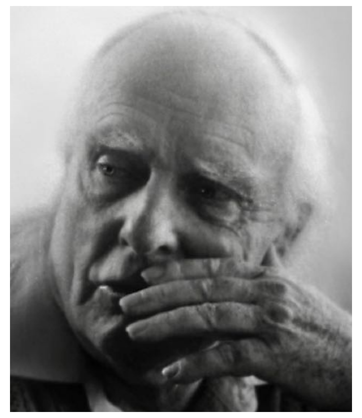
situation $\forall$

situation $\exists\neg\forall$

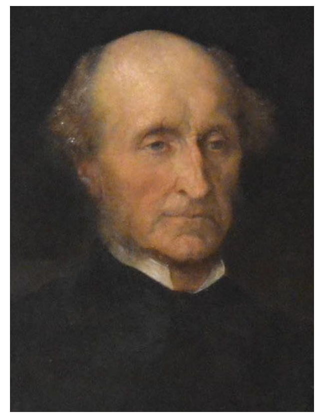


Pragmatics from rational social reasoning

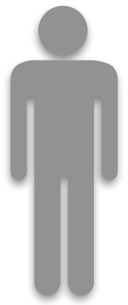
Pragmatics from rational social reasoning



rational interpreter

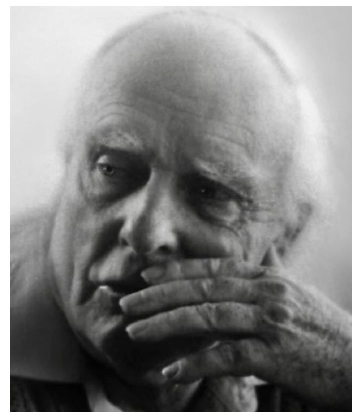


rational speaker



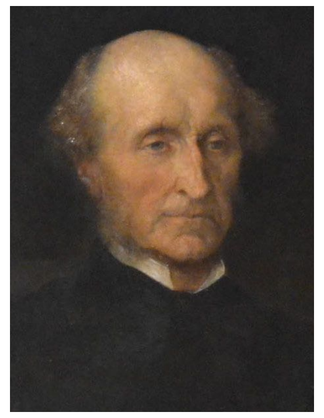
literal interpreter

Pragmatics from rational social reasoning



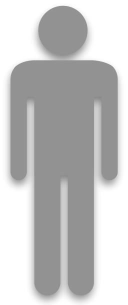
rational interpreter

	∀	∃¬∀
"all"	1	0
"some"	0	1



rational speaker

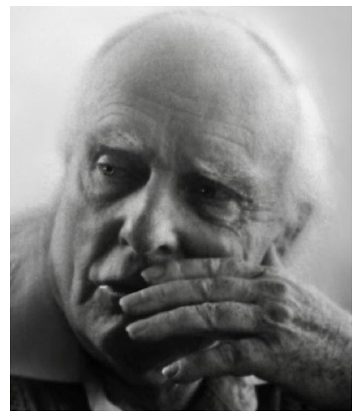
	"all"	**"some"**
∀	1	0
∃¬∀	0	1



literal interpreter

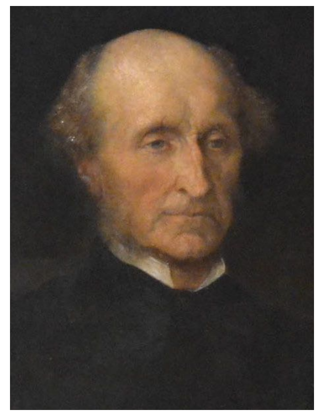
	∀	∃¬∀
"all"	1	0
"some"	.5	.5

Pragmatics from rational social reasoning



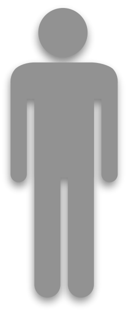
rational interpreter

	$\forall$	$\exists\neg\forall$
"all"	.9	.1
"some"	.1	.9



approximately rational speaker

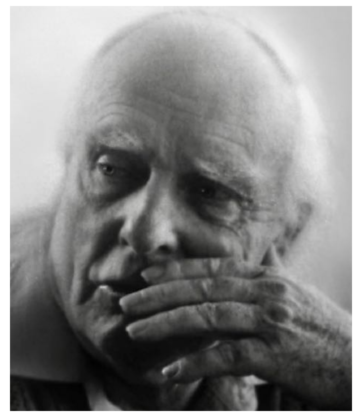
	"all"	**"some"**
$\forall$	.9	.1
$\exists\neg\forall$	.1	.9



literal interpreter

	$\forall$	$\exists\neg\forall$
"all"	1	0
"some"	.5	.5

Pragmatics from rational social reasoning

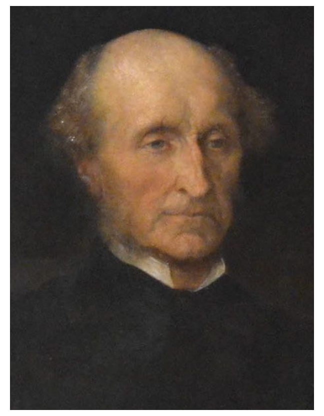


rational interpreter

	∀	∃¬∀
"all"	.9	.1
"some"	.1	.9

listener behavior

$U \to \Delta(S)$

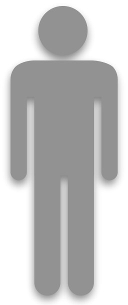


approximately
rational speaker

	"all"	**"some"**
∀	.9	.1
∃¬∀	.1	.9

speaker behavior

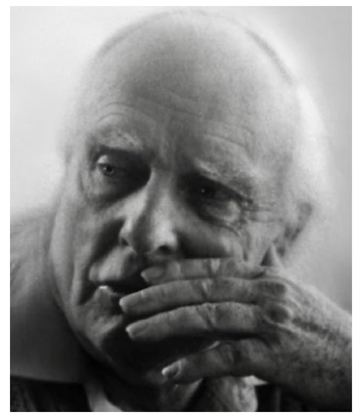
$S \to \Delta(U)$



literal interpreter

	∀	∃¬∀
"all"	1	0
"some"	.5	.5

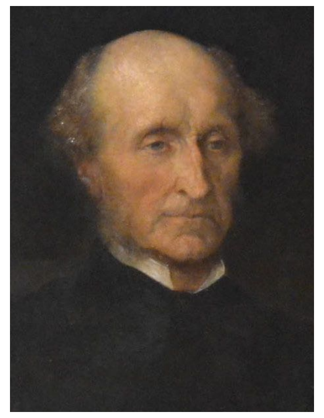
Rational Speech Act model



pragmatic listener

L_1

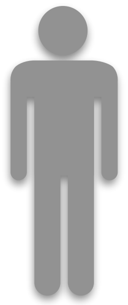
$$P_{L_1}(s \mid u) \propto P_{S_1}(u \mid s) \cdot P(s)$$



pragmatic speaker

S_1

$$P_{S_1}(u \mid s) \propto \exp(\alpha(\underbrace{\log P_{L_0}(s \mid u) - \text{Cost}(u)}_{\text{Exp.Utility}(u|s)}))$$

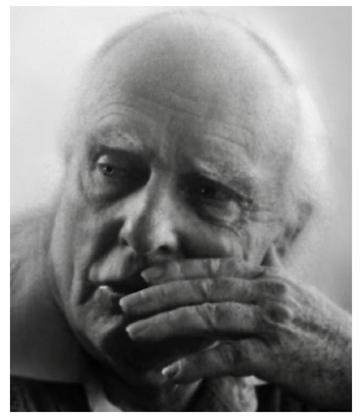


literal listener

L_0

$$P_{L_0}(s \mid u) = P(s \mid [\![u]\!])$$

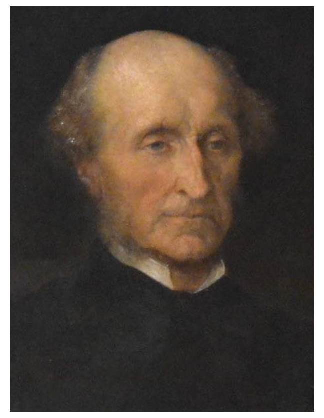
Rational Speech Act model



pragmatic listener

L1

$$P_{L_1}(s \mid u) \propto P_{S_1}(u \mid s) \cdot P(s)$$

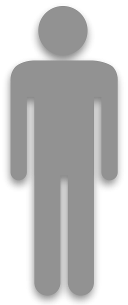


pragmatic speaker

S1

$$P_{S_1}(u \mid s) \propto \exp(\alpha(\underbrace{\log P_{L_0}(s \mid u) - \text{Cost}(u)}_{\text{Exp.Utility}(u|s)}))$$

world knowledge



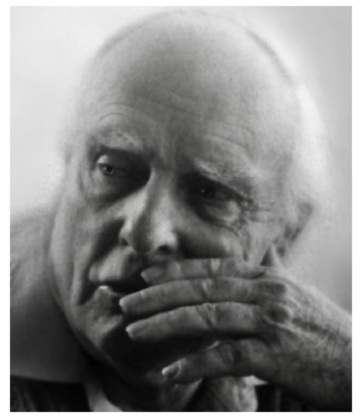
literal listener

L0

$$P_{L_0}(s \mid u) = P(s \mid [\![u]\!])$$

semantic meaning

Rational Speech Act model

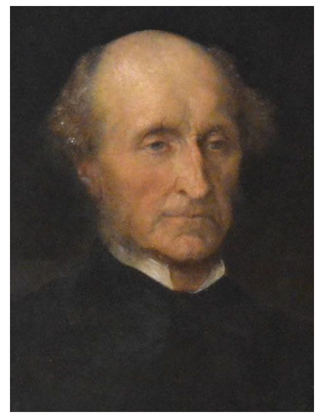


pragmatic listener

L1 $P_{L_1}(s \mid u) \propto P_{S_1}(u \mid s) \cdot P(s)$

rational choice

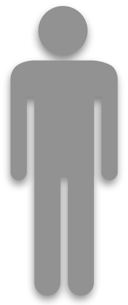
linguistic preference



pragmatic speaker

S1 $P_{S_1}(u \mid s) \propto \exp(\alpha(\underbrace{\log P_{L_0}(s \mid u) - \text{Cost}(u)}_{\text{Exp.Utility}(u|s)}))$

information flow

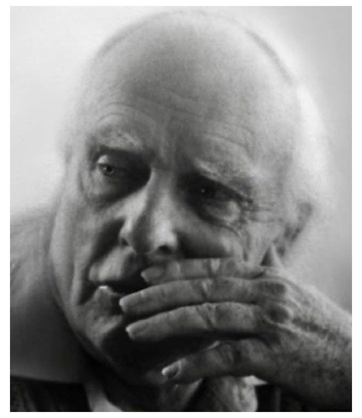


literal listener

L0 $P_{L_0}(s \mid u) = P(s \mid [\![u]\!])$

Rational Speech Act model

speaker model

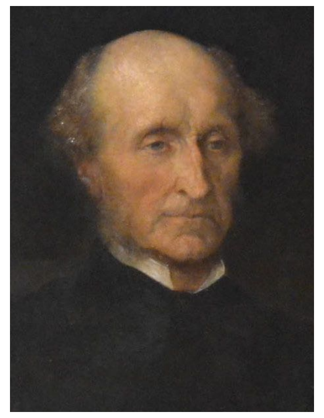


pragmatic listener — L1

$$P_{L_1}(s \mid u) \propto P_{S_1}(u \mid s) \cdot P(s)$$

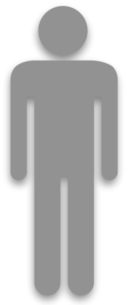
Bayes rule

world knowledge



pragmatic speaker — S1

$$P_{S_1}(u \mid s) \propto \exp(\alpha(\underbrace{\log P_{L_0}(s \mid u) - \text{Cost}(u)}_{\text{Exp.Utility}(u|s)}))$$



literal listener — L0

$$P_{L_0}(s \mid u) = P(s \mid [\![u]\!])$$

This course

applications

referential communication
(epistemic) scalar implicatures
non-literal language use
vagueness
politeness
…

technicalities

WebPPL
Bayesian Data Analysis
…

referential communication

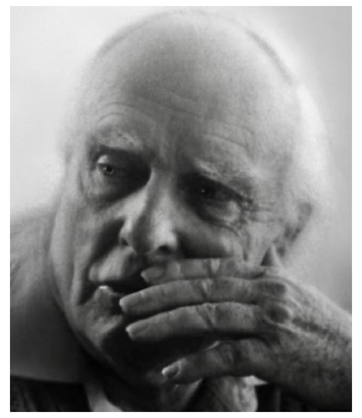
context
set of objects/referents

utterances
single properties of objects

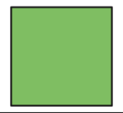
$$U = \{\text{"square"}, \text{"circle"}, \text{"green"}, \text{"blue"}\}$$

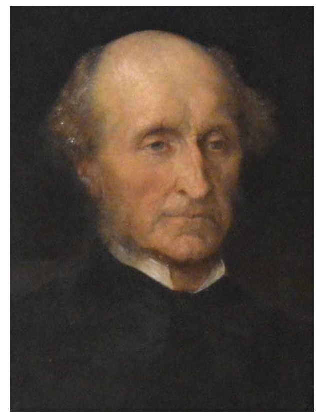
which object do you think a speaker meant when she selects “blue”?

RSA for reference games (example)



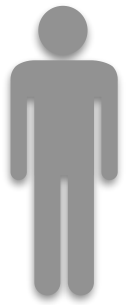
rational interpreter

			
"square"	.82	0	.18
"circle"	0	1	0
"green"	0	0	1
"blue"	.82	.18	0



rational speaker

	"square"	**"circle"**	**"green"**	**"blue"**
	.5	0	0	.5
	0	.89	0	.11
	.11	0	.89	0



literal interpreter

			
"square"	.5	0	.5
"circle"	0	1	0
"green"	0	0	1
"blue"	.5	.5	0