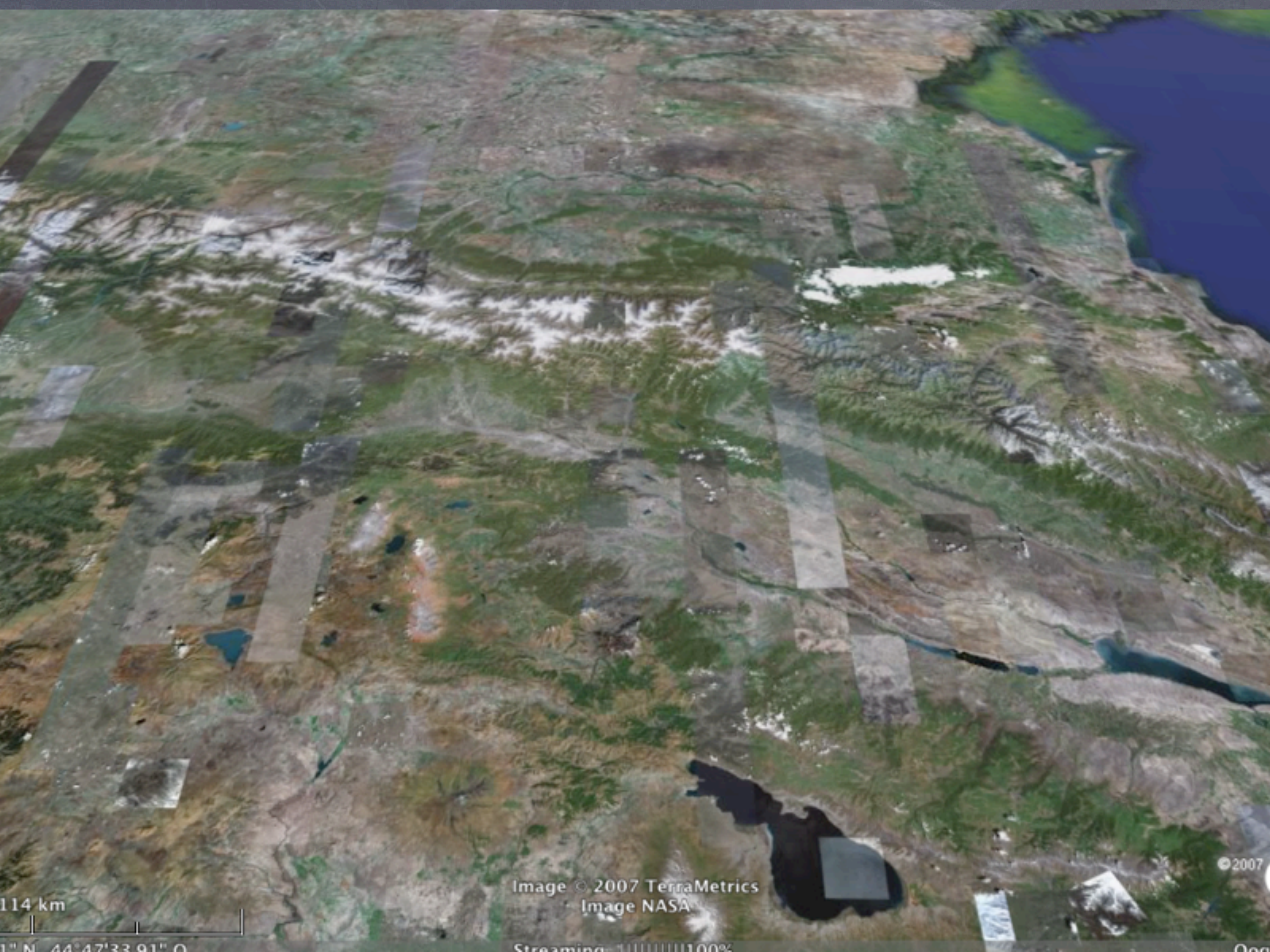
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Inquisitive Semantics

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Inquisitive Semantics

Mission Statement

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- Meaning is information exchange potential

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  - Information exchange is a dynamic process of raising and resolving issues

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  - When the notion of meaning changes, so does the logic that comes with it

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  - In inquisitive logic the core notion is licensing

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- Meaning is information exchange potential
  - Information exchange is a dynamic process of raising and resolving issues
  - Inquisitive meanings directly reflect this
  - They embody both information and issues
  - When the notion of meaning changes, so does the logic that comes with it
  - In inquisitive logic the core notion is licensing
  - Licensing is a notion of logical relatedness

Overview

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1. Syntax and semantics for a language of inquisitive propositional logic

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2. Disjunction responsible for inquisitiveness

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2. Disjunction responsible for inquisitiveness
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4. Inquisitive meanings and pictures of them
5. Inquisitive logic: the logical notion of licensing
6. Inquisitive semantics meets Grice on disjunction

- Syntax of propositional language L

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means definition

Syntax of propositional language L

PV set of propositional variables

1. If $p \in PV$, dan $p \in L$

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Syntax of propositional language L

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gives classical logic

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  - Syntax allows for things like
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  - $(p \rightarrow ?q)$, $(?p \vee ?q)$, $(?p \wedge ?q)$, $(p \wedge ?q)$
  - $\neg?p$, $!?p$, $!!p$, $??p$, $(?p \rightarrow q)$, $(?p \rightarrow ?q)$

Inquisitive Semantics

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i and j valuations for $p \in PV$, $i(p) \in \{0,1\}$

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i and j valuations for $p \in PV$, $i(p) \in \{0,1\}$

1. $\langle i,j \rangle \models p$ iff $i(p) = 1$ and $j(p) = 1$
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symmetry

$\langle i,j \rangle \vDash \varphi$ iff $\langle j,i \rangle \vDash \varphi$

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symmetry

$\langle i,j\rangle \models \varphi$ iff $\langle j,i\rangle \models \varphi$

three pairs matter

$\langle i,j\rangle$ $\langle i,i\rangle$ $\langle j,j\rangle$

Inquisitiveness and Informativeness

Inquisitiveness and Informativeness

- φ is inquisitive iff for some $i \in I$ and $j \in I$:

$$\langle i,i \rangle \models \varphi \text{ and } \langle j,j \rangle \models \varphi \text{ and } \langle i,j \rangle \not\models \varphi$$

Inquisitiveness and Informativeness

- φ is inquisitive iff for some $i \in I$ and $j \in I$:

  $\langle i,i \rangle \vDash \varphi$ and $\langle j,j \rangle \vDash \varphi$ and $\langle i,j \rangle \nvDash \varphi$

- φ is informative iff for some $i \in I$ and $j \in I$:

  $\langle i,i \rangle \vDash \varphi$ and $\langle j,j \rangle \nvDash \varphi$

Inquisitiveness and Informativeness

- φ is inquisitive iff for some $i \in I$ and $j \in I$:

  $\langle i,i \rangle \vDash \varphi$ and $\langle j,j \rangle \vDash \varphi$ and $\langle i,j \rangle \nvDash \varphi$

- φ is informative iff for some $i \in I$ and $j \in I$:

  $\langle i,i \rangle \vDash \varphi$ and $\langle j,j \rangle \nvDash \varphi$

  - φ is an assertion iff φ is not inquisitive

Inquisitiveness and Informativeness

- φ is inquisitive iff for some $i \in I$ and $j \in I$:

  $\langle i,i \rangle \vDash \varphi$ and $\langle j,j \rangle \vDash \varphi$ and $\langle i,j \rangle \nvDash \varphi$

- φ is informative iff for some $i \in I$ and $j \in I$:

  $\langle i,i \rangle \vDash \varphi$ and $\langle j,j \rangle \nvDash \varphi$

  - φ is an assertion iff φ is not inquisitive
  - φ is an question iff φ is not informative

Inquisitiveness and Informativeness

- φ is inquisitive iff for some $i \in I$ and $j \in I$:

  $\langle i,i\rangle \vDash \varphi$ and $\langle j,j\rangle \vDash \varphi$ and $\langle i,j\rangle \nvDash \varphi$

- φ is informative iff for some $i \in I$ and $j \in I$:

  $\langle i,i\rangle \vDash \varphi$ and $\langle j,j\rangle \nvDash \varphi$

  - φ is an assertion iff φ is not inquisitive
  - φ is an question iff φ is not informative
  - φ is a hybrid iff φ is inquisitive and φ is informative

Assertions

Assertions

1. $\langle i,j \rangle \vDash p$ iff $i(p) = 1$ and $j(p) = 1$
2. $\langle i,j \rangle \nvDash \perp$

Assertions

means fact

1. $\langle i,j \rangle \vDash p$ iff $i(p) = 1$ and $j(p) = 1$
2. $\langle i,j \rangle \nvDash \bot$

✓ p and ⊥ are not inquisitive, p and ⊥ assertions

Assertions

1. $\langle i,j \rangle \models p$ iff $i(p) = 1$ and $j(p) = 1$

2. $\langle i,j \rangle \not\models \bot$

- ☑ p and ⊥ are not inquisitive, p and ⊥ assertions
  - ☑ p is informative

Assertions

1. $\langle i,j \rangle \models p$ iff $i(p) = 1$ and $j(p) = 1$
2. $\langle i,j \rangle \not\models \bot$

- p and $\bot$ are not inquisitive, p and $\bot$ assertions
    - p is informative
    - $\bot$ is not informative

Assertions

1. $\langle i,j \rangle \vDash p$ iff $i(p) = 1$ and $j(p) = 1$

2. $\langle i,j \rangle \nvDash \bot$

- [x] p and $\bot$ are not inquisitive, p and $\bot$ assertions
    - [x] p is informative
    - [x] $\bot$ is not informative

Next things to show:

Assertions

1. $\langle i,j \rangle \vDash p$ iff $i(p) = 1$ and $j(p) = 1$
2. $\langle i,j \rangle \nvDash \bot$

- p and $\bot$ are not inquisitive, p and $\bot$ assertions
  - p is informative
  - $\bot$ is not informative

Next things to show:

- If ψ is an assertion, then $(\varphi \rightarrow \psi)$ is an assertion

Implication

Implication

3. $\langle i,j \rangle \vDash (\varphi \rightarrow \psi)$ iff for all $\iota \in \{i,j\}^2$:

   if $\iota \vDash \varphi$, then $\iota \vDash \psi$

Implication

3. $\langle i,j \rangle \vDash (\varphi \rightarrow \psi)$ iff for all $\iota \in \{i,j\}^2$:

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then $(\varphi \rightarrow \psi)$ is an assertion

Implication

3. $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff for all $\iota \in \{i,j\}^2$:

$$\text{if } \iota \vDash \varphi, \text{ then } \iota \vDash \psi$$

- If ψ is an assertion, then among $\{i,j\}^2$ only $\langle i,i\rangle$ and $\langle j,j\rangle$ matter, hence:

then $(\varphi \rightarrow \psi)$ is an assertion

Implication

3. $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff for all $\iota \in \{i,j\}^2$:

if $\iota \vDash \varphi$, then $\iota \vDash \psi$

- If ψ is an assertion, then among $\{i,j\}^2$ only $\langle i,i\rangle$ and $\langle j,j\rangle$ matter, hence:
  - $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff if $\langle i,i\rangle \vDash \varphi$, then $\langle i,i\rangle \vDash \psi$ and if $\langle j,j\rangle \vDash \varphi$, then $\langle j,j\rangle \vDash \psi$

then $(\varphi \rightarrow \psi)$ is an assertion

Implication

3. $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff for all $\iota \in \{i,j\}^2$: only $\langle i,i\rangle$ if $i=j$

if $\iota \vDash \varphi$, then $\iota \vDash \psi$

- If ψ is an assertion, then among $\{i,j\}^2$ only $\langle i,i\rangle$ and $\langle j,j\rangle$ matter, hence:

> $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff if $\langle i,i\rangle \vDash \varphi$, then $\langle i,i\rangle \vDash \psi$
> and if $\langle j,j\rangle \vDash \varphi$, then $\langle j,j\rangle \vDash \psi$

□ $\langle i,i\rangle \vDash (\varphi \rightarrow \psi)$ iff if $\langle i,i\rangle \vDash \varphi$, then $\langle i,i\rangle \vDash \psi$

then $(\varphi \rightarrow \psi)$ is an assertion

Implication

3. $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff for all $\iota \in \{i,j\}^2$: only $\langle i,i\rangle$ if $i=j$

if $\iota \vDash \varphi$, then $\iota \vDash \psi$

- If ψ is an assertion, then among $\{i,j\}^2$ only $\langle i,i\rangle$ and $\langle j,j\rangle$ matter, hence:

> $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff if $\langle i,i\rangle \vDash \varphi$, then $\langle i,i\rangle \vDash \psi$ and if $\langle j,j\rangle \vDash \varphi$, then $\langle j,j\rangle \vDash \psi$

- $\langle i,i\rangle \vDash (\varphi \rightarrow \psi)$ iff if $\langle i,i\rangle \vDash \varphi$, then $\langle i,i\rangle \vDash \psi$

> $\langle i,j\rangle \vDash (\varphi \rightarrow \psi)$ iff $\langle i,i\rangle \vDash (\varphi \rightarrow \psi)$ and $\langle j,j\rangle \vDash (\varphi \rightarrow \psi)$

- ✓ If ψ is an assertion, then $(\varphi \rightarrow \psi)$ is an assertion

Sofar only Assertions

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Sofar only Assertions

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Sofar only Assertions

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   if $\iota \vDash \varphi$, then $\iota \vDash \psi$

4. $\langle i,j \rangle \vDash (\varphi \wedge \psi)$ iff $\langle i,j \rangle \vDash \varphi$ and $\langle i,j \rangle \vDash \psi$

   - If φ and ψ assertions, then $(\varphi \wedge \psi)$ is an assertion

Negation, Assertion

Negation, Assertion

$\neg\varphi =_{def} (\varphi \rightarrow \bot)$

Negation, Assertion

$\neg\varphi =_{def} (\varphi \rightarrow \bot)$

$\langle i,j \rangle \vDash \neg\varphi$ iff $\langle i,i \rangle \nvDash \varphi$ and $\langle j,j \rangle \nvDash \varphi$

Negation, Assertion

$\neg\varphi =_{def} (\varphi \rightarrow \bot)$

$\langle i,j\rangle \vDash \neg\varphi$ iff $\langle i,i\rangle \nvDash \varphi$ and $\langle j,j\rangle \nvDash \varphi$

- For all φ: $\neg\varphi$ is an assertion

Negation, Assertion

$\neg\varphi =_{def} (\varphi \rightarrow \bot)$

$\langle i,j\rangle \models \neg\varphi$ iff $\langle i,i\rangle \not\models \varphi$ and $\langle j,j\rangle \not\models \varphi$

- ✔ For all φ: $\neg\varphi$ is an assertion
- ✔ For all φ: $\neg\neg\varphi$, and hence $!\varphi$ is an assertion

Entailment

Entailment

- $\varphi_1, \ldots, \varphi_n \models \psi$ iff for all $\iota \in I^2$:

  if $\iota \models \varphi_1$, and ... , and $\iota \models \varphi_n$, then $\iota \models \psi$

Entailment

- $\varphi_1, \ldots, \varphi_n \models \psi$ iff for all $\iota \in I^2$:

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- If φ is an assertion, then $\neg\neg\varphi \vDash \varphi$, $!\varphi \vDash \varphi$

Entailment

- $\varphi_1, \ldots, \varphi_n \vDash \psi$ iff for all $\iota \in I^2$:

  if $\iota \vDash \varphi_1$, and ... , and $\iota \vDash \varphi_n$, then $\iota \vDash \psi$

- [x] For ψ is an assertion, we obtain classical logic

- [x] If φ is an assertion, then $\neg\neg\varphi \vDash \varphi$, $!\varphi \vDash \varphi$

- [x] If ψ is an assertion, then $\varphi \vDash \psi$ iff $!\varphi \vDash \psi$

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Disjunctions can be Hybrid

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- ☑ $(p \vee q)$ is inquisitive and informative

Disjunctions can be Hybrid

- (p ∨ q) is inquisitive and informative
  - Let i(p) = 1, i(q) = 0

Disjunctions can be Hybrid

- ☑ $(p \vee q)$ is inquisitive and informative
  - Let $i(p) = 1$, $i(q) = 0$
  - And $j(p) = 0$, $j(q) = 1$

Disjunctions can be Hybrid

- $(p \vee q)$ is inquisitive and informative
  - Let $i(p) = 1$, $i(q) = 0$
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- $\langle i,i \rangle \vDash (p \vee q)$, because $\langle i,i \rangle \vDash p$

Disjunctions can be Hybrid

- $(p \vee q)$ is inquisitive and informative
  - Let $i(p) = 1$, $i(q) = 0$
  - And $j(p) = 0$, $j(q) = 1$
- $\langle i,i \rangle \vDash (p \vee q)$, because $\langle i,i \rangle \vDash p$
- $\langle j,j \rangle \vDash (p \vee q)$, because $\langle j,j \rangle \vDash q$

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- $(p \vee q)$ is inquisitive and informative
  - Let $i(p) = 1$, $i(q) = 0$
  - And $j(p) = 0$, $j(q) = 1$
- $\langle i,i \rangle \vDash (p \vee q)$, because $\langle i,i \rangle \vDash p$
- $\langle j,j \rangle \vDash (p \vee q)$, because $\langle j,j \rangle \vDash q$
- $\langle i,j \rangle \nvDash (p \vee q)$, because $\langle i,j \rangle \nvDash p$ and $\langle i,j \rangle \nvDash q$

Disjunctions can be Hybrid

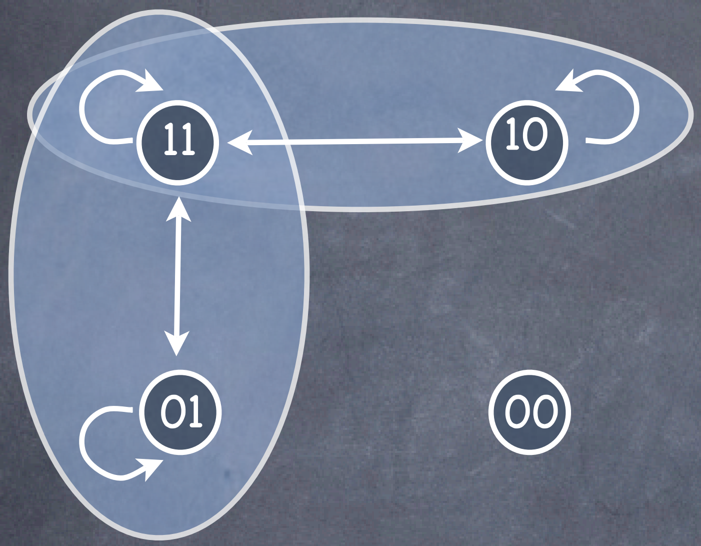
- ☑ $(p \vee q)$ is inquisitive and informative
  - Let $i(p) = 1$, $i(q) = 0$
  - And $j(p) = 0$, $j(q) = 1$

NEW!

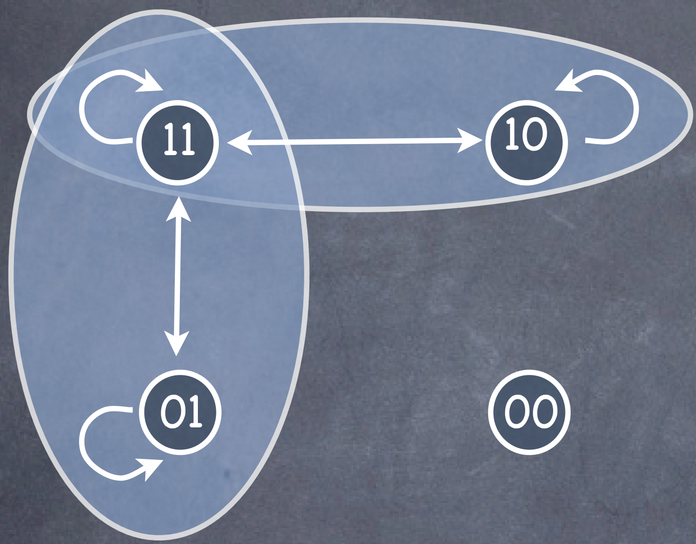
- $\langle i,i\rangle \models (p \vee q)$, because $\langle i,i\rangle \models p$
- $\langle j,j\rangle \models (p \vee q)$, because $\langle j,j\rangle \models q$
- $\langle i,j\rangle \not\models (p \vee q)$, because $\langle i,j\rangle \not\models p$ and $\langle i,j\rangle \not\models q$

Picture of Meaning ($p \vee q$)

Picture of Meaning ($p \vee q$)



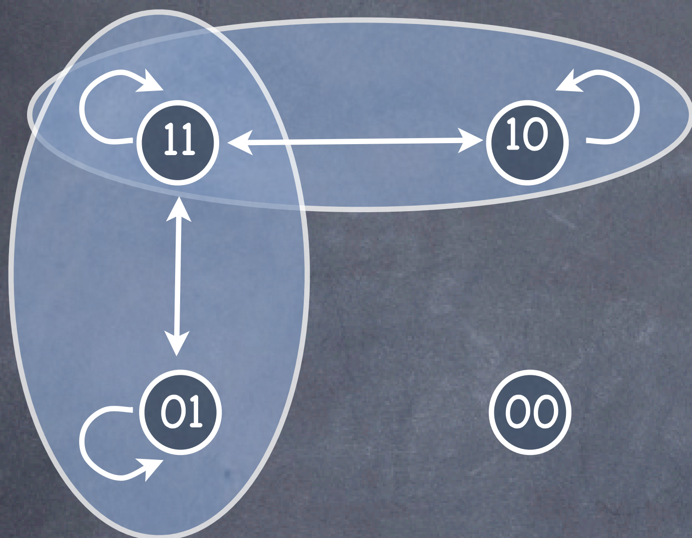
Picture of Meaning (p ∨ q)



i(p)=1   i(q)=0

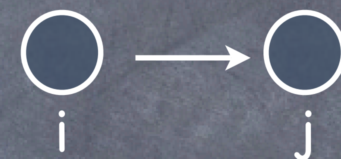
world

Picture of Meaning $(p \vee q)$



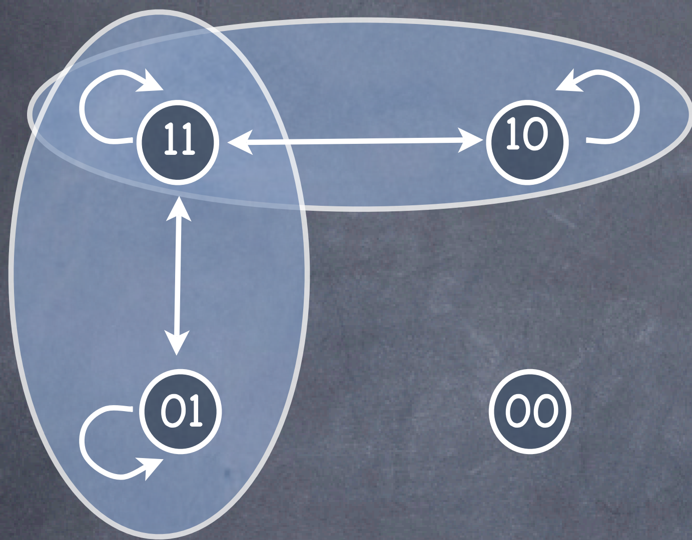
$i(p)=1 \quad i(q)=0$

world



$\langle i,j \rangle \models (p \vee q)$

Picture of Meaning $(p \vee q)$



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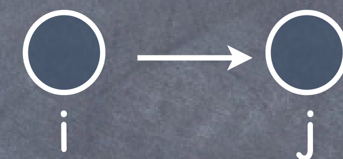
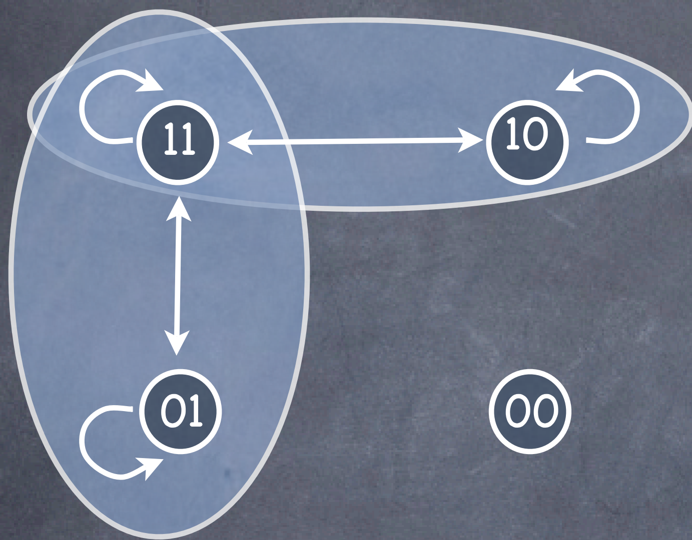


$\langle i,j \rangle \models (p \vee q)$

possibility for $(p \vee q)$

largest set of mutually related worlds

Picture of Meaning (p ∨ q) and !(p ∨ q)



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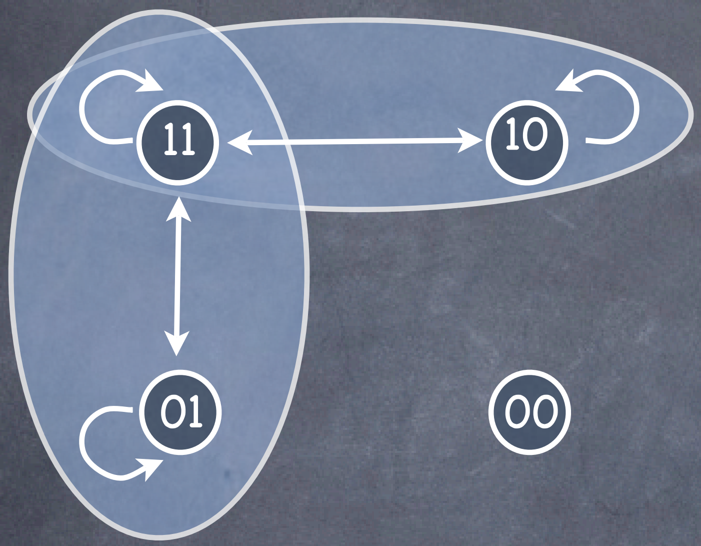
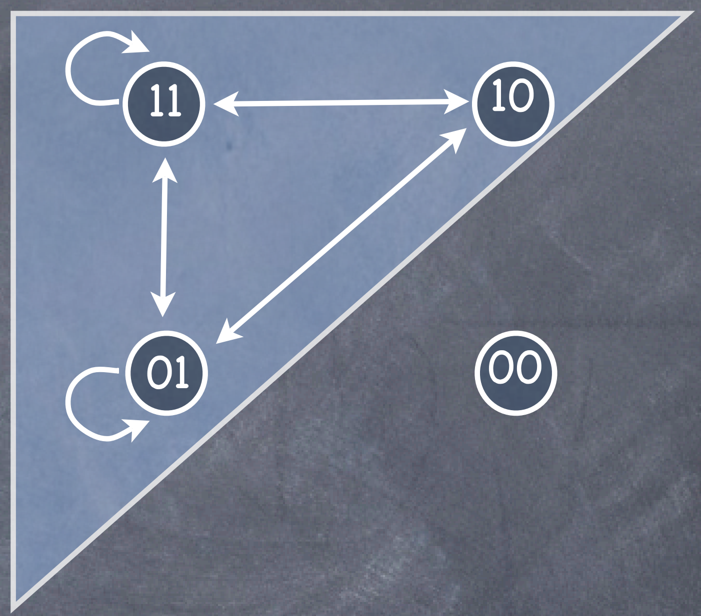
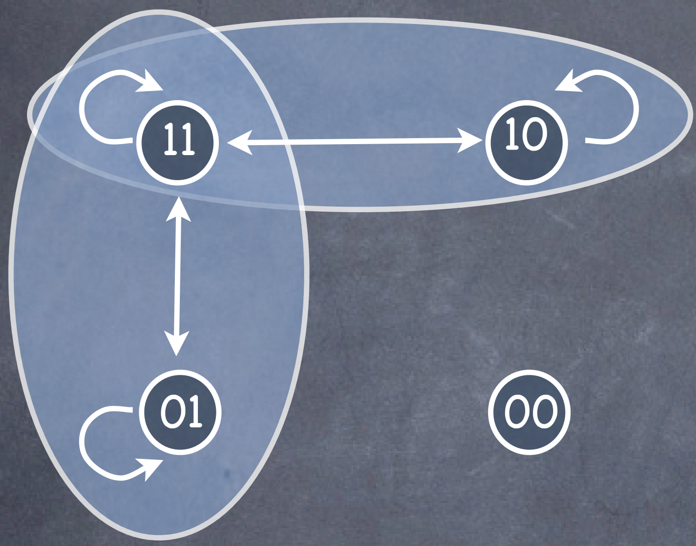
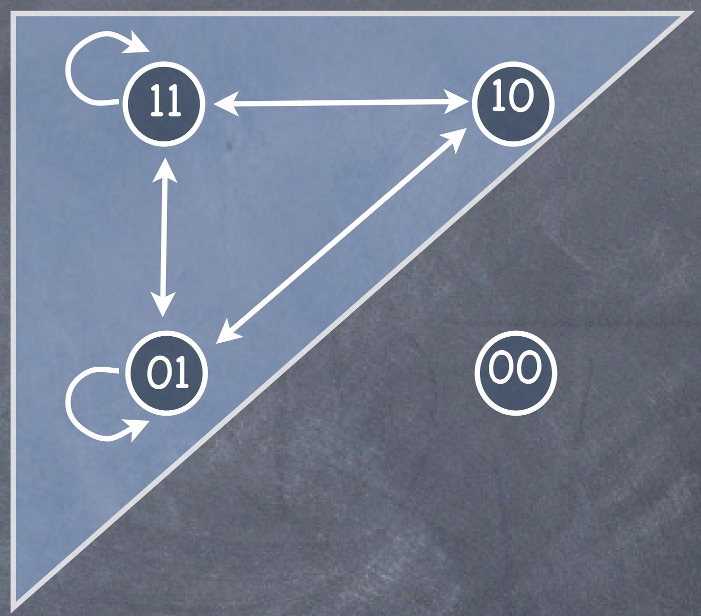




Picture of Meaning $(p \vee q)$ and $!(p \vee q)$





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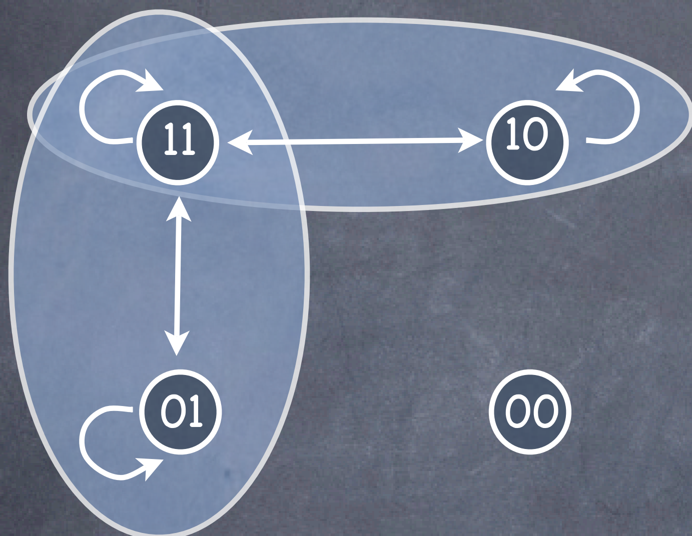

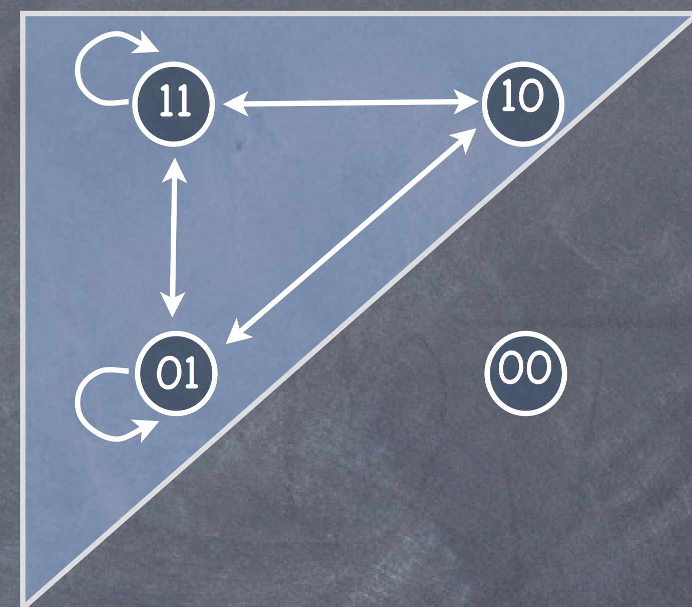

☑ $(p \vee q) \models\ !(p \vee q)$

☑ $!(p \vee q) \not\models (p \vee q)$

Picture of Meaning $?p = (p \vee \neg p)$

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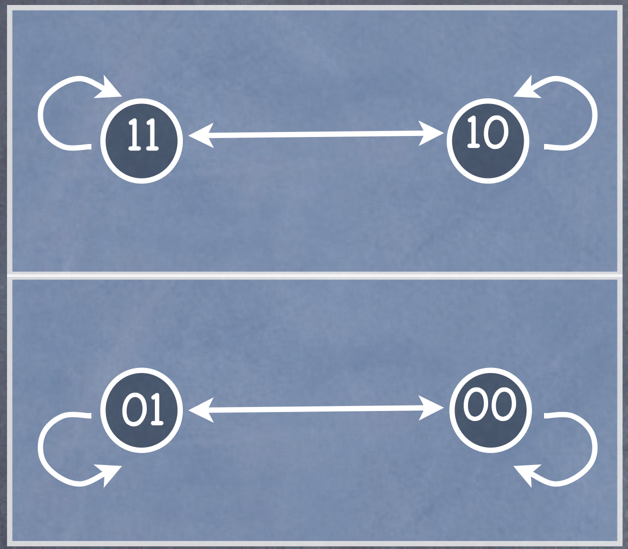

Proper question:
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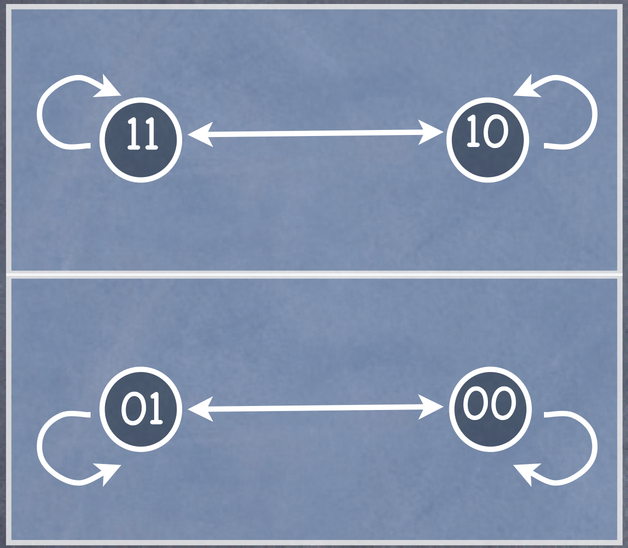

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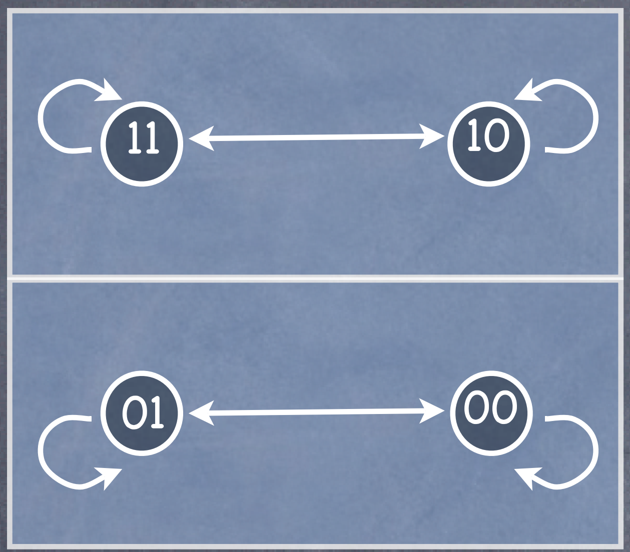

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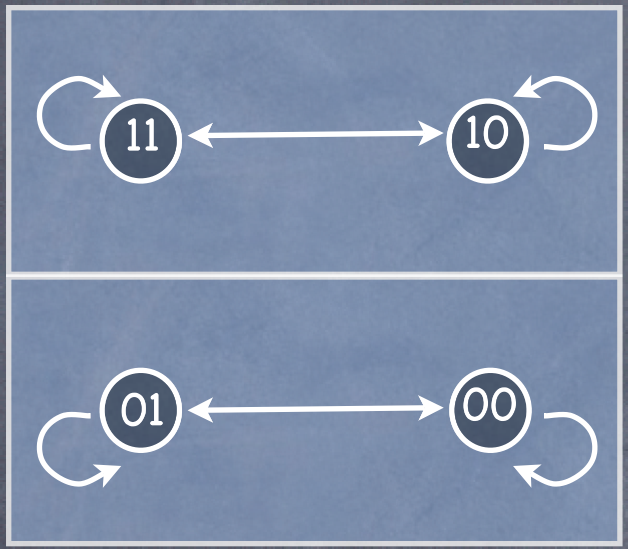
Picture of Meaning ?p = (p ∨ ¬p)



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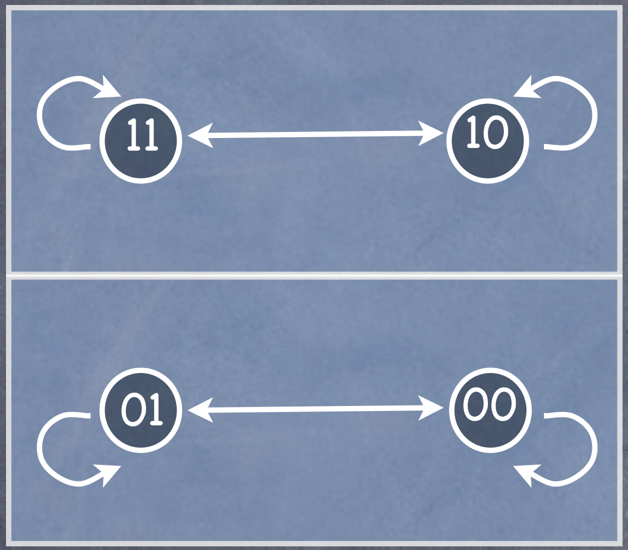

$\nvDash (p \vee \neg p)$

$\vDash\ !(p \vee \neg p)$

$\vDash\ !?p$

$\neg ?p \vDash \bot$

Proper question:
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Why pairs of indices

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- The remarkable thing is not that we need pairs of indices, but that that is all we need!

Conditional question ($p \rightarrow ?q$)

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    The only $\iota \in \{i,j\}^2$ that matters is $\langle i,j \rangle$

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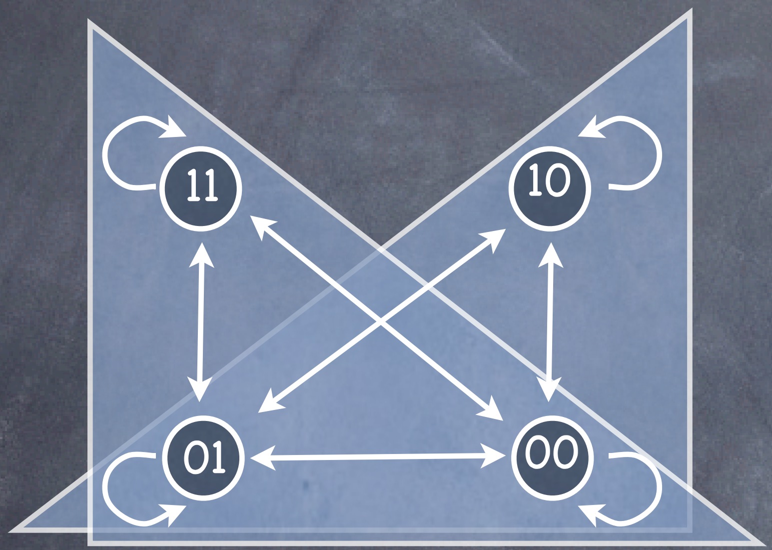
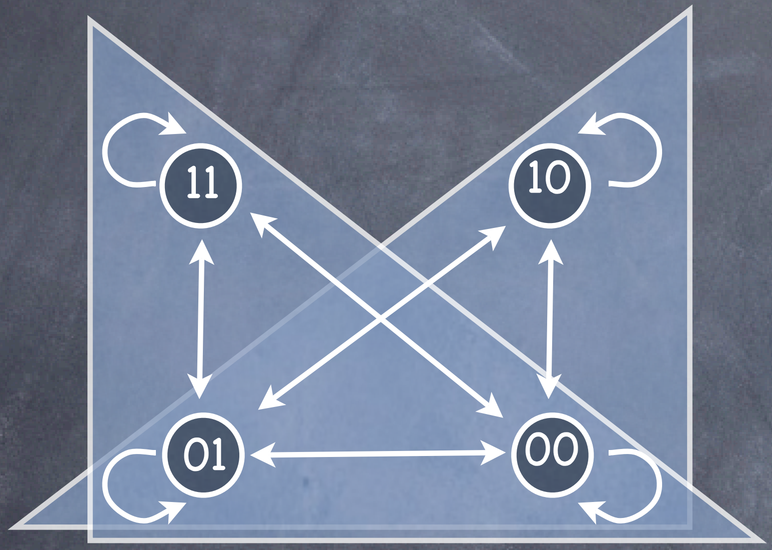
Conditional question ($p \to ?q$)

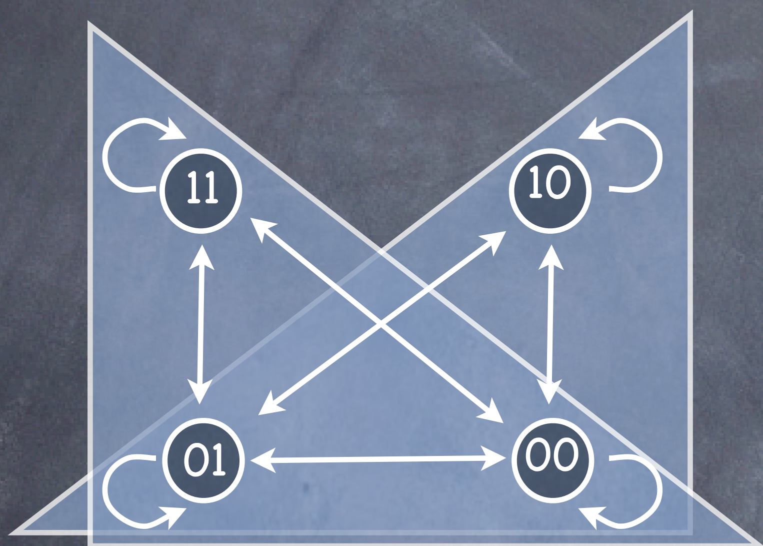


Conditional question (p → ?q)



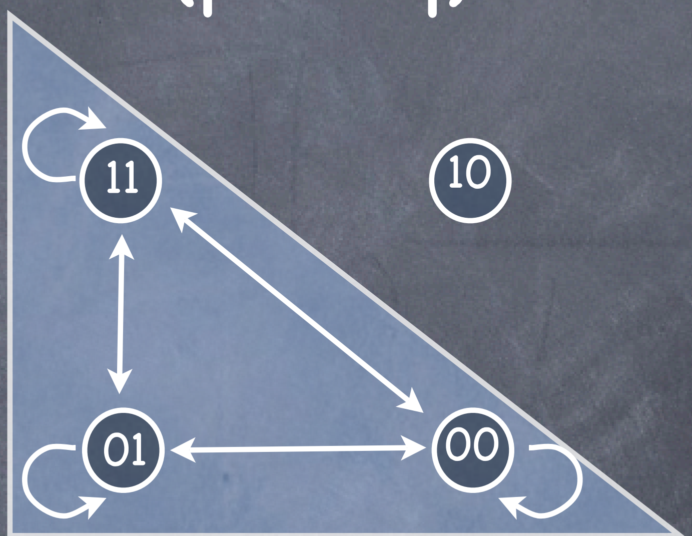
Question: inquisitive
not informative

Conditional question $(p \to ?q)$



Assertive conditional

$(p \to q)$



Question: inquisitive

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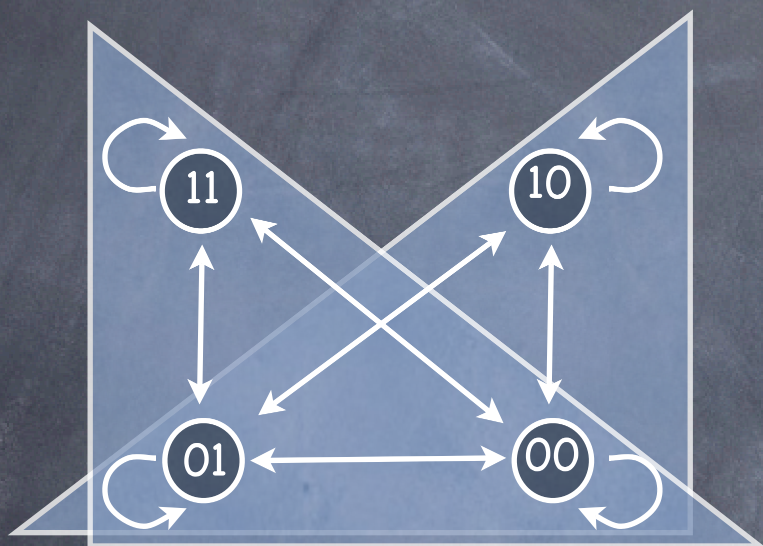
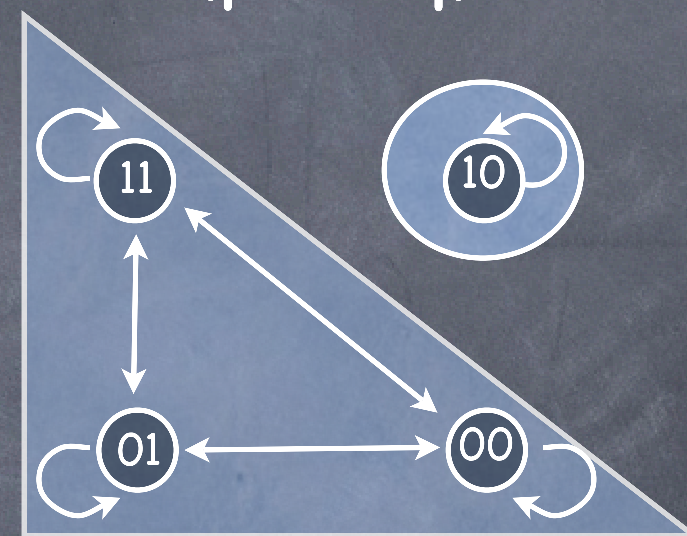
☑ $(p \to q) \vDash (p \to ?q)$

Conditional question $(p \rightarrow ?q)$



Questioned conditional $?(p \rightarrow q)$



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- ☑ $(p \rightarrow q) \models (p \rightarrow ?q)$
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Interplay disjunction and implication

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    $(p \rightarrow r) \wedge (q \rightarrow \neg r)$

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Alternative question $?(p \vee q)$

Choice question $(?p \vee ?q)$

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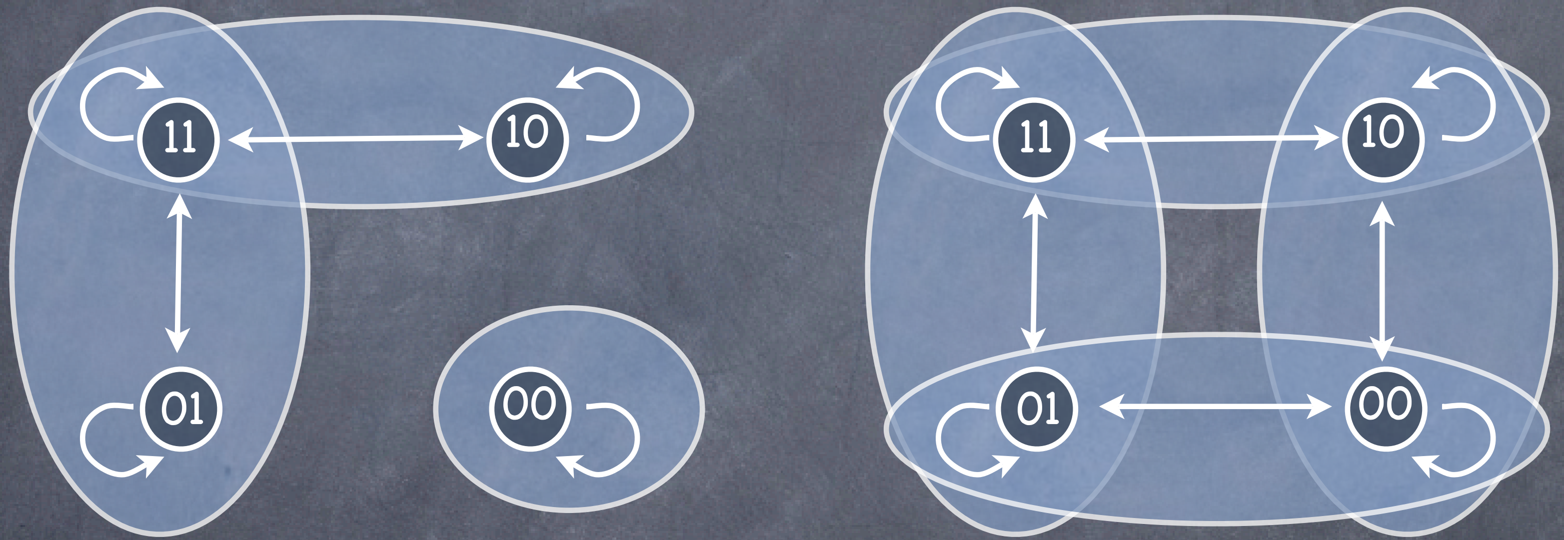

Questions: inquisitive, not informative

Meanings

Reflexive Closure of Symmetric Relation

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     Note: for assertions this runs in both directions

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  ☑ $\varphi \vDash \psi$ iff $\langle\varphi\rangle^{I} \subseteq \langle\psi\rangle^{I}$

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    of indifference

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  So, $\langle\varphi\rangle^{I}$ is a reflexive and symmetric relation on some subset of I

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  Largest set of worlds which are all related to each other

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     Set of propositions

Possibilities and Pictures

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Largest set of worlds which are all related to each other

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   (i) $P \subseteq I$ and for all $i, j \in P$: $\langle i,j \rangle \in \langle\varphi\rangle^{I}$

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NEW!

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Inquisitive Logic

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  - A notion of contextual relatedness

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  - A notion of contextual relatedness
  - Judges whether a sentence fits the context
  - Information and issues the sentence embodies should be logically related to the contextual issues

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  every possibility in the picture of φ is the union of some possibilities in the picture of $?\psi$

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- The notion of licensing intends to characterize when a sentence φ is logically related to a sentence ψ

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To show that $\top$ corresponds to acceptance requires some Gricean reasoning

Licensing and partial answerhood

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Classical licensing and entailment

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- [x] If φ and ψ are classical, then

  $\psi \propto \varphi$ iff $?\psi \models ?\varphi$

Licensing reducable to entailment

- [ ] For classical $?\psi$ and $?\varphi$

  $?\psi \models ?\varphi$ means: $?\varphi$ is a subquestion of $?\psi$

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Does not hold for non-classical case

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- ☐ For classical $?\psi$ and $!\varphi$

  $?\psi \vDash ?!\varphi$ means $!\varphi$ is a partial answer to $?\psi$

Licensing and conditional questions

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    $\psi \propto \varphi$ iff $?\psi \models ?\varphi$ does not always hold
  - $?\psi \models ?!\varphi$ no longer means that $!\varphi$ is a (partial) answer to $?\psi$

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Licensing and atomic questions

☑ $(?p \vee ?q) \propto ?p$

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- But: $?p \vDash (q \rightarrow ?p)$ and $?p \vDash (?p \vee ?q)$
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- Entailment no longer suffices
- Licensing is the new crucial notion
- It embodies a notion of logical relatedness which rules the logical coherence of dialogue
- Unlike entailment, licensing is concerned with the communicative function of language

Grice on Disjunction

In 'Indicative Conditionals', Grice (1989:68), as cited in Simons (2000)

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A standard (if not the standard) employment of “or” is in the specification of possibilities (one of which is supposed by the speaker to be realized, although he does not know which one), each of which is relevant in the same way to a given topic. ‘A or B’ is characteristically employed to give a partial answer to some [wh]-question, to which each disjunct, if assertible, would give a fuller, more specific, more satisfactory answer.

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