Stit Semantics I: Action, Ability, and Oughts

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Outline

1. "Stit" semantics (Belnap/Perloff/Xu)

   $$[\alpha \; stit\colon A] \;\; = \;\; \alpha \text{ (an agent) sees to it that } A$$

2. Applications in ethics

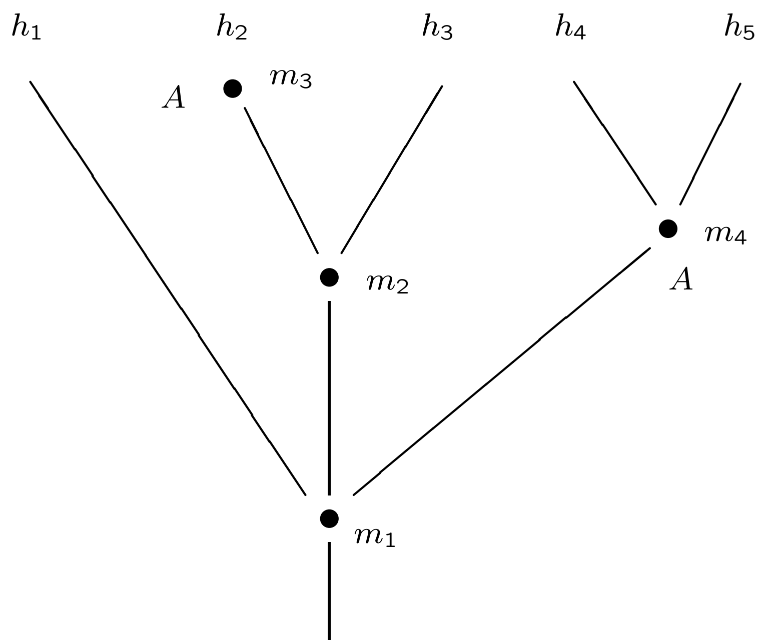
   Statements about actions and "oughts"

   - Group oughts
   - Oughts in time

   Oughts and "utilitarian" theories

   - Reformulate traditional proposals
   - Indeterminist setting suggests some new possibilities

Branching time



1. Concepts:

   Tree

   $<$

   $m_2 \in h_2$

   $H_m = \{h : m \in h\}$

   Question: Is FA true at m_1 ?

   Answer: Who knows?

   Conclusion: Must relativize truth to moments *and* histories (moment/history pairs).

2. Branching time model:

$$\mathcal{M} = \langle \textit{Tree}, <, v \rangle,$$

with v mapping sentence letters into sets of m/h pairs

3. Evaluation rules: booleans, P, F

- $\mathcal{M}, m/h \models A$ iff $m/h \in v(A)$, for A an atomic formula

- $\mathcal{M}, m/h \models \neg A$ iff $\mathcal{M}, m/h \not\models A$

- $\mathcal{M}, m/h \models A \wedge B$ iff $\mathcal{M}, m/h \models A$ and $\mathcal{M}, m/h \models B$

- $\mathcal{M}, m/h \models \mathsf{P}A$ iff there is an $m' \in h$ such that $m' < m$ and $\mathcal{M}, m'/h \models A$

- $\mathcal{M}, m/h \models \mathsf{F}A$ iff there is an $m' \in h$ such that $m < m'$ and $\mathcal{M}, m'/h \models A$

4. Evaluation rules: historical necessity

- $\mathcal{M}, m/h \models \Box A$ iff $\mathcal{M}, m/h' \models A$ for each history $h' \in H_m$

  $(\Diamond A = \neg \Box \neg A)$

5. Moment determinateness:

   A settled true at m if $m/h \models A$ for each $h \in H_m$

   A settled false at m if $m/h \not\models A$ for each $h \in H_m$

   Moment determinate = settled true or settled false

   Examples:

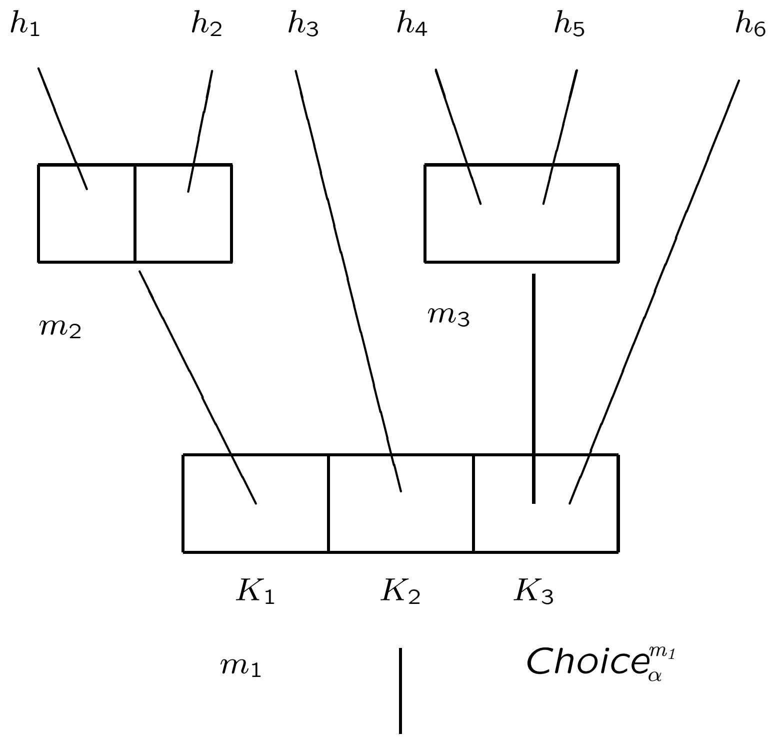
   PA, $\Box A$ moment determinate

   FA not moment determinate

6. Propositions:

$$|A|_m^{\mathcal{M}} = \{h \in H_m : \mathcal{M}, m/h \models A\}$$

Stit semantics



1. Concepts:

$$\textit{Agent}$$

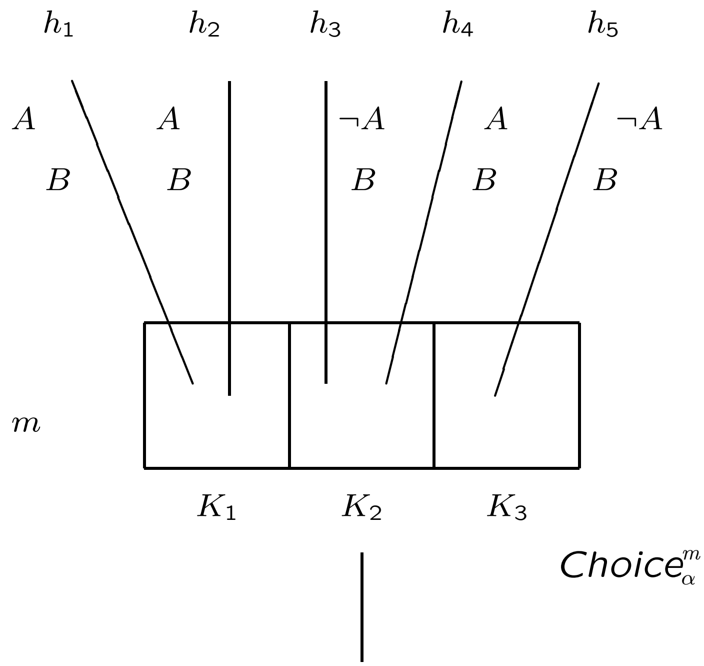
$$\textit{Choice}$$

2. Examples:

$$\textit{Choice}_\alpha^{m_1} = \{K_1, K_2, K_3\}$$

$$\textit{Choice}_\alpha^{m_1}(h_4) = K_3$$

(Condition #1: No choice between undivided histories)



3. Stit model:

$$\mathcal{M} = \langle \textit{Tree}, <, \textit{Agent}, \textit{Choice}, v \rangle$$

4. Evaluation rule: the "Chellas" stit

- $\mathcal{M}, m/h \models [\alpha\ \mathit{cstit}\colon A]$ iff $\textit{Choice}_\alpha^m(h) \subseteq |A|_m^{\mathcal{M}}$

Example: $[\alpha\ \mathit{cstit}\colon A]$ true at m/h_1, not at m/h_4.

5. Evaluation rule: the "deliberative" stit

- $\mathcal{M}, m/h \models [\alpha\ \mathit{dstit}\colon A]$ iff $\textit{Choice}_\alpha^m(h) \subseteq |A|_m^{\mathcal{M}}$ and $|A|_m^{\mathcal{M}} \neq H_m$

Example: $[\alpha\ \mathit{dstit}\colon B]$ true nowhere.

6. Logic of *cstit* (S5 operator):

$RE.$ $A \equiv B$ / $[\alpha\ cstit\colon A] \equiv [\alpha\ cstit\colon B]$

$N.$ $[\alpha\ cstit\colon \top]$

$M.$ $[\alpha\ cstit\colon A \wedge B] \supset ([\alpha\ cstit\colon A] \wedge [\alpha\ cstit\colon B])$

$C.$ $([\alpha\ cstit\colon A] \wedge [\alpha\ cstit\colon B]) \supset [\alpha\ cstit\colon A \wedge B]$

$T.$ $[\alpha\ cstit\colon A] \supset A$

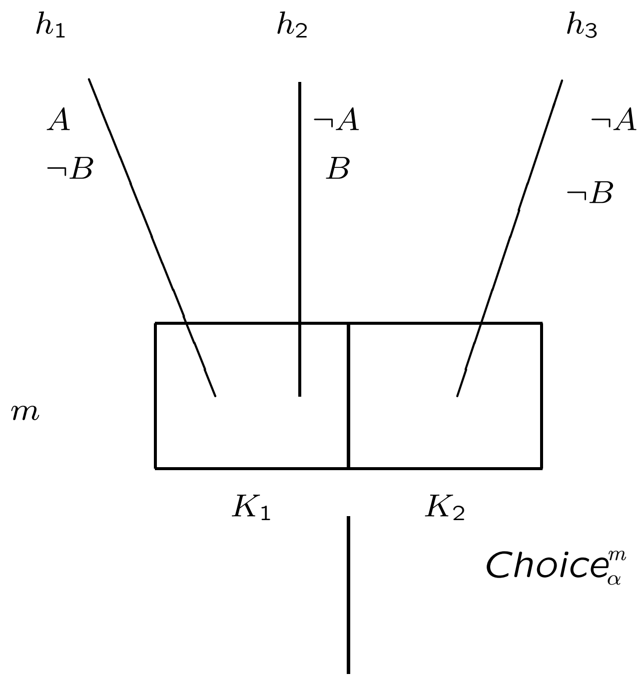
4. $[\alpha\ cstit\colon A] \supset [\alpha\ cstit\colon [\alpha\ cstit\colon A]]$

$B.$ $A \supset [\alpha\ cstit\colon \neg[\alpha\ cstit\colon \neg A]]$

7. *Dstit* axiomatized by Ming Xu

8. Neither $[\alpha\ cstit\colon A]$ nor $[\alpha\ dstit\colon A]$ moment determinate

Ability



1. Proposal:

$$\Diamond[\alpha \; cstit\text{: } A] \;=\; \text{It is possible that } \alpha \text{ sees to it that } A$$
$$=\; \alpha \text{ can (has ability) see to it that } A$$

2. Kenny's objection: modal treatment fails ("ability is not any kind of possibility"), since it validates:

$$A \supset \Diamond A$$
$$\Diamond(A \vee B) \supset (\Diamond A \vee \Diamond B)$$

3. But present proposal validates neither

$$A \supset \Diamond[\alpha \; cstit\text{: } A]$$
$$\Diamond[\alpha \; cstit\text{: } A \vee B] \supset (\Diamond[\alpha \; cstit\text{: } A] \vee \Diamond[\alpha \; cstit\text{: } B])$$

4. Proposal does validate

$$\Diamond[\alpha\ cstit\colon \Diamond[\alpha\ cstit\colon A]] \supset \Diamond[\alpha\ cstit\colon A]$$

Brown objects:

> Suppose I am a skillful enough golfer that on the short par 3 hole I can hit the green in one stroke, and that no matter where on the green the ball lands, I can then putt out in one additional stroke. Nonetheless, until I know where the ball lando on the green I don't know which further action to take to get the ball into the hole. It may not be true that I am able to get a hole in one, nor even that there is some pair of strokes I can choose in advance that will assure the ball's going into the hole.

But this example is better captured with

$$\Diamond[\alpha\ cstit\colon \mathsf{F}\Diamond[\alpha\ cstit\colon A]] \supset \Diamond[\alpha\ cstit\colon A]$$

which is invalid

Refraining (dstit theory)

1. von Wright:

$$\neg[\alpha\ dstit\colon A] \wedge \Diamond[\alpha\ dstit\colon A]$$

2. Belnap and Perloff:

$$[\alpha\ dstit\colon \neg[\alpha\ dstit\colon A]]$$

3. Fact:

$$[\alpha\ dstit\colon \neg[\alpha\ dstit\colon A]] \equiv (\neg[\alpha\ dstit\colon A] \wedge \Diamond[\alpha\ dstit\colon A])$$

4. Meinong:

> One may ask whether the essential features of the law of omission are to be found in the law of double negation .... In such a case omission of omission would yield commission, just as the negation of a negation yields an affirmation ....

5. Answer: yes.

$$[\alpha\ dstit\colon \neg[\alpha\ dstit\colon [\alpha\ dstit\colon \neg[\alpha\ dstit\colon A]]]] \equiv [\alpha\ dstit\colon A]$$

6. Aristotle:

> ... where it is in our power to do something, it is also in our power not to do it, and when the 'no' is in our power, the 'yes' is also (NE 1113b7-8).

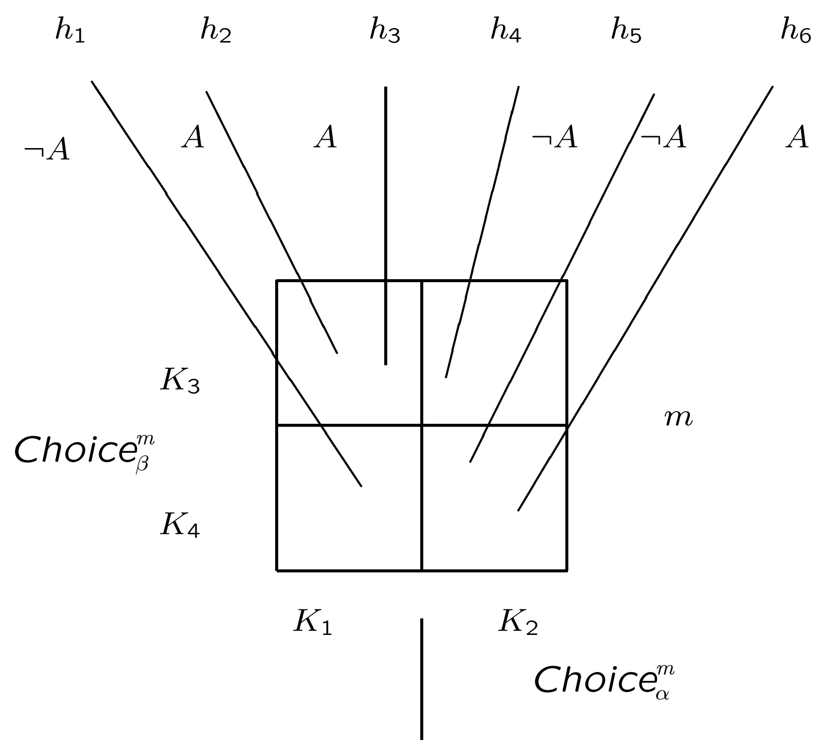
7. Fact:

$$\Diamond[\alpha\ dstit\colon A] \equiv \Diamond[\alpha\ dstit\colon \neg[\alpha\ dstit\colon A]]$$

8. But we need dstit for this, since

$$\neg[\alpha\ cstit\colon A] \equiv [\alpha\ cstit\colon \neg[\alpha\ cstit\colon A]]$$

Group agency



1. Both $\Diamond[\alpha\ cstit\colon A]$ and $\Diamond[\beta\ cstit\colon A]$ fail, but where $\Gamma = \{\alpha, \beta\}$, want $\Diamond[\Gamma\ cstit\colon A]$.

2. Group actions:

   Choice$^m_\Gamma = \{K_1 \cap K_3, K_1 \cap K_4, K_2 \cap K_3, K_2 \cap K_4\}$

   (Condition #2: Independence of agents)

3. Evaluation rule: group cstit.

   - $\mathcal{M}, m/h \models [\Gamma\ cstit\colon A]$ iff *Choice*$^m_\Gamma \subseteq |A|^{\mathcal{M}}_m$

4. Individual and group actions:

$$[\alpha \; cstit\colon A] \equiv [\{\alpha\} \; cstit\colon A]$$

5. Free riders: where $\Gamma \subseteq \Delta$,

$$[\Gamma \; cstit\colon A] \supset [\Delta \; cstit\colon A]$$

6. Group ability:

$$\Diamond[\Gamma \; cstit\colon A]$$

Ought to be

1. Standard deontic stit model:

$$\mathcal{M} = \langle \textit{Tree}, <, \textit{Agent}, \textit{Choice}, Ought, v \rangle,$$

   where $Ought_m$ is a nonempty subset of H_m.

2. Evaluation rule: standard deontic operator.

   - $\mathcal{M}, m/h \models \bigcirc A$ iff $\mathcal{M}, m/h' \models A$ for each history $h' \in Ought_m$

   (cf. Thomason/Åqvist)

3. Principles:

$$\begin{array}{ll} RE\bigcirc. & A \equiv B \quad / \quad \bigcirc A \equiv \bigcirc B \\ N\bigcirc. & \bigcirc \top \\ M\bigcirc. & \bigcirc(A \wedge B) \supset . \bigcirc A \wedge \bigcirc B \\ C\bigcirc. & \bigcirc A \wedge \bigcirc B \supset \bigcirc(A \wedge B) \\ & \\ D\bigcirc. & \bigcirc A \supset \Diamond A \end{array}$$

4. General deontic stit model:

$$\mathcal{M} = \langle \textit{Tree}, <, \textit{Agent}, \textit{Choice}, \textit{Value}, v\rangle,$$

where *Value* maps histories into some set of values ordered by $\leq$.

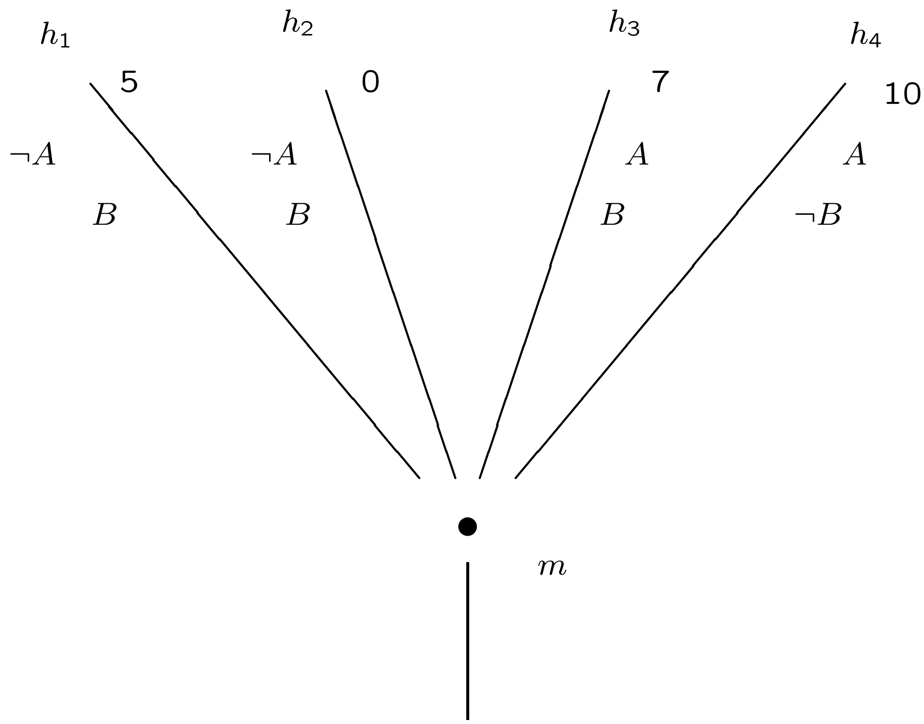
5. Evaluation rule: general deontic operator

- $\mathcal{M}, m/h \models \bigcirc A$ iff there is some history $h' \in H_m$ such that
  - $\mathcal{M}, m/h' \models A$, and
  - $\mathcal{M}, m/h'' \models A$ for each history $h'' \in H_m$ such that $\textit{Value}(h') \leq \textit{Value}(h'')$

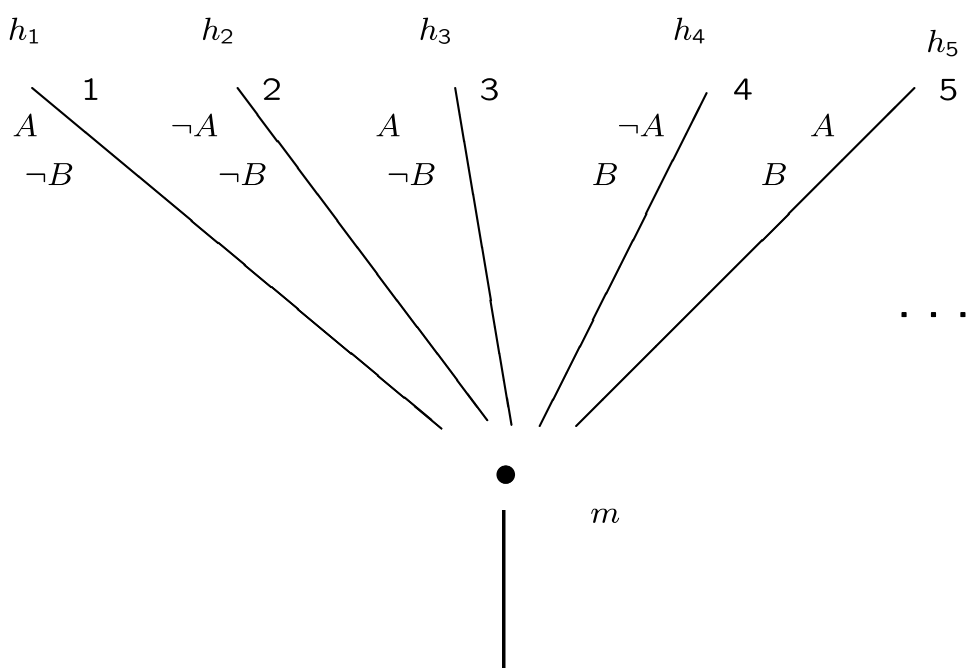
6. Utilitarian stit model: a general deontic stit model in which the values are represented by real numbers, with linear order. If finite:

- $\mathcal{M}, m/h \models \bigcirc A$ iff $\mathcal{M}, m/h' \models A$ for each $h' \in H_m$ such that there is no $h'' \in H_m$ such that $\textit{Value}(h') < \textit{Value}(h'')$

7. The validities generated by standard deontic stit models and utilitarian stit models agree



$\bigcirc A$ and $\neg \bigcirc B$.



$\neg \bigcirc A$ and $\bigcirc B$.

Meinong/Chisholm analysis

1. "S ought to bring it about that p" defined as "It ought to be that S brings it about that p" (Chisholm).

$$\begin{aligned} \bigcirc[\alpha\ \textit{cstit}\text{: } A] &= \text{It ought to be that} \\ &\quad\ \alpha \text{ sees to it that } A \\ &= \alpha \text{ ought to see to it that } A \end{aligned}$$

2. Some validities:

$$A \equiv B\ \ /\ \ \bigcirc[\alpha\ \textit{cstit}\text{: } A] \equiv \bigcirc[\alpha\ \textit{cstit}\text{: } B]$$

$$\bigcirc[\alpha\ \textit{cstit}\text{: } \top]$$

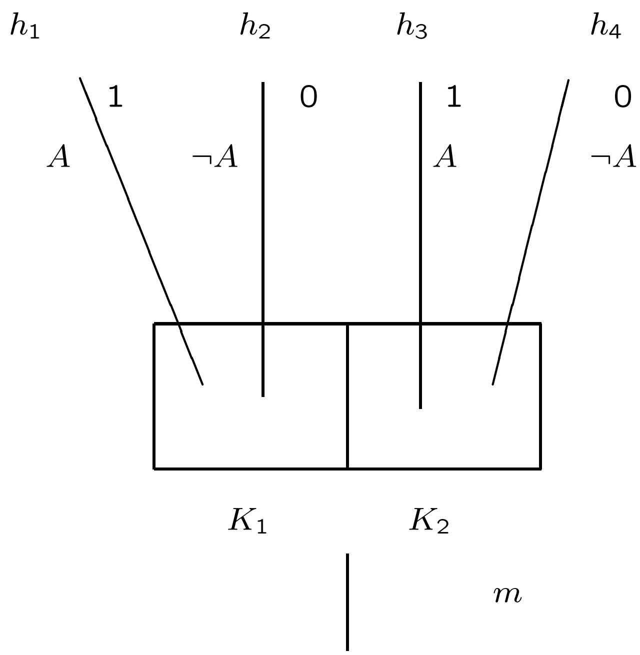
$$\bigcirc[\alpha\ \textit{cstit}\text{: } A \wedge B] \supset (\bigcirc[\alpha\ \textit{cstit}\text{: } A] \wedge \bigcirc[\alpha\ \textit{cstit}\text{: } B])$$

$$(\bigcirc[\alpha\ \textit{cstit}\text{: } A] \wedge \bigcirc[\alpha\ \textit{cstit}\text{: } B]) \supset \bigcirc[\alpha\ \textit{cstit}\text{: } A \wedge B]$$

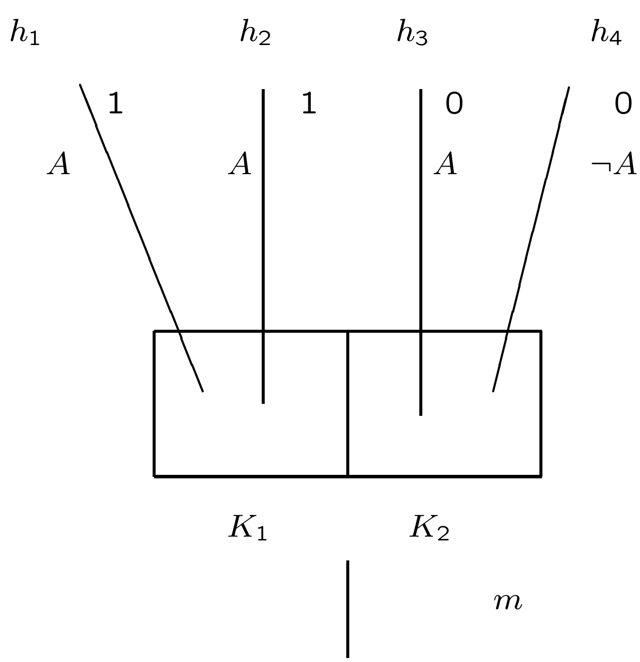
$$\bigcirc[\alpha\ \textit{cstit}\text{: } A] \supset \Diamond[\alpha\ \textit{cstit}\text{: } A],$$

$$\bigcirc[\alpha\ \textit{cstit}\text{: } A] \supset \Box \bigcirc [\alpha\ \textit{cstit}\text{: } A]$$

3. Examples:

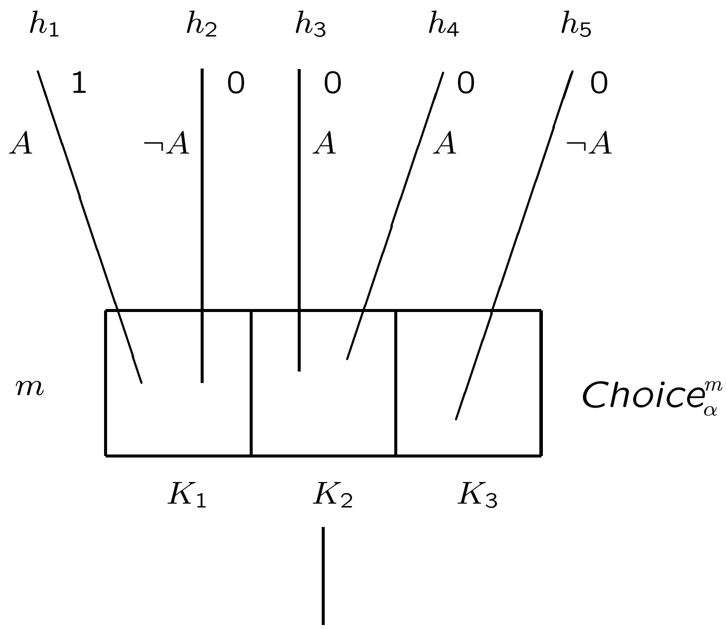


$\bigcirc A$ without $\bigcirc[\alpha\ cstit: A]$



$\bigcirc[\alpha\ cstit: A]$

4. Horse story:



$\bigcirc A$ and $\Diamond[\alpha\ cstit\colon A]$ without $\bigcirc[\alpha\ cstit\colon A]$

$K_1 = \alpha$ offers \$10,000 for horse

$K_2 = \alpha$ throws \$10,000 down drain

$A = \alpha$ is less wealthy by \$10,000

5. Geach's objection: Meinong/Chisholm analysis allows bad arguments.

   (i) Fred ought to dance with Ginger

   (ii) $\bigcirc$(Fred dances with Ginger)

   (iii) $\Box$(Fred dances with Ginger $\equiv$
   Ginger dances with Fred)

   (iv) $\bigcirc$(Ginger dances with Fred)

   (v) Ginger ought to dance with Fred

6. But current treatment blocks this argument.

   (ii') $\bigcirc[\alpha\ cstit\text{: } A]$

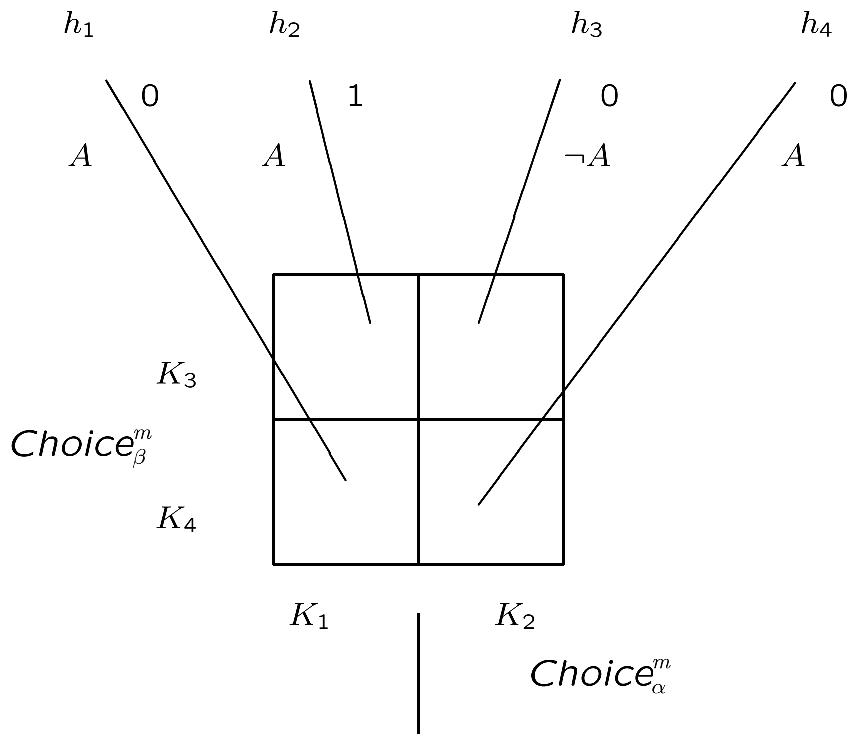
   (iii') $\Box([\alpha\ cstit\text{: } A] \not\equiv [\beta\ cstit\text{: } A])$!!

   (iv') $\bigcirc[\beta\ cstit\text{: } A]$

   $\alpha =$ Fred,

   $\beta =$ Ginger,

   $A =$ They dance.



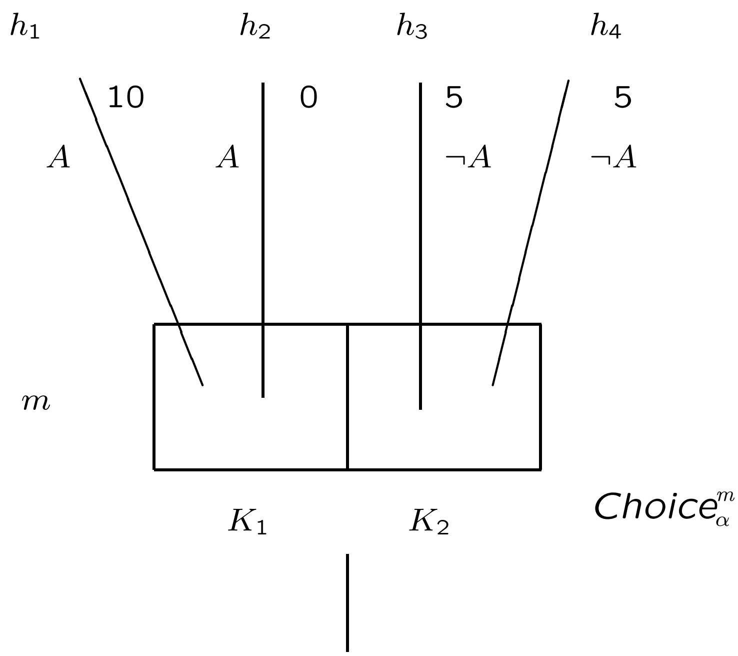
$\bigcirc[\alpha\ cstit: A]$ without $\bigcirc[\beta\ cstit: A]$.

$\alpha =$ Fred

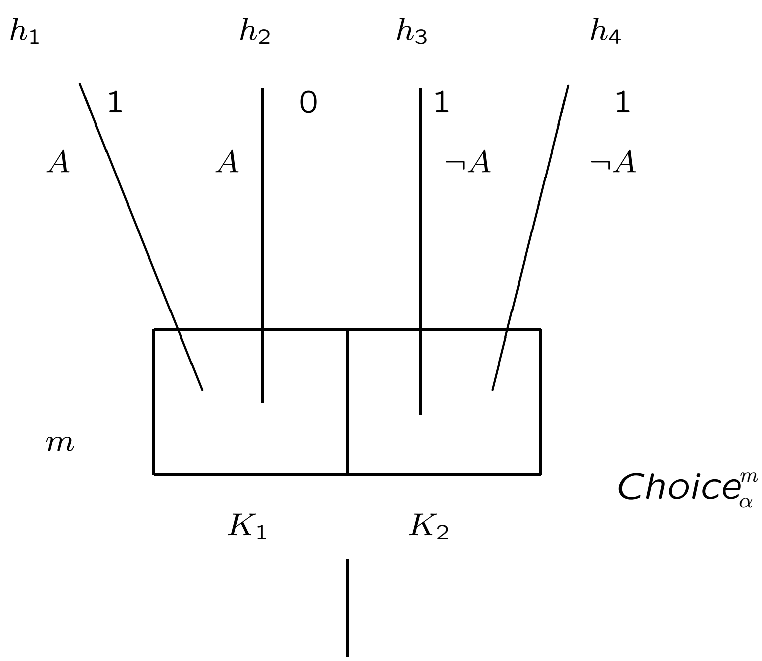
$\beta =$ Ginger

$A =$ They dance

7. The gambling problems



$$\bigcirc[\alpha\ cstit\colon A]$$



$$\neg\bigcirc[\alpha\ cstit\colon \neg A]$$

A dominance analysis

1. Ordering the propositions: where X and Y are propositions at some moment

$$X \leq Y \text{ iff } \forall h \in X \forall h' \in Y[\mathit{Value}(h) \leq \mathit{Value}(h')]$$

$$X < Y \text{ iff } X \leq Y \text{ and } \neg(Y \leq X)$$

2. Some properties:

If $X < Y$ then $X \leq Y$

If $X \leq Y$ and $Y \leq Z$, then $X \leq Z$

If $X \leq Y$ and $Y < Z$, then $X < Z$

If $X < Y$ and $Y \leq Z$, then $X < Z$

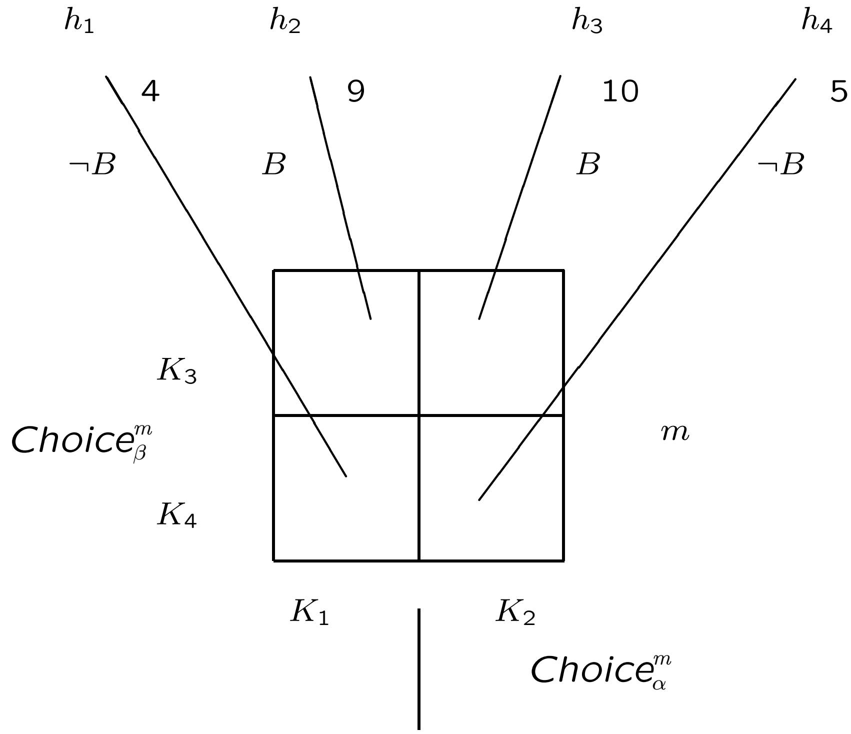
If $X < Y$ and $Y < Z$, then $X < Z$

If $X < Y$ then it is not the case that $Y < X$

It is not the case that $X < X$

But we don't have linearity:

$X \leq Y$ or $Y \leq X$



$K_1 =$ heads up
$K_2 =$ tails up
$K_3 =$ heads up
$K_4 =$ tails up

3. Sure thing reasoning

4. Probabilistic vs. causal independence

5. States confronting an agent at a moment identified with possible patterns of action that might be performed at that moment by all other agents

6. States:

$$\textit{State}_\alpha^m = \textit{Choice}^m_{\textit{Agent}-\{\alpha\}}$$

7. Dominance ordering of actions: where K and K' are actions available to α at m,

$$K \preceq K' \text{ iff } \forall S \in \textit{State}_\alpha^m [K \cap S \leq K' \cap S]$$

$$K \prec K' \text{ iff } K \preceq K' \text{ and } \neg(K' \preceq K)$$

8. Dominance-optimal actions:

$$\textit{D-Optimal}_\alpha^m = \{K \in \textit{Choice}_\alpha^m : \neg\exists\, K' \in \textit{Choice}_\alpha^m (K \prec K')\}$$

9. Utilitarianism: an action *right* iff there is no action among available alternatives with better consequences.

10. We understand *alternatives* and *better*, but what are *consequences*?

    A quote from Prior:

    > Suppose that determinism is *not* true.
    >
    > Then there may indeed be a number of alternative actions which we could perform on a given occasion, . . .
    >
    > But none of these actions can be said to have any "total consequences," or to bring about a definite state of the world which is better than any other that might be brought about by other choices.
    >
    > It's not merely that one cannot calculate the totality of what will happen if one decides in a certain way; the point is rather that there *is* no such totality.

11. Dominance act utilitarianism:

    > Action K is *right* at m/h iff $K \in$ *D-Optimal*$_{\alpha}^{m}$, *wrong* otherwise.

12. A new deontic operator:

   - $\mathcal{M}, m/h \models \odot[\alpha\ cstit\colon A]$ iff $K \subseteq |A|^{\mathcal{M}}_{m}$ for each $K \in$ *D-Optimal*$^{m}_{\alpha}$

   (Definition supposes finite number of available actions)

13. Logical points:

   Normal deontic operator, with deontic law, and settled truth:

$$\odot[\alpha\ cstit\colon A] \supset \Diamond[\alpha\ cstit\colon A]$$
$$\odot[\alpha\ cstit\colon A] \supset \Box\odot[\alpha\ cstit\colon A]$$

   Incomparable with Meinong/Chisholm analysis:

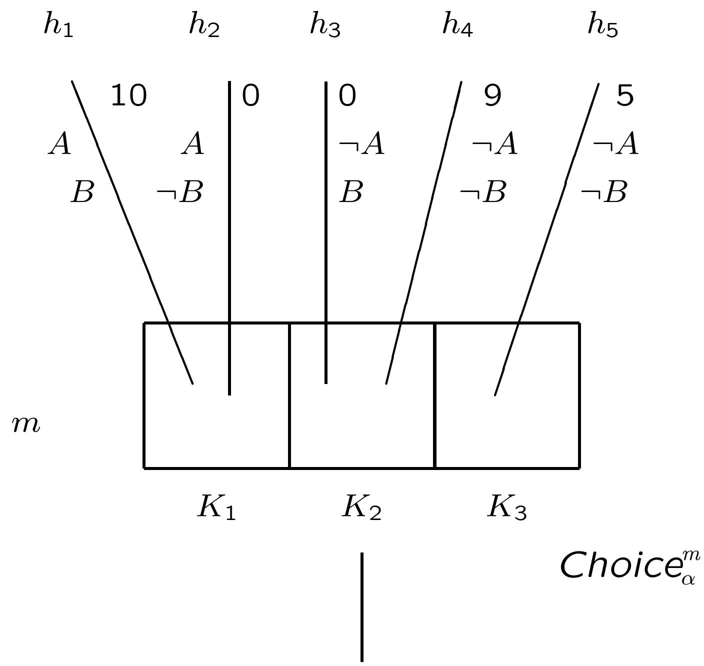
$$\bigcirc[\alpha\ cstit\colon A] \not\supset \odot[\alpha\ cstit\colon A]$$
$$\odot[\alpha\ cstit\colon A] \not\supset \bigcirc[\alpha\ cstit\colon A]$$

   But consistent:

$$\neg(\odot[\alpha\ cstit\colon A] \wedge \bigcirc[\alpha\ cstit\colon \neg A])$$

14. Axiomatized by Yuko Murakami

Conditional oughts



1. Actions available under condition X:

$$\textit{Choice}^m_\alpha/X = \{K \in \textit{Choice}^m_\alpha : K \cap X \neq \emptyset\}$$

Example: $\textit{Choice}^m_\alpha/|B|_m = \{K_1, K_2\}$

2. Conditional dominance:

- $K \preceq_X K'$ iff $\forall S \in \textit{State}^m_\alpha[K \cap X \cap S \leq K' \cap X \cap S]$
- $K \prec_X K'$ iff $K \preceq_X K'$ and $\neg(K' \preceq_X K)$

Example: $K_2 \prec_{|B|_m} K_1$

3. Conditional optimality:

$$\begin{aligned}\textit{D-Optimal}^m_\alpha/X \quad = \quad & \{K \in \textit{Choice}^m_\alpha/X : \\ & \neg\exists\, K' \in \textit{Choice}^m_\alpha/X\ (K \prec_X K')\}\end{aligned}$$

Example: $\textit{D-Optimal}^m_\alpha/|B|_m = \{K_1\}$

4. Evaluation rule:

    - $\mathcal{M}, m/h \models \odot([\alpha\ cstit\text{: } A] \,/\, B)$ iff $K \subseteq |A|_m^{\mathcal{M}}$ for each $K \in$ *D-Optimal*$_\alpha^m / |B|_m^{\mathcal{M}}$

    Example: $m/h_n \models \odot([\alpha\ cstit\text{: } A] \,/\, B)$.

5. Logic:

    Normal in consequent.

    Antecedent:

$$B \equiv C \ \ / \ \ \odot([\alpha\ cstit\text{: } A] \,/\, B) \equiv \odot([\alpha\ cstit\text{: } A] \,/\, C)$$

$$\odot([\alpha\ cstit\text{: } A] \,/\, \top) \equiv \odot[\alpha\ cstit\text{: } A]$$

    Deontic law:

$$\odot([\alpha\ cstit\text{: } A] \,/\, B) \not\supset \Diamond[\alpha\ cstit\text{: } A]$$

$$\Diamond B \supset [\odot([\alpha\ cstit\text{: } A] \,/\, B) \supset \Diamond[\alpha\ cstit\text{: } A]]$$

6. Detachment

Factual detachment (“truth” of antecedent):

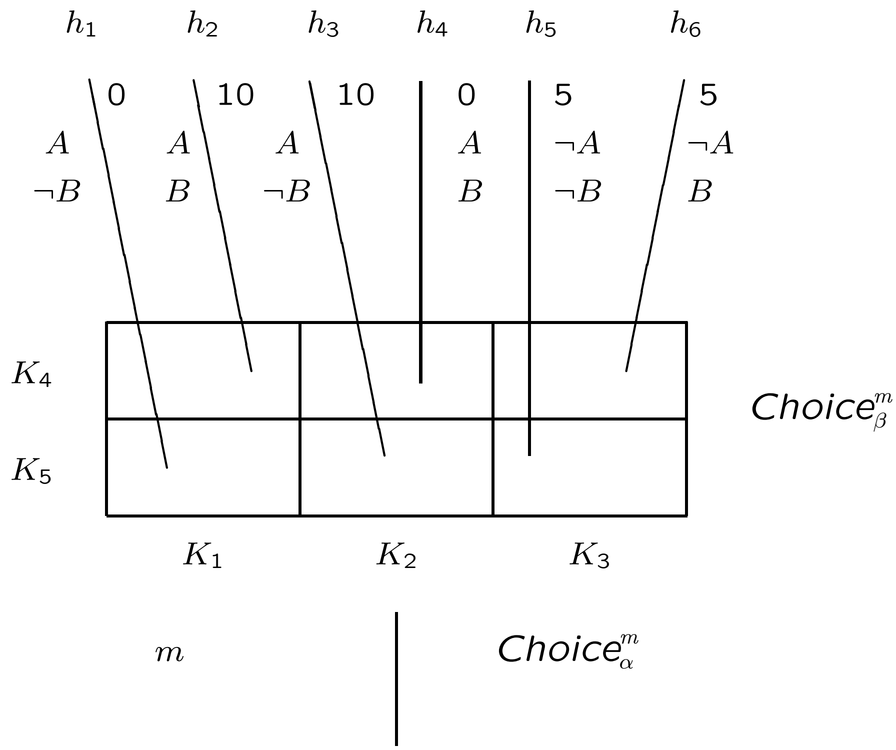
$$\frac{\begin{array}{l}\odot([\alpha\ cstit\colon A] \,/\, B)\\ B\end{array}}{\odot[\alpha\ cstit\colon A]}$$

$$\frac{\begin{array}{l}\odot([\alpha\ cstit\colon A] \,/\, B)\\ \Box B\end{array}}{\odot[\alpha\ cstit\colon A]}$$

Deontic detachment (“prescription” of antecedent):

$$\frac{\begin{array}{l}\odot([\alpha\ cstit\colon A] \,/\, B)\\ \bigcirc B\end{array}}{\odot[\alpha\ cstit\colon A]}$$

$$\frac{\begin{array}{l}\odot([\alpha\ cstit\colon A] \,/\, B)\\ \odot[\alpha\ cstit\colon B]\end{array}}{\odot[\alpha\ cstit\colon A]}$$



7. Reasoning by cases

A common validity:

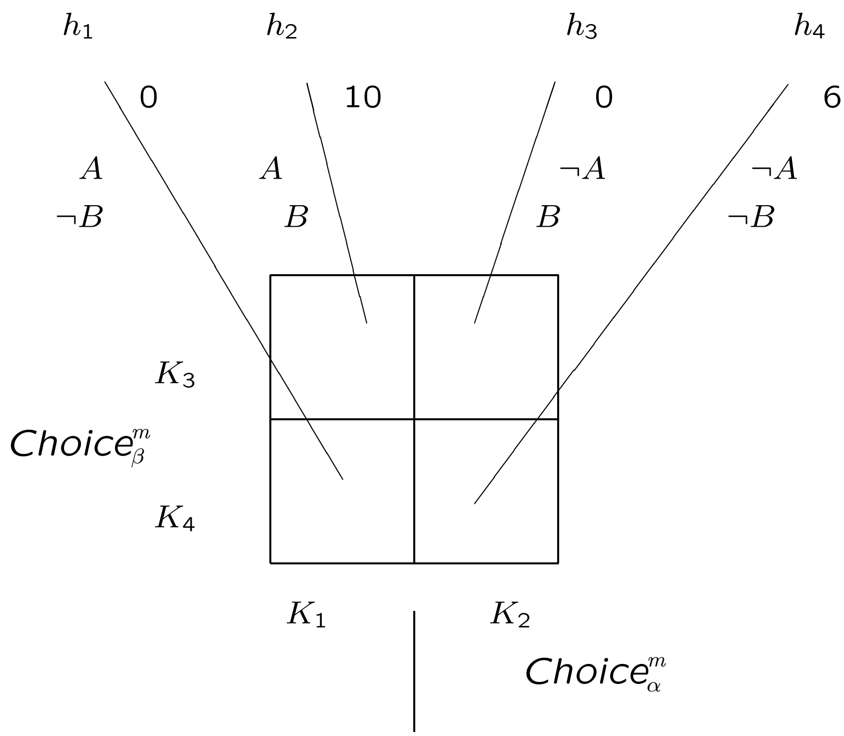
$$\bigcirc(A/B) \wedge \bigcirc(A/\neg B) \supset \bigcirc A$$

But analogue invalid:

$$\odot([\alpha\ cstit\colon A]/B) \wedge \odot([\alpha\ cstit\colon A]/\neg B) \supset \odot[\alpha\ cstit\colon A]$$

$K_1 =$ Bet heads up
$K_2 =$ Bet tails up
$K_3 =$ Don't gamble
$K_4 =$ Place heads up
$K_5 =$ Place tails up
$A =$ Gamble,
$B =$ Coin placed heads up

The orthodox perspective



1. Dominance view: either action right.

2. Orthodox view (Regan):

> Now, if we ask what AU directs Whiff to do, we find that we cannot say. ... Until we specify how Poof behaves, AU gives Whiff no clear direction.
>
> Note that the 'situation' of the agent includes all causally relevant features of the rest of the world. In particular, it includes the behaviour of other agents ...

3. Orthodox-optimal actions:

$$\textit{O-Optimal}_\alpha^{m/h} = \textit{D-Optimal}_\alpha^m / \textit{State}_\alpha^m(h)$$

4. Orthodox act utilitarianism:

   Action K is *right* at m/h iff $K \in$ *O-Optimal*$_\alpha^{m/h}$, *wrong* otherwise.

5. *Not* moment determinate:

$$\begin{aligned}
\textit{O-Optimal}_\alpha^{m/h_2} &= \textit{D-Optimal}_\alpha^m / \textit{State}_\alpha^m(h_2) \\
&= \textit{D-Optimal}_\alpha^m / K_3 \\
&= \{K_1\}
\end{aligned}$$

$$\begin{aligned}
\textit{O-Optimal}_\alpha^{m/h_1} &= \textit{D-Optimal}_\alpha^m / \textit{State}_\alpha^m(h_1) \\
&= \textit{D-Optimal}_\alpha^m / K_4 \\
&= \{K_2\}
\end{aligned}$$

6. An orthodox deontic operator:

   - $\mathcal{M}, m/h \models \bigoplus[\alpha\ cstit\colon A]$ iff $K \subseteq |A|_m^{\mathcal{M}}$ for each $K \in$ *O-Optimal*$_\alpha^{m/h}$

7. Logical points

   Not moment determinate:

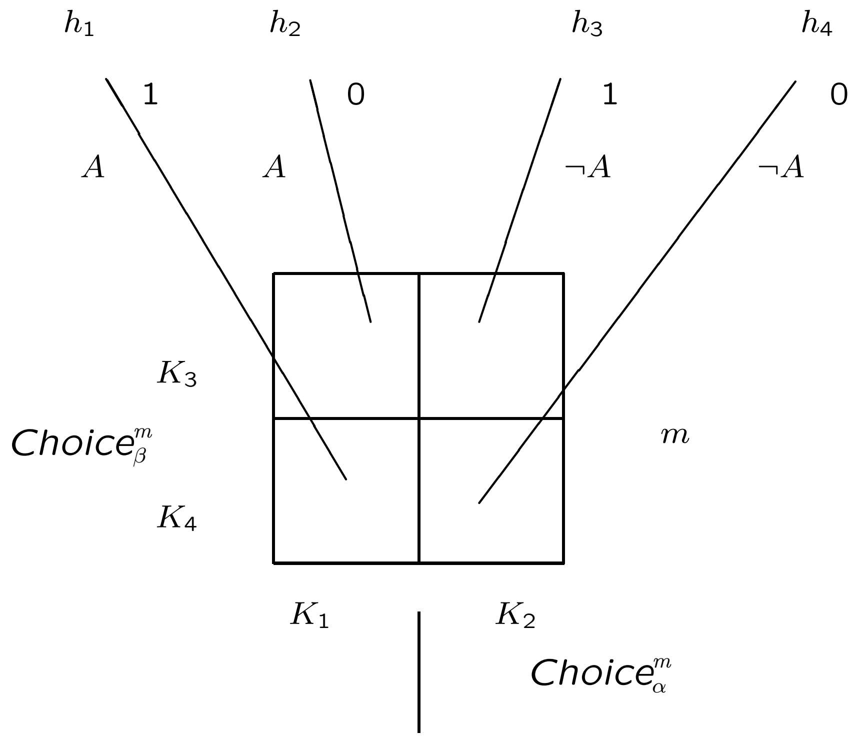
$$\bigodot[\alpha\ cstit\colon A] \supset \Box \bigodot[\alpha\ cstit\colon A]$$
$$\Diamond \bigoplus[\alpha\ cstit\colon A] \wedge \Diamond \bigoplus[\alpha\ cstit\colon \neg A]$$

   No entailments:

$$\bigoplus[\alpha\ cstit\colon A] \supset \bigodot[\alpha\ cstit\colon A]$$
$$\bigodot[\alpha\ cstit\colon A] \supset \bigoplus[\alpha\ cstit\colon A]$$

   Yet consistent:

$$\neg(\bigodot[\alpha\ cstit\colon A] \wedge \bigoplus[\alpha\ cstit\colon \neg A])$$



8. The driving example

Where $m' \in h_4$ and $m < m'$, have:

$$m'/h_4 \models \mathsf{P} \bigoplus [\alpha\ cstit\colon A]$$

$$m'/h_4 \not\models \mathsf{P} \bigodot [\alpha\ cstit\colon A]$$

$K_1 = \alpha$ swerves

$K_2 = \alpha$ continues

$K_3 = \beta$ swerves

$K_4 = \beta$ continues

$A = \alpha$ swerves

Group oughts

1. States confronting groups:

$$\textit{State}_{\Gamma}^{m} = \textit{Choice}_{\textit{Agent}-\Gamma}^{m}$$

2. Dominance ordering of group actions: where K and K' are actions available to Γ at m,

   $K \preceq K'$ iff $\forall S \in \textit{State}_{\Gamma}^{m}[K \cap S \leq K' \cap S]$

   $K \prec K'$ iff $K \preceq K'$ and $\neg(K' \preceq K)$

3. Optimal group actions:

$$\textit{D-Optimal}_{\Gamma}^{m} = \{K \in \textit{Choice}_{\Gamma}^{m} : \neg\exists\, K' \in \textit{Choice}_{\Gamma}^{m}(K \prec K')\}$$

4. Dominance act utilitarianism for group Γ:

   Action K is *right* at m/h iff $K \in$ *D-Optimal*$_{\Gamma}^{m}$, *wrong* otherwise

5. Group deontic operator:

   - $\mathcal{M}, m/h \models \bigodot[\Gamma\ cstit\text{: } A]$ iff $K \subseteq |A|_{m}^{\mathcal{M}}$ for each $K \in$ *D-Optimal*$_{\Gamma}^{m}$

6. Logic like logic for individual agents, which is special case:

$$\odot[\{\alpha\}\ cstit\text{: } A] \equiv \odot[\alpha\ cstit\text{: } A]$$

7. Downward inheritance: if Γ ought to see to it that A, and that can happen only if α ($\alpha \in \Gamma$) sees to it that B, then should α see to it that B?

> Even it is true that *you and I* constitute a group of people who together ought to do something, it does not follow that *each* of us ought to 'do his share'.
>
> Even it is true of you and me that we ought to perform the collective action consisting in my pouring water into the pool and your jumping into it, it does not follow logically that you ought to jump .... To think otherwise is a mistake in deontic logic (Tännsjö).

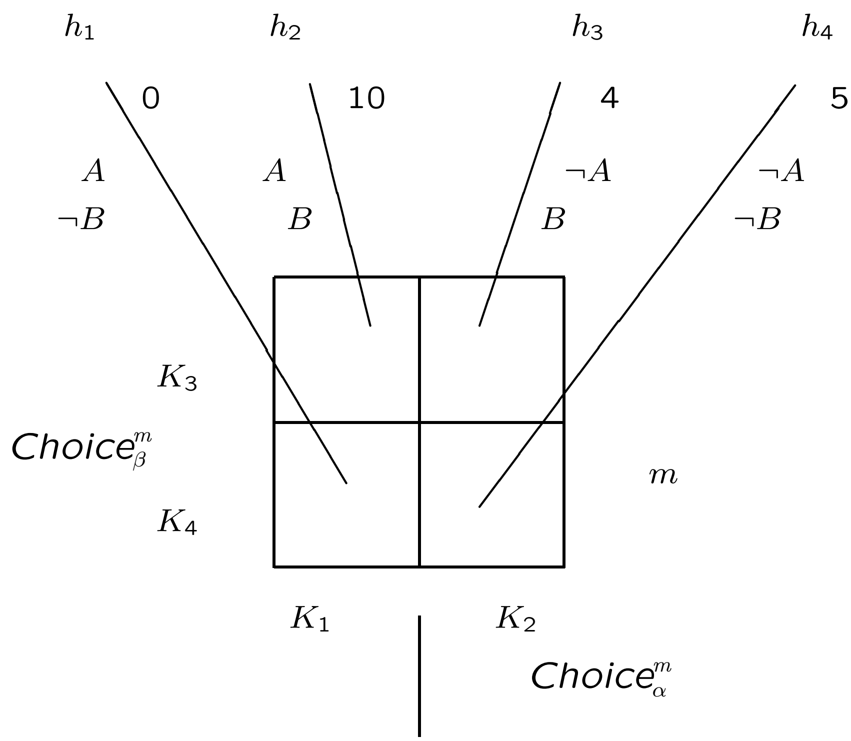
Meinong/Chisholm approach:

$$\begin{array}{l} \bigcirc[\{\alpha,\beta\}\ cstit\text{: } A \wedge B], \\ \Box([\{\alpha,\beta\}\ cstit\text{: } A \wedge B] \supset [\alpha\ cstit\text{: } A]) \\ \hline \bigcirc[\alpha\ cstit\text{: } A] \end{array}$$

$\alpha =$ you, $\beta =$ me,

$A =$ You jump,

$B =$ I fill.



Dominance approach:

$$\frac{\begin{array}{l}\odot[\{\alpha,\beta\}\ cstit\text{: } A \wedge B] \\ \Box([\{\alpha,\beta\}\ cstit\text{: } A \wedge B] \supset [\alpha\ cstit\text{: } A])\end{array}}{\odot[\alpha\ cstit\text{: } A]}$$

$\alpha =$ you, $\beta =$ me,

$K_1 =$ You jump,

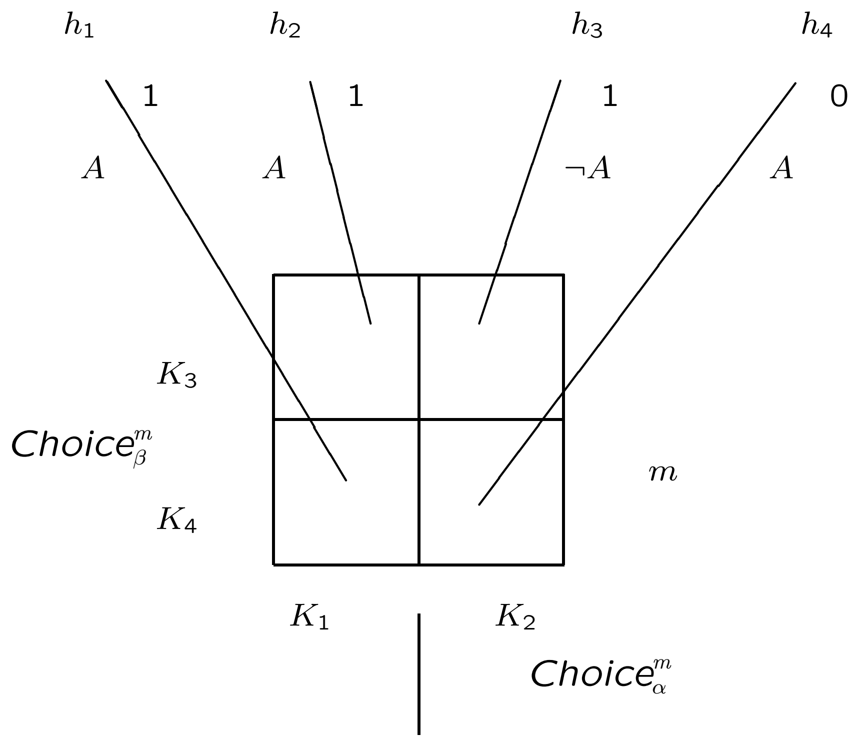
$K_2 =$ You don't jump,

$K_3 =$ I fill,

$K_3 =$ I don't fill,

$A =$ You jump,

$B =$ I fill.



7. Upward inheritance: if α ought to see to it that A, and that can happen only if Γ ($\alpha \in \Gamma$) sees to it that B, then should Γ see to it that B?

   Meinong/Chisholm approach:

$$\frac{\bigcirc[\alpha\ cstit\text{: } A], \quad \Box([\alpha\ cstit\text{: } A] \supset [\{\alpha, \beta\}\ cstit\text{: } B])}{\bigcirc[\{\alpha, \beta\}\ cstit\text{: } B]}$$

   Dominance approach:

$$\frac{\odot[\alpha\ cstit\text{: } A], \quad \Box([\alpha\ cstit\text{: } A] \supset [\{\alpha, \beta\}\ cstit\text{: } B])}{\odot[\{\alpha, \beta\}\ cstit\text{: } B]}$$

Individual and group utilitarianism

1. Question: does satisfaction of utilitarianism by individuals α and β entail satisfaction by the group $\Gamma = \{\alpha, \beta\}$?

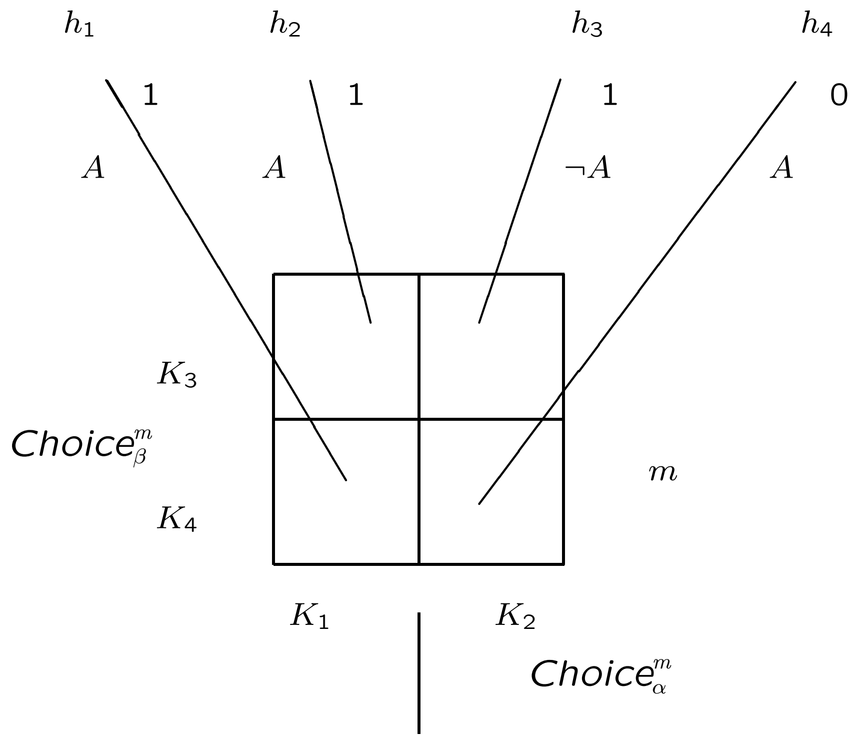
   Answer: No.

2. Question: does satisfaction of utilitarianism by the group $\Gamma = \{\alpha, \beta\}$ entail satisfaction by the individuals α and β?

   Answer:

   > . . . any pattern of behavior by a group of agents which produces the best consequences possible is a pattern in which the members of the group all satisfy AU. (Regan)

   > . . . if the right group action is actually performed, then that group action's constituent individual actions must be right (Jackson)



3. Entailment from group to individal satisfactiion *fails* for dominance utilitarianism. Where $\Gamma = \{\alpha, \beta\}$

$$\textit{D-Optimal}_\Gamma^m = \{K_1 \cap K_3, K_1 \cap K_4, K_2 \cap K_3\}$$

$$\textit{D-Optimal}_\alpha^m = \{K_1\}$$

So Γ but not α satisfies dominance act utilitarianism at m/h_3.

4. Orthodox act utilitarianism for groups: K is *right* at m/h iff

$$K \in \textit{O-Optimal}_\Gamma^{m/h} (= \textit{D-Optimal}_\Gamma^m / \textit{State}_\Gamma^m(h)),$$

wrong otherwise.

5. Then entailment from group to individal satisfactiion *holds* for orthodox theory.

Rule utilitarianism

1. Optimality notion:

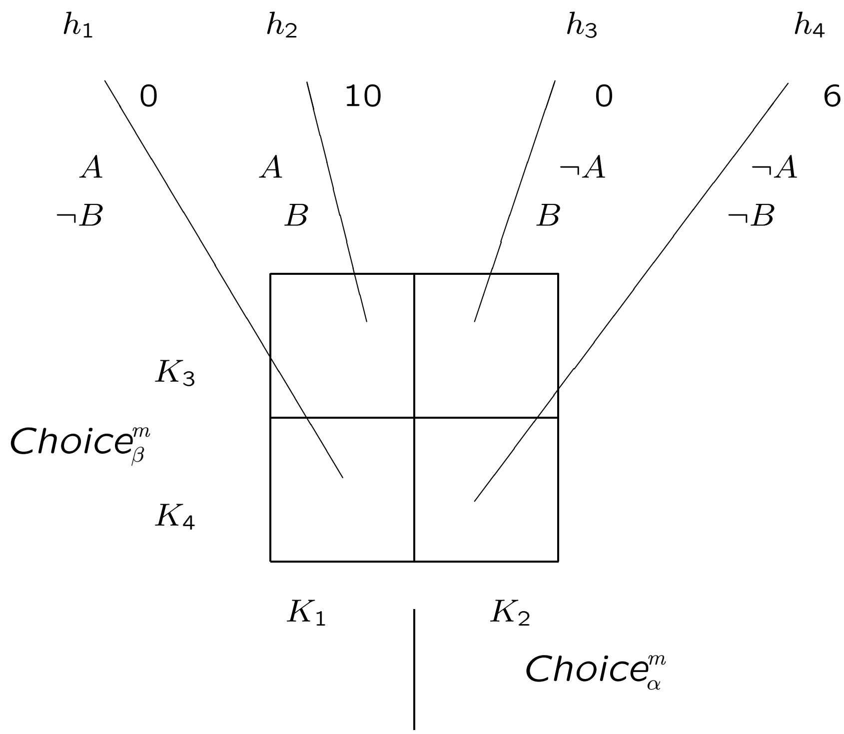
$$\textit{R-Optimal}_\alpha^m = \{K \in \textit{Choice}_\alpha^m : \exists K' \in \textit{D-Optimal}_{\textit{Agent}}^m (K' \subseteq K)\}$$

2. Rule utilitarianism:

   Action K is *right* at m/h iff $K \in$ *R-Optimal*$_\alpha^m$, *wrong* otherwise.

3. Note: no distinct dominance and orthodox forms of rule utilitarianism

4. Note: Theory is most naturally applicable when there is only one rule optimal pattern of action



5. Comparison with orthodox act utilitarianism

At m/h_4, agent α satisfies orthodox act utilitarianism but not rule utilitarianism:

$$\begin{array}{lcl} \textit{R-Optimal}_\alpha^m & = & \{K_1\} \\ \textit{O-Optimal}_\alpha^{m/h_4} & = & \{K_2\} \end{array}$$

At m/h_1, agent α satisfies rule utilitarianism but not orthodox act utilitarianism:

$$\textit{O-Optimal}_\alpha^{m/h_1} \;=\; \{K_2\}$$

Note: the clash is severe. Both m/h_1 and m/h_4 are "situations" in which it is impossible to satisfy both theories.

5. Comparison with dominance act utilitarianism

Possible to satisfy either dominance act utilitarianism or rule utilitarianism without satisfying the other. In general:

$$\textit{D-Optimal}^m_\alpha \not\subseteq \textit{R-Optimal}^m_\alpha$$

$$\textit{R-Optimal}^m_\alpha \not\subseteq \textit{D-Optimal}^m_\alpha$$

But the two theories are consistent:

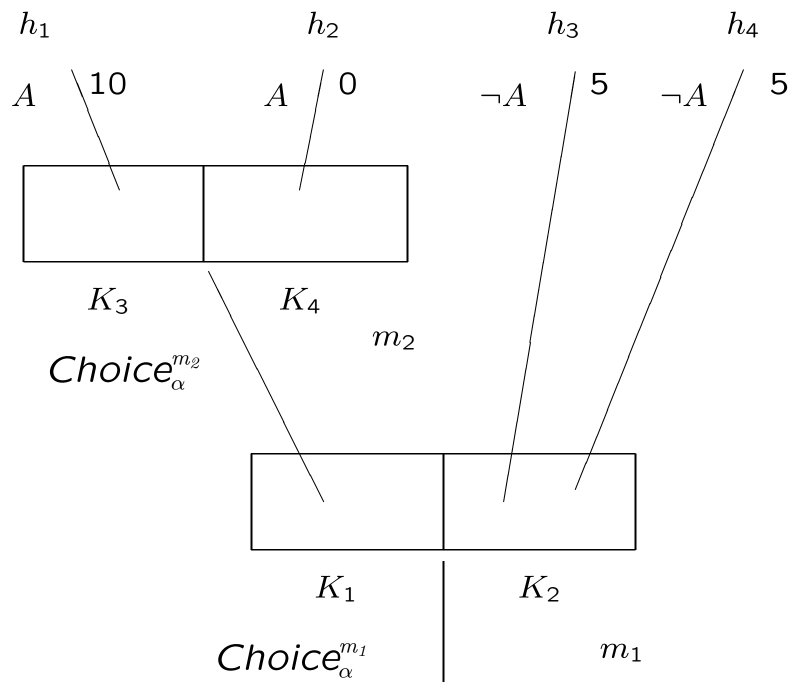
$$\textit{D-Optimal}^m_\alpha \cap \textit{R-Optimal}^m_\alpha \neq \emptyset$$

And when $\textit{R-Optimal}^m_\alpha$ has only one element—when it's most naturally applicable—we *do* have

$$\textit{R-Optimal}^m_\alpha \subseteq \textit{D-Optimal}^m_\alpha$$

so satisfying rule utilitarianism entails satisfying dominance act utilitarianism

Strategic oughts



Clear that we want $\odot[\alpha\ cstit: A]$, but theory must be elaborated to give us this.

Summary

Stit approach to action.

Coherent logical theory of what an agent ought to do that improves on Meinong/Chisholm idea of identifying what an agent ought to do with what it ought to be that the agent does.

Theory based on analogy between action in indeterministic setting and choice under uncertainty.

Applications/generalizations:

- Conditional oughts
- Group oughts
- Orthodox oughts
- Forms of act utilitarianism
- Rule utilitarianism
- Strategic oughts