New Clip-Linear Deontic Logic with a Choice Connective

Preliminary ideas

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Thank you for your invitation

8. 8. Decidability Results in Non-Classical Logic III (Systems with Statability Operators)
Israel Journal of Mathematics, 10, 135—146, 1971.

Tools 1: Linear Logic

$A, A \to B \vdash B$

$A, A \to (A \to B) \nvdash B$

$A, A, A \to B \nvdash B$

$A \& B$ - Additive Connective
use one of $\{A, B\}$ only
But consume $A \& B$.

$A \& C, A \to B \vdash B$

Tool 2 new idea of clip-Linearity

$$(A \& (B \& C)), \quad A \to (B \to X) \nvdash X$$

We can get

$$B \to x \overset{?}{\vdash} X$$

but both assumptions are consumed.

Clip-Linearity = Clip the used assumption.

write $A \& B$ as $\{\{A, B\}\}$

clip $\{\{A, B, \{\{-^{1}-\}\}, \{\{-^{2}-\}\}\}\}$

as $-$ $\{\{\{\{-^{1}-\}\}, \{\{-^{2}-\}\}\}\}$

So

$(A \& (B \& C)), A \to (B \to X) \vdash^{?} X$

choose A we get

$B \& C$, $B \to X \vdash^{?} X$

clipped

choose B and get X.

Note. clip only internal &. So

$\text{clip}\,(A \& (B \& C)) = B \& C$

if choose A

$\text{clip}\,(A \& B) = \emptyset$

Chisholm paradox

1. $O\,go$
2. $go \to O\,tell$
3. $\neg go \to O\,\neg tell$
4. $\neg go$.

rewrite using additive

(1), (2)$\&$(3), (4)

If we choose (3) and get

$O\,\neg tell$ then (2) is not available!

What if we choose (2)?

we get (1), (2), (4)

lack of Symmetry!!

new System

1. Add constant v for violation. v is not consumed. i.e. $!v$.

2. Replace O by $\boxed{c}$ = choice Modality

Dov comment
I don't think we need to replace O, we can leave it and just add the additive &

3. Add clip-&.

Chisholm Paradox ?

1a $\boxed{c}\neg V \to \boxed{c}\, go$

1b $\boxed{c}\, V \to \boxed{c}\neg go$

2. $\overset{c}{\boxed{}}\, go \to (\overset{c}{\boxed{}}\, tell \,\&\, \boxed{c}\neg tell)$

3. $\overset{c}{\boxed{}}\neg g \to (\overset{c}{\boxed{}}\neg tell \,\&\, \boxed{c}\, tell)$

4. $\boxed{c}\, V \,\&\, \boxed{c}\neg V$

Rules

- multisets
- use $!v$ to help
- $\boxed{c}(A \to B) \to (\boxed{c}A \to \boxed{c}B)$
- $\boxed{c}X, \ \{\{ X \to A_i, \ \{\{ -- \{\}\}\}$

  $\vdash$ Choose $\{\{A_i\}\}$

  and clip $\{\{X \to A_i, \{\{ — \{\}\}\}$

  to $\{\{ \{\{ — \{\}\}\{\}\}$

  and consume $\boxed{c}X$.

Dov comment
If there is no X , do nothing
this happens for example , when in Chisholm paradox instead of ¬go we have ¬tell.

- $\boxed{c}X^1 \& \boxed{c}X^2, \ \{\{ X^j \to A_i^j, \ \{\{ - \{\}^j\}\}$

  $\vdash \{\{A_i^j \cdots\}\}, \ \{\{ \{\{ - \{\}^j\}\}$.

7 Miners Paradox

1. $\neg(BlockA \vee BlockB)$

2. $InA \rightarrow BlockA$

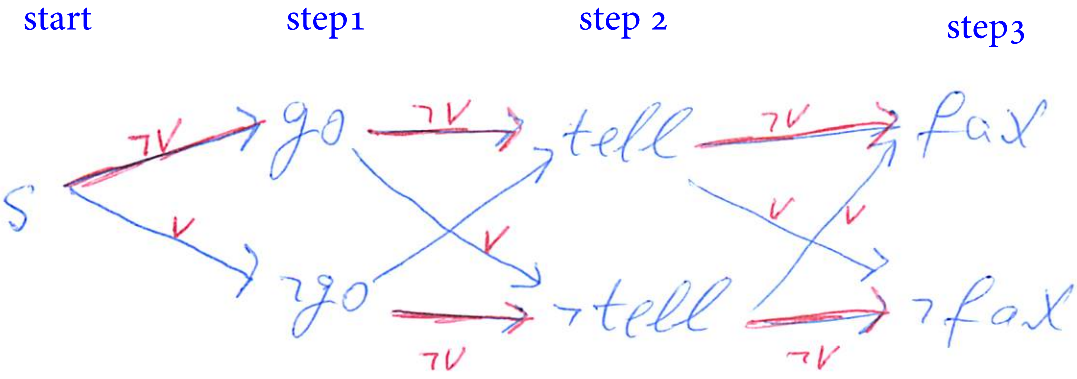
3. $InB \rightarrow BlockB$

4. $InA \vee InB$

$\vdash BlockA \vee BlockB$

Solution. Take

(1), {{(2),(3)}}, (4.)



1. O go

2. go → O tell

3. ¬go → O ¬tell

4. tell → O fax

5. ¬tell → O ¬fax

6. fax

(¬V & V), { {V → ¬go , ¬V → go, { {tell → fax, tell → ¬fax}, {¬tell → fax, ¬tell → ¬f(x)}, go → tell, go → ¬tell } }

{ ¬go → tell, ¬go → ¬tell, {¬tell → fax, ¬tell → ¬fax}, {tell → fax, tell → ¬fax} } }

Conclusion.

1. linear logic generalises any logic because any proof can be made linear by adding more copies as needed.

2. Take SDL, add additives $\oplus$ $\&$ and add clip-linearity and use obvious axioms.

3. Adjust as needed.

We advance in the violations using clip linearity which consumes the assumptions of the previous step and prepares for the next step

Thank you.