Count-as Conditionals in Channel Theory

Tomoyuki Yamada
Faculty of Humanities and Human Sciences, Hokkaido University
SOCREAL 2019
November 15-17, 2019, Hokkaido University, Japan

Formal approaches to count-as conditionals

Several attempts to capture the logic of count-as conditionals have been made in the deontic logic literature recently. Grossi and Jones (2013) gives a succinct overview of the following works:

1. Jones et al. (1996),
2. Gelati et al. (2002, 2004),
4. Lorini et al. (2008, 2009),
5. Governatori et al. (2008),
7. Lindahl et al. (2006, 2008a, b).

Some Earlier Works

Earlier works on the kind of regularity in question include:


A problem

Count-as conditionals are introduced by John Searle (1969) as “constitutive rules” of the following form.

\[ X \text{ counts as } Y \text{ in context } C. \]

I’m wondering whether the recent discussions pay enough attention to the distinction between concrete particular contexts in which entities or processes of type X count as Y and the common type C shared by such contexts.

The purpose of this paper is to show how this problem can be avoided by modeling contexts and actions done in them in channel theory of Barwise and Seligman (1997).

Why this is a problem?

In Grossi and Jones (2013, p.416), Jones and Sergot (1996) are said to represent count-as conditional as \( \phi_1 \rightarrow \exists c \phi_2 \).

They proposed the following principle as one of the “minimal core of the logical principles for the logic of count-as” (Grossi et al. 2013, pp. 416-417. Cf. Jones and Sergot, 1996, pp. 436).

\[ ((\phi_1 \rightarrow \exists c \phi_2) \land (\phi_2 \rightarrow \exists c \phi_3)) \rightarrow (\phi_1 \rightarrow \exists c \phi_3) \]

As Jones and Sergot (1996, p. 430) understand \( c \) as an institution, it is natural to think of \( c \) as fixed.

If \( c \) is understood just as an arbitrary context, however, we have to admit the possibility of a context being part of two or more institutions.

Iteration

Consider the following quotation from Searle (1995).

Making certain noises counts as uttering an English sentence, uttering a certain sort of English sentence in certain circumstance counts as entering into a contract, entering into certain sorts of contracts counts as getting married (Searle, 1995, p. 83).

Consider a particular context \( c_1 \) in which a person a gets married.
Count-as Conditionals

Here we can assume that $c_1$ is:
the context in which $a$’s entering into a certain sort of contract counts as getting married.

But if so, it can also be
the context in which $a$’s uttering a certain sort of English sentence counts as entering into a certain sort of contract

and similarly,

the context in which $a$’s making certain noises counts as uttering an English sentence.

Context Types

Compare that with the following:

Performing such and such speech acts (the X term) in front of a presiding official (the C term) now counts as getting married (the Y term). Saying those very same words in a different context, while making love, for example, will not constitute getting married (Searle 1995, p. 82).

Here the C term seems to refer to a repeatable condition “in front of a presiding official”.

Two hierarchical structures

Now let us compare the following two hierarchical structures.

$$c_1 \subseteq \Sigma_2 \subseteq \Sigma_3 \subseteq \Sigma_1$$

$X_3$ counts-as $Y_3$ in $C_0$

$X_2$ counts-as $Y_2$ in $C_2$

$X_1$ counts-as $Y_1$ in $C_1$

Suppose $\Sigma_1 = \{x : x$ is of type $C_1\}$, etc. Then we have $c_1$ is of type $C_1$, of type $C_2$, and of type $C_3$.

But we can also say:

$C_1$, $C_2$, and $C_3$ are distinct from each other.

Conditions on contexts

Channel theory enables us to talk not only about particular contexts such as $c_1$, but also about types of contexts such as $C_1$, $C_2$, and $C_3$.

If we are to be able to say under what conditions $X$ counts as $Y$, we need to be able to say, at least partly, what these types are.

This is one of the things we need to do in order to develop a logical analysis of social institutions in general and speech acts in particular.

Context Tokens

Let $\Sigma_1$ be the set of all the contexts in which making of certain noises counts as uttering a particular English sentence $S$.

Let $\Sigma_2$ be the set of all the contexts in which uttering of that particular English sentence $S$ counts as entering into a certain sort of contract.

Let $\Sigma_3$ be the set of all the contexts in which entering into that sort of contract counts as getting married.

Now we can say:

$$c_1 \in \Sigma_2 \subseteq \Sigma_3 \subseteq \Sigma_1$$

A hierarchical structure

“We can impose status-functions on entities that have already had status-functions imposed on them. In such cases the X term at a higher level can be a Y term from an earlier level” (Searle 1995, p. 80).

Channel theory enables us to talk not only about particular contexts such as $c_1$, but also about types of contexts such as $C_1$, $C_2$, and $C_3$.

A failed illocutionary act

A private: Clean this room.

A sergeant: You don’t have the authority to give me a command.

Normally, privates would not say things like this to a sergeant. By contrast, the following looks normal.

A sergeant: Clean this room.

A private: Yes, sir.
Judith's flashlight (Barwise and Seligman, 1997, p. 23)

In doing things in everyday life, we rely on various regularities that hold normally.
For example, by turning the switch of her flashlight on, Judith lights its bulb.
(1) The switch being on entails that the bulb is lit.
What will happen, however, if the battery is dead?

Weakening? (Barwise & Seligman, p. 23)
By applying the inference rule called weakening, we could derive the following:
(2) The switch being on and the battery being dead entails that the bulb is lit.
Since this conclusion is unacceptable, we might wish to revise (1) and say:
(3) The switch being on and the battery being live entails that the bulb is lit.
What will happen, however, if the bulb is gone?

Classification (Barwise & Seligman, p. 69)
Definition. A classification \( A = (\text{tok}(A), \text{typ}(A), \vdash_A) \) consists of
1. a set \( \text{tok}(A) \) of objects to be classified, called the tokens of \( A \),
2. a set \( \text{typ}(A) \) of objects used to classify the tokens, called the types of \( A \), and
3. a binary relation, \( \vdash_A \), between tokens of \( A \) and types of \( A \).
If \( a \vdash_A \alpha \), then \( a \) is said to be of type \( \alpha \) in \( A \).
A classification is depicted by means of a diagram as follows.

\[
\begin{align*}
\text{typ}(A) & \quad \vdash_A \\
\text{tok}(A) & \quad \vdash \\
\end{align*}
\]

Sequents, constraints, the complete theory (Barwise & Seligman, p. 29)
By a sequent we just mean a pair \((\Gamma, \Delta)\) of sets of types.
Definition. Let \( A \) be a classification and let \((\Gamma, \Delta)\) be a sequent of \( A \).
- A token \( a \) of \( A \) satisfies \((\Gamma, \Delta)\) provided that \( a \) is of type \( \alpha \) for every \( \alpha \in \Gamma \) and is of type \( \beta \) for some \( \beta \in \Delta \).
- We say that \( \Gamma \) entails \( \Delta \) in \( A \), written \( \Gamma \vdash_A \Delta \), if every token \( a \) of \( A \) satisfies \((\Gamma, \Delta)\).
- If \( \Gamma \vdash_A \Delta \) then the pair \((\Gamma, \Delta)\) is called a constraint supported by the classification \( A \).

Infomorphisms (Barwise & Seligman, p. 32)
Definition. If \( A = (\text{tok}(A), \text{typ}(A), \vdash_A) \) and \( B = (\text{tok}(B), \text{typ}(B), \vdash_B) \) are classifications, then an infomorphism is a pair \( f = (f^\text{r}, f^\text{t}) \) of functions

\[
\begin{align*}
\text{typ}(A) & \quad f^\text{r} \quad \text{typ}(B) \\
\text{tok}(A) & \quad f^\text{t} \quad \text{tok}(B) \\
\end{align*}
\]

Information Channels(Barwise & Seligman, pp. 34–35)
We say that \( f = (f^\text{r}, f^\text{t}) \) is a contravariant pair from \( A \) to \( B \), and write \( f : A \Rightarrow B \), if \( f^\text{r} : \text{typ}(A) \rightarrow \text{typ}(B) \) and \( f^\text{t} : \text{tok}(B) \rightarrow \text{tok}(A) \).
We think of an infomorphism \( f = (f^\text{r}, f^\text{t}) \) as an infomorphism from \( A \) to \( B \) if it is a contravariant pair form \( A \) to \( B \).

Definition. An information channel consists of an indexed family \( C = \{ \cdot : A \Rightarrow C \} \) of infomorphisms with a common codomain \( C \) called the core of the channel.
An example.

\[
\{f_{\text{Switch}}(\text{ON})\} \supset \text{Flashlight}\left( f_{\text{Bulb}}(\text{LIT}) \right)
\]

Flashlight

\[
\text{Bulb} \quad f_{\text{Bulb}}(\text{LIT}) \quad \text{Switch} \quad f_{\text{Switch}}(\text{OFF})
\]

\[f_{\text{Bulb}}(\text{LIT}) \supset \text{Switch} \quad f_{\text{Switch}}(\text{OFF}) \]

A refinement (Barwise & Seligman, pp. 43–44)

Even if \( \{f_{\text{ON}}(\text{ON})\} \supset \{f_{\text{LIT}}(\text{LIT})\} \) holds, \( \{f_{\text{ON}}(\text{ON})\} \supset \{f_{\text{LIT}}(\text{LIT})\} \) might not hold.

\[
\begin{array}{cccc}
F & r & F' & F'' \\
| & | & | & | \\
A & B & B & B \\
S & S & S & S \\
\end{array}
\]

Local logic (Barwise & Seligman, p. 40)

**Definition.** A local logic \( \mathfrak{L} = (A, \vdash, N_c) \) consists of:
- a classification \( A \),
- a set \( \vdash \) of sequents (satisfying certain structural rules) involving the types of \( A \), called the constraints of \( \mathfrak{L} \), and
- a subset \( N_c \) of the set of all the tokens of \( A \), called the normal tokens of \( \mathfrak{L} \), which satisfy all the constraints of \( \vdash \).

A local logic \( \mathfrak{L} \) is sound if every token is normal; it is complete if every sequent that holds of all normal tokens is in the consequence relation \( \vdash \).

The Outline of a Dynamic Theory of Action (Barwise & Seligman, pp. 50-65)

Acts of using flashlights in channel theory

Flashlight using actions are modeled as connections that connects initial states and final states of such actions by constructing an information channel \( \mathcal{C}_{\text{Act}} = \{f_{\text{init}}, C_{\text{Act}} = C_{\text{Act}}, f_{\text{fin}}, C_{\text{Act}} = C_{\text{Act}}\} \) such that \( C_{\text{Act}} \) classifies flashlight using action tokens, and \( f_{\text{init}} \) and \( f_{\text{fin}} \) classify their initial states and final states respectively. Thus two copies of the earlier classification Flashlight can be used as \( f_{\text{init}} \) and \( f_{\text{fin}} \).

Then, the local logic on \( C_{\text{Act}} \) can be defined.

Non-normal action tokens in the flashlight example

Even if \( \{f_{\text{ON}}(\text{OFF}), \text{PSO}\}, \{f_{\text{LIT}}(\text{LIT})\} \) holds, \( \{f_{\text{ON}}(\text{OFF}), \text{PSO}\}, \{f_{\text{LIT}}(\text{LIT})\} \) might not hold.

\[
\begin{array}{cccc}
F & F' & F'' & F''' \\
| & | & | & | \\
B & B & B & B \\
\end{array}
\]
The Language of Acts of commanding in channel theory (Barwise & Seligman 1997)

Logical dynamics of speech acts

Acts of commanding in channel theory

The problem

Actions in channel theory (Barwise & Seligman 1997)

Logical dynamics of speech acts

Acts of commanding in channel theory

Count-as Conditionals

The development of PAL

Public Announcement Logic PAL

adding dynamic modalities

rewriting along recursion axioms

Multi-agent Epistemic Logics EL

K_3


The development of DMEDL^+

Yamada (2016)

[command]_{i,j}^v\psi, [promise]_{i,j}^v\psi, [request]_{i,j}^v\phi, [assert]_{i,j}^v\phi

DMEDL^+ (Dynamified DMEDL)

adding dynamic modalities

rewriting along recursion axioms

MEDL (Multi-agent Epistemic Deontic Logic)

K_3, O_{[i,j,k]}^2

Dynamified Logics of acts of commanding and promising

(Yamada, 2007a, b, 2008a, b)

[command]_{i,j}^v\psi, [promise]_{i,j}^v\psi

DMDL III (Dynamified Multi-agent Deontic Logic)

adding dynamic modalities

rewriting along recursion axioms

MDL III (Multi-agent Deontic Logic)

O_{[i,j,k]}^2

The problem

Actions in channel theory (Barwise & Seligman 1997)

Logical dynamics of speech acts

Acts of commanding in channel theory

The Language of MDL^+ III and DMDL^+ III

O_{[i,j,k]}^2 It is obligatory for i with respect to j by the name of k to see to it that \phi.

i The agent who owes the obligation (obligor)

j The agent to whom the obligation is owed (obligee)

k The agent who creates the obligation

[command]_{i,j}^v\psi Whenever an agent i commands an agent j to see to it that \phi, \psi holds in the resulting situation.

[promise]_{i,j}^v\psi Whenever an agent i promises an agent j that i will see to it that \phi, \psi holds in the resulting situation.

The problem

Actions in channel theory (Barwise & Seligman 1997)

Logical dynamics of speech acts

Acts of commanding in channel theory

More formally

Take a countably infinite set A_{prop} of proposition letters and a finite set I of agents, with p ranging over A_{prop} and i, j, k over I. The languages of MDL^+ III and DMDL^+ III are given respectively by:

\phi ::= T \mid p \mid \neg \phi \mid (\phi \land \psi) \mid [\psi[DMDL^+ III] \mid [\psi[DMDL^+ III]

\pi ::= Com_{[i,j]}^2 \mid Prom_{[i,j]}^2

The problem

Actions in channel theory (Barwise & Seligman 1997)

Logical dynamics of speech acts

Acts of commanding in channel theory

An L_{MDL^+ III}-model

By an L_{MDL^+ III}-model, we mean a quadruple \mathcal{M} = \langle W^\mathcal{M}, A^\mathcal{M}, \{D_{ijk}^\mathcal{M}\} \mid i, j, k \in I \rangle, V^\mathcal{M} \rangle where:

- W^\mathcal{M} is a non-empty set (heuristically, of 'possible worlds'),
- A^\mathcal{M} \subseteq W^\mathcal{M} \times W^\mathcal{M},
- \{D_{ijk}^\mathcal{M}\} \mid i, j, k \in I \subseteq A^\mathcal{M},
- V^\mathcal{M} is a function that assigns a subset V^\mathcal{M}(\phi) of W^\mathcal{M} to each proposition letter \phi \in A_{prop}. 

The problem

Actions in channel theory (Barwise & Seligman 1997)

Logical dynamics of speech acts

Acts of commanding in channel theory

Updating models

An acts of commanding

\mathcal{M}, w \models_{MDL^+ III} [Com_{[i,j]}^2] \phi iff \mathcal{M}_{Com_{[i,j]}^2} \models w \models_{MDL^+ III} \phi ,

where \mathcal{M}_{Com_{[i,j]}^2} is the L_{MDL^+ III}-model obtained from \mathcal{M} by replacing D_{ij} with \langle (x, y) \in D_{ij} \mid | M, y \models_{MDL^+ III} \psi \rangle .

An acts of promising

\mathcal{M}, w \models_{MDL^+ III} [Prom_{[i,j]}^2] \phi iff \mathcal{M}_{Prom_{[i,j]}^2} \models w \models_{MDL^+ III} \phi ,

where \mathcal{M}_{Prom_{[i,j]}^2} is the L_{MDL^+ III}-model obtained from \mathcal{M} by replacing D_{ij} with \langle (x, y) \in D_{ij} \mid | M, y \models_{MDL^+ III} \psi \rangle .
Your boss’s act of commanding

Given the command fragment of the language $\mathcal{C}_{\text{MDL}^+}$ of DMDL$^{+}$ III, an arbitrary model $M$ of the static base logic $\text{MDL}^+\text{III}$, and the truth-in relation $\models_{\text{MDL}^+\text{III}}$, the classification $D_M^+ = (\text{tok}(D_M^+), \text{typ}(D_M^+), |D_M^+|)$ is defined as follows:

\[
\begin{align*}
\text{typ}(D_M^+) & \\ |D_M^+| & \\ \text{tok}(D_M^+) & 
\end{align*}
\]

A command and a promise can lead to a dilemma

If $\varphi$ is a formula of $\text{MDL}^+\text{III}$ and is free of modal operators of the form $\bigl[\text{Prom}_{(a,b)}\bigl]_0\varphi$, the following formula is valid:

\[
\text{Com}_{(a,b)}[\varphi]_0 \bigl[\text{Prom}_{(a,b)}\bigl]_0 \varphi
\]

Acts of commanding in channel theory

In order to address issues raised at the beginning of this talk, we construct an information channel from the language and the models of DMDL$^{+}$ III.

The CUGO Principle

If $\varphi$ is a formula of $\text{MDL}^+\text{III}$ and is free of modal operators of the form $\bigl[\text{Prom}_{(a,b)}\bigl]_0\varphi$, the following formula is valid:

\[
\text{Com}_{(a,b)}[\varphi]_0 \bigl[\text{Prom}_{(a,b)}\bigl]_0 \varphi
\]

How to do that

- For the sake of simplicity, we ignore acts of promising and alethic modality. Thus, we will work with a fragment of $\mathcal{C}_{\text{MDL}^+\text{III}}$ which lacks the promise modalities and the alethic modality. Call it the command fragment of $\mathcal{C}_{\text{MDL}^+\text{III}}$.
- We will work not with the whole class of $\mathcal{C}_{\text{MDL}^+\text{III}}$-models but with a set of $\mathcal{C}_{\text{MDL}^+\text{III}}$-models obtained by updating an arbitrary chosen one.
**Command channel**

Then an information channel

\[ D^M = (A_M; D^M_U = D^M_L; \text{fin}_D; D^M_{\langle s \rangle}) \]

with a core \( D^M_U \) can be defined as follows:

- Action tokens of \( D^M_U \) can be modeled as connections of the form \((a, b)_i\) such that \(a\) is a token of \( D^M_U\), \(b\) is a token of \( D^M_L\), and for some sequence \( r \) of action types and an action type \( \text{com}_{\text{MDL}}\), \(a_1 = (\langle a_0, a_1 \rangle, w)\) and \(a_2 = (\langle M_1, w_{a_0}, w_{a_1} \rangle, w)\). This gives us the set \( \text{fin}(D^M_U) \) of the tokens of \( D^M_U\).

We will omit the superscript "\(\text{fin}\)" hereafter.

**Local logic on \( L_{\text{Act}} \)**

Now we can define a local logic \( L_{\text{Act}} = (D_{\text{Act}}; \text{act}_L; N_{\text{act}_L}) \) on \( D_{\text{Act}} \).

- The problem of how we could characterize the class of formulas \( \varphi \) such that \( \varphi \in \text{MDL}^{III} \) and \( \varphi \) is non-deontic if \( \varphi \in \text{MDL}^{III} \) and no deontic modality occurs in \( \varphi \).

If we wish to have a sound local logic, we have to accept

\[ \varphi \vdash_c \text{act} \{ f_{\text{act}}(\text{Com}_{\langle j \rangle}\varphi) \text{act}_L \} \]

\[ \varphi \vdash_c \text{act} \{ f_{\text{act}}(\text{Com}_{\langle j \rangle}\varphi) \text{act}_L \} \]

The problem of how we could characterize the class of formulas \( \varphi \) such that \( \varphi \) is non-deontic if \( \varphi \in \text{MDL}^{III} \) and no deontic modality occurs in \( \varphi \).

If we model a community where people only issue commands with non-deontic contents, CUGO-principle will be valid.

If we model such a community by \( D' \), we will have

\[ \varphi \vdash_c \text{act} \{ f_{\text{act}}(\text{Com}_{\langle j \rangle}\varphi) \text{act}_L \} \]

\[ \varphi \vdash_c \text{act} \{ f_{\text{act}}(\text{Com}_{\langle j \rangle}\varphi) \text{act}_L \} \]
Count-as Conditionals

If we only include constraints derived from valid formulas of DMDL−III, both \( D_{DA} \) and \( D_{DA}^\prime \) will be sound.

\[
\begin{align*}
D_{DA} & \\
D_{DA}^\prime & \\
D_{EA} & \\
D_{EA}^\prime & \\
D_{EN} & \\
D_{EN}^\prime & \\
\end{align*}
\]

How then is \( D_{DA}^\prime \) different from \( D_{DA} \)?

Condition of authority

In the flashlight example, the background condition that the battery is live is the condition that must be satisfied in order for an act of switching the switch to be a way of turning the flashlight on.

Similarly, the condition that the agent has the suitable authority to issue such a command is the condition that must be satisfied in order for her act of saying so and so to counts as an act of commanding.

Acts of saying

The language of DMDL−III has to be substantially extended in other respects as well, if we are to capture the kind of regularities included in normal situations. We have to be able to talk about acts of saying so and so (illocutionary acts).

Let CTR be the type of acts of saying “Clean this room” while pointing to a particular room \( r \), and \( p \) be the proposition that \( r \) is clean.

Then, roughly speaking, the relevant regularity will be of the form \( (\text{Say}(ijkl,CTR), \text{Com}(ijkl,p)) \).

This is a channel theoretic analogue of count-as conditional.

An enriched classification

An act of type \( \text{Say}(ijkl,CTR) \) counts-as an act of type \( \text{Com}(ijkl,p) \) in a context of type \( \text{Auth}(ijkl,p) \).

Context types

\[
\begin{align*}
(\text{Say}(ijkl,CTR)) & \vdash \text{Com}(ijkl,p) \\
(\text{Com}(ijkl,p)) & \vdash (\text{Auth}(ijkl,p), \text{Say}(ijkl,CTR)) \\
(\text{Auth}(ijkl,p), \text{Say}(ijkl,CTR)) & \vdash (\text{Com}(ijkl,p), \text{Auth}(ijkl,p)) \\
\end{align*}
\]
Count-as conditionals and CUGO Principle

A sergeant a said “Clean this room”, addressing a private b and pointing to the room r.

\[ \text{[count-as]} \{ \text{Say}(a, b, \text{CTR}) \} \vdash \text{Com}(a, b, p) \]

a commanded b to see to it that r is clean.

\[ \text{[CUGO]} \{ \text{Com}(a, b, p) \} \vdash \text{CUGO}(\text{C}(b, a, b, p)) \]

b is obligated to see to it that r is clean with respect to a by the name of a.

Count-as conditions and the Dynamic Logic of Y-ing

\( (X) \vdash_C Y, (f_{\text{fin}}(Y)) \vdash (f_{\text{fin}}(C)) \)

What about the hierarchy?

\( (X_2) \vdash_{C_2} (Y_2), (f_{\text{fin}}(Y)) \vdash_{C_2} (f_{\text{fin}}(C)) \)

\( (X_1) \vdash_{C_1} (Y_1), (f_{\text{fin}}(Y)) \vdash_{C_1} (f_{\text{fin}}(C_1)) \)

\( (X_1) \vdash_{C_1} (Y_1), (X_1) \vdash_{C_2} (Y_2) \)

Acknowledgement

- This work is supported by the JSPS grant (KAKENHI) 17H02258.
- Earlier versions of this talk were presented in AWPL 2018, held in Tsinghua University, Beijing in October, 2018, and in CLMPST 2019, held in Czech Technical University in Prague in August, 2019. I am grateful to the participants of these meetings for their helpful comments and discussions.

The End

Thanks!!