Enthymemes as Rhetorical Resources

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Consider the interpretation of *rise* in (1):

(1)   Cherrilyn: Yeah I mean ⟨pause⟩ dog hairs rise
                       anyway so

Consider the interpretation of *rise* in (2):

(2) Cherrilyn: Yeah I mean ⟨pause⟩ dog hairs rise
       anyway so
     Fiona: What do you mean, rise?

Consider the interpretation of *rise* in (3):

(3)   Cherrilyn: Yeah I mean ⟨pause⟩ dog hairs rise anyway so

              Fiona: What do you mean, rise?

              Cherrilyn: The hair ⟨pause⟩ it rises upstairs.

BNC file KBL, sentences 4201–4203

(4) Cherrilyn: Most dogs aren't allowed up ⟨pause⟩ upstairs.
                 He's allowed to go wherever he wants ⟨pause⟩ do whatever he likes.
     Fiona :   Too right!
                 So they should!
                 Shouldn't they?
     Cherrilyn: Yeah I mean ⟨pause⟩ dog hairs rise anyway so
     Fiona: What do you mean, rise?
     Cherrilyn: The hair ⟨pause⟩ it rises upstairs.
                 I mean I, you know friends said it was, oh God I wouldn't allow mine upstairs because of all the ⟨pause⟩ dog hairs!
                 Oh well ⟨pause⟩ they go up there anyway.
     Fiona: So, but I don't know what it is, right, it's only a few bloody hairs!

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- We suggest a theory of *enthymemes*, inspired by Aristotle's *Rhetoric* and previously discussed in [Breitholtz and Villing, 2008], [Breitholtz, 2010].
- We argue that, in a gameboard or information state update approach to dialogue [Ginzburg, 1994, Cooper et al., 2000, Larsson, 2002, Ginzburg, fthc], rhetorical arguments point to a notion of *Enthymemes under Discussion* (EUD), similar to Questions under Discussion (QUD).

Dialogue and Argumentative Structure

- Enthymemes have been little studied in linguistics, but are frequently relevant for the type of data studied by linguists. (For some examples of this, and a general discussion of enthymemes in dialogue, see [Jackson and Jacobs, 1980],[Breitholtz and Villing, 2008].)

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  - deductive argument
  - has the form of a syllogism
  - is not logical since it is often based on what is accepted or likely rather than what is logically valid
  - not all premises that are needed to form a logical argument are expressed.

Dialogue and Argumentative Structure

- A theory of enthymemes focuses interplay between
  - Argumentative structure
  - *Rhetorical resources* that an agent utilises when engaged in dialogue.
- Such an argumentative structure can be relevant over many turns in a dialogue and may be available in the background during the course of a whole dialogue.
- In this respect our proposal differs from theories of rhetorical relations as presented for example in SDRT [Asher and Lascarides, 2003]

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                    (*Rhetoric*, II.23.4)

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▶ The argument patterns that enthymemes are derived from are usually referred to as *topoi* (sg. *topos*). For example, in (8)

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   a. A person who has beaten his father, has also beaten his neighbour

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▶ the topos is that of "the more and the less", which is basically a notion about scalarity, that in this case would correspond to a slightly more specific argument
   ▶ If something is the case in a situation when it should be less expected, then it is probably the case in a situation where it should be more expected.

Distinction Enthymeme/Topos

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- We refer to the more specified rules of inference as enthymemes and the more general ones as topoi.
- Since enthymemes and topoi can be modelled by the same semantic objects, we will not attempt to make any precise distinction between the two

Modelling Enthymemes Using TTR

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(11) $\lambda r{:}T_1(T_2[r])$

- T_1 and $T_2[r]$ (given some value for r) are record types.
- Observing a situation, represented as a record r of type T_1, we can draw the conclusion that there is a situation of type $T_2[r]$.
- The function just returns the type but does not tell us what situation is of this type.
- The type T_1 thus corresponds to the premises of the enthymeme/topos and $T_2[r]$ to the conclusion.

Modelling Enthymemes Using TTR

(12) is a simple example of an enthymeme from [Aristotle, 2007].

(12)

   a. [he] is sick, for he has a fever

$$\lambda r : \begin{bmatrix} \text{x:} Ind \\ \text{c}_{\text{has\_fever}} : \text{has\_fever(x)} \end{bmatrix}$$
(*Rhetoric*, I.2.18)

$$\left(\begin{bmatrix} \text{c}_{\text{sick}} : \text{sick}(r.\text{x}) \end{bmatrix} \right)$$

This is an example of an "irrefutable sign" (anybody who has a fever is indeed sick

- However, enthymemes can also be "refutable" which we might regard as corresponding to a defeasible inference.

(13)

    a. it is a sign of fever that somebody breathes rapidly

$$(\textit{Rhetoric}, \text{I.2.18})$$

    b. $\lambda r : \begin{bmatrix} \text{x}:\textit{Ind} \\ \text{c}_{\text{breathe\_rapidly}}:\text{breathe\_rapidly}(\text{x}) \end{bmatrix}$

$$\left(\begin{bmatrix} \text{c}_{\text{has\_fever}}:\text{has\_fever}(r.\text{x}) \end{bmatrix} \right)$$

Modelling Enthymemes Using TTR

- Modelling enthymemes using record types gives us straightforward ways to manipulate them, to create new enthymemes
- For example, we may wish to specify (13b) so that it applies to only one individual Socrates. This we can do by employing TTR's manifest fields as in (14).
- $\lambda r : \begin{bmatrix} \text{x=socrates:} Ind \\ \text{c}_{\text{breathe\_rapidly}} \text{:breathe\_rapidly(x)} \end{bmatrix}$
  $\quad\quad\quad (\begin{bmatrix} \text{c}_{\text{has\_fever}} \text{:has\_fever}(r.\text{x}) \end{bmatrix})$

More examples to follow!

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- $\lambda r : \begin{bmatrix} \text{x:}Ind \\ \text{c}_{\text{mortal}}\text{:mortal(x)} \end{bmatrix}$
  (! do_not_cherish_immortal_anger(r.x))

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- These resources are dynamic, and might be affected by speech events during the course of a dialogue
  - language acquisition
  - adaption to new dialogue situations
- We propose to add **rhetorical resources** in the form of collections of enthymemes (and topoi)

Operations on Enthymemes

- If enthymemes are to be included as rhetorical resources, then it becomes important for us to be able to relate enthymemes to each other and have well-defined operations for creating new enthymemes on the basis of old.

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- "If a dog with hairs is at a particular location at a certain time, then there will be a subsequent time at which hairs from that dog will be at that location."

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- $\lambda r:$
$$\begin{bmatrix} \text{x:}Ind \\ c_{\text{dog}}:\text{dog(x)} \\ \text{y:}\{Ind\} \\ c_{\text{hairs}}:\text{hairs(y)} \\ c_{\text{of}}:\text{of(y,x)} \\ \text{e-loc:}Loc \\ \text{e-time:}Time \\ c_{\text{be}}:\text{be(x,e-loc,e-time)} \end{bmatrix}$$
$$\left(\begin{bmatrix} \text{z:}\{Ind\} \\ c_{\text{hairs}_1}:\text{hairs(z)} \\ c_{\text{of}_1}:\text{of(z,}r.\text{x)} \\ \text{e-time}_1:Time \\ c_{<}:r.\text{t}{<}\text{t} \\ c_{\text{be}_1}:\text{be(z,}r.\text{e-loc,e-time)} \end{bmatrix} \right)$$

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- Thus we may generalize this enthymeme to concern all dogs (not just dogs with hair) by removing the 'y'-field, and all the fields that depend on the 'y'-field from the domain type.

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- λr: $\begin{bmatrix} \text{x}:Ind \\ c_{\text{dog}}:\text{dog(x)} \\ \text{e-loc}:Loc \\ \text{e-time}:Time \\ c_{\text{be}}:\text{be(x,e-loc,e-time)} \end{bmatrix}$

$\left(\begin{bmatrix} \text{z}:\{Ind\} \\ c_{\text{hairs}_1}:\text{hairs(z)} \\ c_{\text{of}_1}:\text{of(z},r.\text{x)} \\ \text{e-time}_1:Time \\ c_<:r.\text{t}<\text{t} \\ c_{\text{be}_1}:\text{be(z},r.\text{e-loc,e-time)} \end{bmatrix} \right)$

This says that if a dog is at a certain place at a certain time there will be dog hairs at that place at a later time.

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- λr:
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(18)
$$
\begin{bmatrix}
\text{x}: Ind \\
c_{\text{dog}}: \text{dog(x)} \\
\text{e-loc}: Loc \\
c_{\text{upstairs}}: \text{upstairs(e-loc)} \\
\text{e-time}: Time \\
c_{\text{be}}: \text{be(x,e-loc,e-time)} \\
\text{z}: \{Ind\} \\
c_{\text{hairs}_1}: \text{hairs(z)} \\
c_{\text{of}_1}: \text{of(z,x)} \\
\text{e-time}_1: Time
\end{bmatrix}
$$

- We want to compose our fixed point type with the enthymeme "dog hairs upstairs is an undesirable situation".

- λr: $\begin{bmatrix} \text{x:}Ind \\ c_{\text{dog}}\text{:dog(x)} \\ \text{e-loc:}Loc \\ c_{\text{upstairs}}\text{:upstairs(e-loc)} \\ \text{z:}\{Ind\} \\ c_{\text{hairs}_1}\text{:hairs(z)} \\ c_{\text{of}_1}\text{:of(z,x)} \\ \text{e-time}_1\text{:}Time \\ c_{\text{be}_1}\text{:be(z,e-loc,e-time}_1) \end{bmatrix}$

  $\left(\begin{bmatrix} c_{\text{undesirable}}\text{:undesirable}(r) \end{bmatrix} \right)$

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- Composing these is possible since our fixed point type $(\mathcal{F}(\varepsilon_1))$ is a subtype of the domain type of "dog hairs upstairs is an undesirable situation"

- $\lambda r : \mathcal{F}(\varepsilon_1)(\big[c_{\text{undesirable}}:\text{undesirable}(r)\big])$
  From this, by generalization, we can obtain a useful enthymeme: "Dogs upstairs is an undesirable situation"

- $\lambda r: \begin{bmatrix} \text{x}:Ind \\ c_{\text{dog}}:\text{dog(x)} \\ \text{e-loc}:Loc \\ c_{\text{upstairs}}:\text{upstairs(e-loc)} \\ \text{e-time}:Time \\ c_{\text{be}}:\text{be(x,e-loc,e-time)} \end{bmatrix}$
  $(\big[c_{\text{undesirable}}:\text{undesirable}(r)\big])$

The "Dog Hairs" Dialogue

(19) Cherrilyn: **Most dogs aren't allowed up ⟨pause⟩ upstairs.**
He's allowed to go wherever he wants ⟨pause⟩ do whatever he likes.

Fiona : Too right!
So they should!
Shouldn't they?

Cherrilyn: Yeah I mean ⟨pause⟩ dog hairs rise anyway so

Fiona: What do you mean, rise?

Cherrilyn: The hair ⟨pause⟩ it rises upstairs.
I mean I, you know friends said it was, oh God I wouldn't allow mine upstairs because of all the ⟨pause⟩ dog hairs!
Oh well ⟨pause⟩ they go up there anyway.

Fiona: So, but I don't know what it is, right.

The "Dog Hairs" Dialogue

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(20)   Cherrilyn: Most dogs aren't allowed up ⟨pause⟩ upstairs.
                    He's allowed to go wherever he wants ⟨pause⟩ do whatever he likes.

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       Fiona: What do you mean, rise?

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                    I mean I, you know friends said it was, oh God I wouldn't allow mine upstairs because of all the ⟨pause⟩ dog hairs!
                    Oh well ⟨pause⟩ they go up there anyway.

       Fiona: So, but I don't know what it is, right, it's only a few bloody hairs!

The "Dog Hairs" Dialogue

- ▶ She then continues by saying that *her* dog is allowed to go wherever he wants, thus challenging the notion that dogs upstairs are undesirable .

- ▶ However, she still seems to accept the enthymeme in (21) "dog hairs upstairs are undesirable"

$$
(21) \quad \lambda r: \begin{bmatrix} \text{x:}Ind \\ c_{\text{dog}}\text{:dog(x)} \\ \text{e-loc:}Loc \\ c_{\text{upstairs}}\text{:upstairs(e-loc)} \\ \text{z:}\{Ind\} \\ c_{\text{hairs}_1}\text{:hairs(z)} \\ c_{\text{of}_1}\text{:of(z,x)} \\ \text{e-time}_1\text{:}Time \\ c_{\text{be}_1}\text{:be(z,e-loc,e-time}_1) \end{bmatrix}
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       Cherrilyn: **Yeah I mean ⟨pause⟩ dog hairs rise anyway so**

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                  I mean I, you know friends said it was, oh God I wouldn't allow mine upstairs because of all the ⟨pause⟩ dog hairs!
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       Fiona: So, but I don't know what it is, right, it's only a few bloody hairs!

The "Dog Hairs" Dialogue

- ▶ Cherrilyn is drawing on the enthymeme "if there are dog hairs downstairs at some point in time there will be dog hairs upstairs at a later point in time "

- ▶ λr:
$$\begin{bmatrix} \text{x:} Ind \\ c_{\text{dog}}:\text{dog(x)} \\ \text{y:} \{Ind\} \\ c_{\text{hairs}_1}:\text{hairs(y)} \\ c_{\text{of}_1}:\text{of(y,x)} \\ \text{e-loc:} Loc \\ c_{\text{downstairs}}:\text{downstairs(e-loc)} \\ \text{e-time:} Time \\ c_{\text{be}}:\text{be(y,e-loc,e-time)} \end{bmatrix}$$

$$\left(\begin{bmatrix} \text{z:} \{Ind\} \\ c_{\text{hairs}_1}:\text{hairs(z)} \\ c_{\text{of}_1}:\text{of(z,} r.\text{x)} \\ \text{e-loc}_1:Loc \\ c_{\text{upstairs}}:\text{upstairs(e-loc)} \\ \text{e-time}_1:Time \end{bmatrix} \right)$$

The "Dog Hairs" Dialogue

- There seems to be a connection between what is desirable or undesirable and what is allowed and not allowed
- In order to connect desirable/undesirable to allowed/allowed, we need action enthymemes

(23)

    a. $\lambda r : \begin{bmatrix} \text{s} & :Rec \\ \text{c}_{\text{desirable}} : \text{desirable(s)} \end{bmatrix}$
        (!allow(r.s))

    b. $\lambda r : \begin{bmatrix} \text{s} & :Rec \\ \text{c}_{\text{undesirable}} : \text{undesirable(s)} \end{bmatrix}$
        (!disallow(r.s))

The "Dog Hairs" Dialogue

- We would like to compose "dogs upstairs are undesirable" with "if something is undesirable, don't allow it!" "

- For technical reasons having to do with the predication of thecomplete record r rather than a field in r we cannot form a fixed point type from "dogs upstairs are undesirable" but need to work with the variant (24).

$$(24) \quad \lambda r : \left[\text{s:} \begin{bmatrix} \text{x:} \textit{Ind} \\ c_{\text{dog}} \text{:dog(x)} \\ \text{e-loc:} \textit{Loc} \\ c_{\text{upstairs}} \text{:upstairs(e-loc)} \\ \text{e-time:} \textit{Time} \\ c_{\text{be}} \text{:be(x,e-loc,e-time)} \end{bmatrix} \right] \left(\begin{bmatrix} c_{\text{undesirable}} \text{:undesirable}(r.\text{s}) \end{bmatrix} \right)$$

From the version of "dogs upstairs are undesirable" we just saw, and "if something is undesirable, don't allow it" we can, by composition and generalization obtain the enthymeme " don't allow dogs upstairs"

$$(25) \quad \lambda r: \begin{bmatrix} s: \begin{bmatrix} x:Ind \\ c_{dog}:dog(x) \\ e\text{-loc}:Loc \\ c_{upstairs}:upstairs(e\text{-loc}) \\ e\text{-time}:Time \\ c_{be}:be(x,e\text{-loc},e\text{-time}) \end{bmatrix} \end{bmatrix}$$
$$(!disallow(r.s))$$

- ▶ We also assume that there is a similar enthymeme saying that dogs should be allowed upstairs on the basis of this being a desirable situation.

The "Dog Hairs" Dialogue

- ▶ Given that "dog hairs rise", there will be dog hairs upstairs whether you allow your dog upstairs or not.

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The "Dog Hairs" Dialogue

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- So there is a question of balancing the undesirable consequences of dogs upstairs with the desirable consequences.

- Cherrilyn's point is that it does not matter which of these that is most important, since both options – allow dog upstairs or not allow dog upstairs – result in the same situation: hairs upstairs.

(26)	Cherrilyn:	Most dogs aren't allowed up ⟨pause⟩ upstairs. He's allowed to go wherever he wants ⟨pause⟩ do whatever he likes.
	Fiona :	Too right! So they should! Shouldn't they?
	Cherrilyn:	Yeah I mean ⟨pause⟩ dog hairs rise anyway so
	Fiona:	What do you mean, rise?
	Cherrilyn:	The hair ⟨pause⟩ it rises upstairs. I mean I, you know friends said it was, oh God I wouldn't allow mine upstairs because of all the ⟨pause⟩ dog hairs! Oh well ⟨pause⟩ they go up there anyway.
	Fiona:	**So, but I don't know what it is, right, it's only a few bloody hairs!**

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- We have suggested how enthymemes can be used to
  - represent the rhetorical resources that an agent needs to draw common sense inferences
  - assign rhetorical relations between utterances
- The idea that rhetorical resources include associations between types (propositions) that are established and reinforced over time in an agent's resources seems to resemble the work of [Shastri, 1999] and colleagues on neural computation of reflexive reasoning and relational information processing.
  - Enthymematic rhetorical resources could be neurally plausible.

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  - We can represent different kinds of resources in one framework
- If we can find a neurological representation for our types we will have found neurological representations in all of these domains.

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