

You and I in Modal Logic

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Basic properties of indexicals

Context dependence (Kaplan)

- ▶ Distinct occurrences of indexicals may have distinct referents in distinct **contexts**:

(1) I am tired today.

- a. David Kaplan is tired on 26 March 1977.
- b. Maria Aloni is tired on 28 October 2015.

- ▶ Intuition: 'I' refers to the speaker in the context of utterance, 'today' refers to the day in the context of utterance

Contingent a priori (Kripke, Kaplan)

- ▶ Indexicals typically appear in contingent a priori statements:

(2) I am here today.

Insensitivity to intensional operators

- ▶ Classical example (Kaplan):

- (3) It is possible that in Pakistan, in five years, only those who are actually here now are envied.

'Actually', 'here' and 'now' naturally interpreted wrt *actual utterance situation* despite the presence of shifting operators

- ▶ **Aside:** Potential counterexamples to this specific claim (Hunter 2012):

- (4) And what would terrify the right, of course, is the likelihood that genuine socialized medicine would **actually** win that competition.
- (5) All over England folk began to hear of the wonderful saint who lived alone in the desert island, [. . .] He built a house by the landing-place on the island for his visitors to stay in, and **here**, too, his monks would come on festivals to have a talk with him.
- (6) Brutally, the banks knowingly gamed the system to grow their balance sheets ever faster and with even less capital underpinning them in the full knowledge that everything rested on the bogus claim that their lending was **now** much less risky.

- ▶ I will exclusively focus on 'you' and 'I', which arguably don't have such anaphoric uses

Indexicals vs definite descriptions

- (7) The president of the US could have been a Republican.
- a. Barack Obama could have been a Republican
De re: $\exists x[x = \textit{the president} \wedge \Diamond Rx]$
 - b. A Republican (Romney) could have won the last elections
De dicto: $\Diamond \exists x[x = \textit{the president} \wedge Rx]$
- (8) I could have been a Republican. (used by Barack Obama)
- a. Barack Obama could have been a Republican
 - b. #A Republican could have been speaking
- How to account for the contrast between (7) and (8)?

1st strategy: Indexicals always have primary scope

- ▶ Indexicals as wide scope definite descriptions ('I' \mapsto *the speaker*):

(9) I could have been a Republican. (used by Obama)
'Obama could have been a Republican'

- a. *De re*: $\exists x[x = \textit{the speaker} \wedge \diamond Rx]$
- b. *#De dicto*: $\diamond \exists x[x = \textit{the speaker} \wedge Rx]$

\Rightarrow *De dicto* representation never generated or somehow ill-formed

- ▶ Recent implementations

- ▶ Indexicals as presupposition triggers with preference for global vs local resolutions in DRT (Zeevat, Roberts, Hunter & Asher, Hunter)

- ▶ Problem (Meier 2009, echoing Kripke)

- (10) a. The speaker is speaking. [necessary]
b. I am speaking. [contingent]
c. $\exists x[x = \textit{the speaker} \wedge Sx]$

No way to distinguish between (10-a) and (10-b), both represented as (10-c)

2nd strategy: Kaplan's two-dimensional analysis

- ▶ Indexicals interpreted wrt to **contexts** $c = \langle s_c, a_c, \dots, w_c \rangle$ rather than **worlds** w : [where $s_c, a_c \in D, w_c \in W$ in $M = \langle W, R, D, I \rangle$]

- (11)
- a. $\llbracket I \rrbracket_{M,c,w,g} = s_c$ (the speaker in c)
 - b. $\llbracket you \rrbracket_{M,c,w,g} = a_c$ (the addressee in c)

- ▶ Both representations in (12) give rise to the same reading:

- (12) I could have been a Republican. (used by Obama)
'Obama himself could have been a Republican'

- a. *De re*: $\exists x[x = I \wedge \Diamond Rx]$
- b. *De dicto*: $\Diamond \exists x[x = I \wedge Rx]$

- ▶ This prediction relies on various assumptions:

1. Modals cannot manipulate context parameter
2. Indexicals are directly referential and, therefore, rigid designators
3. Variables are rigid designators ("the paradigm of direct reference")

- ▶ IN THIS TALK:

- ▶ Challenge assumptions 2 and 3: against rigidity!
- ▶ Propose a pragmatic account of the interaction between indexicals and intensional operators

Motivation for a pragmatic account

▶ Deferred reference

(13) *Condemned prisoner*: I am traditionally allowed to order whatever I like for my last meal. [Nunberg 1993, p. 20]

(14) Why did you open the door without checking? You should be more careful! I could have been a burglar.
[Hans Kamp, from Meier 2009, p. 285]

▶ Reading (15-b) not predicted by Kaplan's analysis. Both representations in (16) give rise to reading (15-a):

(15) I could have been a burglar. (used by Hans Kamp)
a. Hans Kamp himself could have been a burglar
b. A burglar could have been knocking at the door

(16) a. *De re*: $\exists x[x = I \wedge \Diamond Bx]$
b. *De dicto*: $\Diamond \exists x[x = I \wedge Bx]$

⇒ Kaplan's account of interaction between indexicals and modals not flexible enough to account for these cases

Motivation for a pragmatic account

► Indexicals in 3rd person attitude reports

(17) *Context:* Miss Jones, the new director of Lorenzo's school, would assent to 'Lorenzo's mother is Spanish'. She further has no idea who Lorenzo's mother is. Lorenzo's mother name is Maria. Maria reports to her husband: [Aloni 2001, 2005]

(18) Miss Jones believes that I am Spanish. [true]

- Reading (19-b) not predicted by Kaplan's analysis. Both representations in (20) give rise to reading (19-a):

(19) Miss Jones believes that I am Spanish.

- a. Miss Jones would assent to 'This individual (pointing at Maria) is Spanish'
- b. Miss Jones would assent to 'Lorenzo's mother is Spanish'

- (20) a. *De re*: $\exists x[x = I \wedge \Box Sx]$
b. *De dicto*: $\Box \exists x[x = I \wedge Sx]$

⇒ Kaplan's account of interaction between indexicals and modals not flexible enough to account for these cases

Outlook

1. Against rigidity!
 - ▶ Phone booth and amnesiacs
2. A two-dimensional semantics w/o rigidity
 - ▶ First attempt: indexicals as non-rigid designators in a classical two-dimensional modal logic
 - ▶ Proposal: a two-dimensional modal logic under conceptual covers
3. Indexicals under intensional operators: a pragmatic account

Against rigidity!

Phone booth

Consider A – a man stipulated to be intelligent, rational, a competent speaker of English, etc.– who both sees a woman, across the street, in a phone booth, and is speaking to a woman through a phone. He does not realize that the woman to whom he is speaking – B, to give her a name – is the woman he sees. He perceives her to be in some danger – a run-away steamroller, say, is bearing down upon her phone booth. A waves at the woman; he says nothing into the phone

[Richard 1983, p. 439]

- (21)
- | | | |
|----|--------------------------------|---------|
| a. | (I believe) she is in danger. | [true] |
| b. | (I believe) you are in danger. | [false] |

Amnesiacs

Rudolf Lingens and Gustav Lauben are amnesiacs: each of them knows that he is one of the two, but doesn't know which. [adapted from Santorio 2012]

- (22)
- | | | |
|----|----------------------------|--------|
| a. | I might be Rudolf Lingens. | [true] |
| b. | I might be Gustav Lauben. | [true] |

- ⇒ A, RL and GL predicted to have inconsistent beliefs by Kaplan's analysis
- ⇒ Dropping (epistemic) rigidity for indexicals would give us a ready account of these cases

Two-dimensional semantics w/o rigidity: first attempt

- ▶ New definition of a context: (based on $M = \langle W, R, D, I \rangle$)

(23) A context c is (at least) a triple $\langle \mathbf{s}_c, \mathbf{a}_c, w_c \rangle$ such that

(i) $\mathbf{s}_c, \mathbf{a}_c \in D^W$

(ii) $\mathbf{s}_c(w_c) = \llbracket \textit{the speaker} \rrbracket_{w_c}$ & $\mathbf{a}_c(w_c) = \llbracket \textit{the addressee} \rrbracket_{w_c}$

- ▶ Main features:

- ▶ Contexts supply individuating functions (or concepts) rather than objects:

$$\mathbf{s}_c \in D^W \text{ (rather than } s_c \in D)$$

- ▶ The value of \mathbf{s}_c in w_c is the speaker in w_c :

$$\mathbf{s}_c(w_c) = \llbracket \textit{the speaker} \rrbracket_{w_c}$$

- ▶ But crucially \mathbf{s}_c need not be equivalent with $\lambda w. \llbracket \textit{the speaker} \rrbracket_w$

- ▶ New interpretation of indexicals:

(24) a. $\llbracket I \rrbracket_{M,c,w,g} = \mathbf{s}_c(w)$
b. $\llbracket \textit{you} \rrbracket_{M,c,w,g} = \mathbf{a}_c(w)$

Applications

- ▶ Richard's phone booth:

- (25) a. (I believe) she is in danger. [true]
b. (I believe) you are in danger. [false]

'you' and 'she' can be assigned different individuating functions even though they refer to one and the same individual in the actual world

- ▶ Santorio's amnesiacs case:

- (26) a. I might be Rudolf Lingens. [true]
b. I might be Gustav Lauben. [true]

s_c need not be a constant function

- ▶ Kamp's burglar:

- (27) I could have been a burglar. $\leftrightarrow \Box \exists x [x = I \wedge Bx]$ (*de dicto*)
'A burglar could have been knocking at the door'

s_c can be equivalent to $\lambda w. \llbracket \textit{the person knocking at the door} \rrbracket_w$

- ▶ Kripke/Meier case:

- (28) a. I am speaking. [contingent]
b. The speaker is speaking. [necessary]

s_c need not be equivalent with $\lambda w. \llbracket \textit{the speaker} \rrbracket_w$

Problems: logic of reference

- ▶ Standard Kaplanian principles fail to be validated:

SI $\not\models_{2D\bar{R}} I = x \rightarrow (\phi[I] \rightarrow \phi[x])$ (substitutivity of identicals)

EG $\not\models_{2D\bar{R}} \phi[I] \rightarrow \exists x\phi[x]$ (existential generalisation)

Kaplan

	SI	EG
variables	yes	yes
indexicals	yes	yes
definites	no	no

$2D\bar{R}$

	SI	EG
variables	yes	yes
indexicals	no	no
definites	no	no

⇒ Indexicals no longer genuine referential expressions:

- ▶ *you* and *I* stand for ways of representing objects ($\alpha \in D^W$), rather than for the objects themselves ($d \in D$).

⇒ Difference indexicals vs definites no longer accounted for

Problems: Obama vs burglar

- ▶ Back to Obama:

- (29) I could have been a Republican. (used by Obama)
- Obama could have been a Republican
 - #A Republican could have been speaking

Nothing prevents s_c to be equivalent to $\lambda w. \llbracket \text{the speaker} \rrbracket_w$, so *de dicto* (30-b) could mean (29-b):

- (30) a. *De re*: $\exists x[x = I \wedge \diamond\phi]$
b. *De dicto*: $\diamond\exists x[x = I \wedge \phi]$

Possible solution: ban descriptive concepts from our contexts!

- ▶ But if indexicals cannot be assigned descriptive concepts, intended reading of (31) no longer generated:

- (31) (Why did you open?) I could have been a burglar.
'A burglar could have been knocking at the door'

Proposal

- ▶ Rethink the way of modelling the objects we refer to in conversation
↳ a new logic of reference
- ▶ Pragmatic account of the difference between Obama and the burglar

Quantification in situations of partial information

Card scenario

Two face-down cards, the ace of hearts and the ace of spades.

Anna knows that the winning card is the ace of hearts, but doesn't know whether it's the card on the left or the one on the right.

(32) Anna doesn't know which card is which.

How to express (32) in epistemic logic?

(33) Anna knows which card is the winning card.

True or false?

Intuitive analysis

Two salient ways to identify the cards:

1. By their position: the card on the left, the card on the right
2. By their suit: the ace of hearts, the ace of spades

Whether (33) is judged true depends on which of these perspectives is adopted; (32) can be expressed if we allow both identification methods to play a role.

Conceptual Covers

- Identification methods can be formalized as *conceptual covers*:

(34) A conceptual cover CC based on $\langle W, D \rangle$ is a set of functions from W to D s.t.: $\forall w \in W : \forall d \in D : \exists! c \in CC : c(w) = d$

In each world each individual is identified by at least one concept (existence); in no world is an individual counted twice (uniqueness) [Aloni 2001, Aloni 2005]

Card scenario

- 3 salient covers/ways of identifying the cards:

(35)

a.	{on-the-left, on-the-right}	[perceptually-based]
b.	{ace-of-spades, ace-of-hearts}	[naming]
c.	{the-winning-card, the-losing-card}	[description]
d.	#{on-the-left, ace-of-spades}	[not a cover]

- In a conceptual cover, each individual in the domain is identified in a determinate way;
- Different conceptual covers constitute different ways of conceiving one and the same domain.

Quantification under conceptual covers

- ▶ Variables x_n range over elements of a pragmatically selected cover $\wp(n)$:

$$M, w \models_g^{\wp} \exists x_n \phi \quad \text{iff} \quad \exists \alpha \in \wp(n) : M, w \models_{g[x_n/\alpha]}^{\wp} \phi$$

where $g(x_n) \in \wp(n)$ & $\llbracket x_n \rrbracket_{M,w,g} = g(x_n)(w)$

- ▶ Sound and complete axiomatisation in Aloni (2001, 2005).

Card Scenario

- ▶ Evaluation of (36) depends on which cover is adopted:

- (36)
- Anna knows which_n card is the winning card.
 - $\exists x_n (Cx_n \wedge K_a x_n = \textit{the winning card})$

- (37)
- False, if $n \mapsto \{\textit{on-the-left, on-the-right}\}$
 - True, if $n \mapsto \{\textit{ace-of-spades, ace-of-hearts}\}$
 - Trivial, if $n \mapsto \{\textit{the-winning-card, the-losing-card}\}$

- ▶ Representation of (38) involves a shift from one cover to the other

- (38)
- Anna doesn't know which_n card is which_m.
 - $\forall x_n \forall y_m \neg K_a x_n = x_m$

Further applications: double-vision puzzles, identity questions, knowing-who, ...

Two-Dimensional Semantics with Conceptual Covers

► Contexts, modals and validity as in Kaplan

- Contexts are tuples $c = \langle s_c, a_c, \dots, w_c \rangle$ containing actual speaker, addressee and world, where $s_c, a_c \in D$ & $w_c \in W$
- Modals do not manipulate context parameter:

$$M, c, w \models_g^{\wp} \Box \phi \quad \text{iff} \quad \forall w' \in W : wRw' \Rightarrow M, c, w' \models_g^{\wp} \phi$$

- Real-world validity as logical validity:

$$\models_{2D_{cc}} \phi \quad \text{iff} \quad \forall M, c, w, g, \wp : M, c, w_c \models_g^{\wp} \phi$$

► Quantification as in modal logic under conceptual covers

- Variables x_n range over elements of pragmatically selected conceptual cover $\wp(n)$:

$$M, c, w \models_g^{\wp} \exists x_n \phi \quad \text{iff} \quad \exists \alpha \in \wp(n) : M, c, w \models_{g[x_n/\alpha]}^{\wp} \phi$$

► New view on indexicals

- Indexicals I_n, you_n assigned elements of pragmatically selected conceptual cover $\wp(n)$:

$$\llbracket I_n \rrbracket_{M,c,w,g}^{\wp} = \alpha(w), \quad \text{where } \alpha \in \wp(n) \text{ \& } \alpha(w_c) = s_c$$

$$\llbracket you_n \rrbracket_{M,c,w,g}^{\wp} = \alpha(w), \quad \text{where } \alpha \in \wp(n) \text{ \& } \alpha(w_c) = a_c$$

Applications: basic properties and non-rigidity

- ▶ Context dependence and contingent a priori (as in Kaplan)

$$(39) \quad \models_{2D_{cc}} I_n = \textit{the speaker} \quad (\text{a priori})$$

$$(40) \quad \not\models_{2D_{cc}} \Box I_n = \textit{the speaker} \quad (\text{but not necessary})$$

- ▶ Phone booth and amnesiacs (as in $2D\bar{R}$)

$$(41) \quad \not\models_{2D_{cc}} \textit{you}_n = \textit{she}_m \rightarrow \Box \textit{you}_n = \textit{she}_m$$

you and *she* can be assigned elements of two different perceptually-based covers (visual vs auditory)

$$(42) \quad \not\models_{2D_{cc}} I_n = a \rightarrow \Box I_n = a$$

Perceptually-based concepts need not be constant functions

Applications: logic of reference

- ▶ While substitutivity of identicals and existential generalisation fail in general:

$$\mathbf{SI} \quad \not\models_{2D_{cc}} x_n = y_m \rightarrow (\phi[x_n] \rightarrow \psi[y_m])$$

$$\mathbf{EG} \quad \not\models_{2D_{cc}} \phi[y_m] \rightarrow \exists x_n \phi[x_n]$$

- ▶ Restricted forms are validated for **variables** and **indexicals**:

$$(43) \quad \begin{aligned} &\models_{2D_{cc}} x_n = y_n \rightarrow (\phi[x_n] \rightarrow \psi[y_n]) \\ &\models_{2D_{cc}} I_n = y_n \rightarrow (\phi[I_n] \rightarrow \psi[y_n]) \end{aligned}$$

$$(44) \quad \begin{aligned} &\models_{2D_{cc}} \phi[y_n] \rightarrow \exists x_n \phi[x_n] \\ &\models_{2D_{cc}} \phi[I_n] \rightarrow \exists x_n \phi[x_n] \end{aligned}$$

- ▶ But not for **definites**:

$$(45) \quad \not\models_{2D_{cc}} \iota z_n Pz_n = y_n \rightarrow (\phi[\iota z_n Pz_n] \rightarrow \psi[y_n])$$

$$(46) \quad \not\models_{2D_{cc}} \phi[\iota z_n Pz_n] \rightarrow \exists x_n \phi[x_n]$$

Validities in (43) and (44) rely on uniqueness and existence condition on CC respectively

Back to Obama

- (47) I could have been a Republican. (used by Obama)
- a. Obama could have been a Republican
 - b. #A Republican could have been speaking

Overgeneration problem

Nothing prevents x_n or I_m to be assigned to $\lambda w. \llbracket the\ speaker \rrbracket_w$, so both *de re* and *de dicto* (48-a-b) could mean (47-b):

- (48) a. *De re*: $\exists x_n [x_n = I_m \wedge \diamond R x_n]$ (only n relevant here)
b. *De dicto*: $\diamond \exists x_n [x_n = I_m \wedge R x_n]$ (only m relevant here)

NB: value of n relevant only when x_n/I_n occurs free in the scope of a modal operator, i.e. its referent needs to be identified across worlds

A pragmatic solution

General pragmatic principles prevent descriptive covers to be at work in ordinary cases (as in Obama), while being possibly operative in extraordinary circumstances (as in the burglar case)

Pragmatic theory

- ▶ We assume that there are certain default choices for cover indices n ;
- ▶ Deviation from default resolution possible, but only justified if needed in order to comply with Gricean principles of conversation.

Proposal

- 1. Default resolutions:** Cover indices n , m are by default resolved to the contextually most salient cover, which is typically
 - ▶ a perceptually-based cover, if application criteria satisfied
 - ▶ naming

⇒ Application criteria for perceptually-based cover generally satisfied in the case of indexicals
- 2. Deviation from default resolution licensed:**
 - (i) only if necessary to avoid false/vacuous/irrelevant meanings
[Gricean QUALITY, QUANTITY, RELEVANCE]
 - (ii) only if the meaning obtained by shifting to a non-default resolution could not have been expressed in a more perspicuous/effective form
[Gricean MANNER (as **blocking**)]

A default resolution: Obama example

- ▶ In a neutral context deviation from default resolution is unjustified:

(49) I could have been Republican. (used by Obama)
'Obama himself could have been a Republican'

- De re*: $\exists x_n[x_n = I_m \wedge \Diamond Rx_n]$
- De dicto*: $\Diamond \exists x_n[x_n = I_m \wedge Rx_n]$

⇒ Optimal resolution: n, m assigned *perceptually-based cover*

- ▶ As in Kaplan, no ambiguity predicted for (49)

(50) The president of the US could have been a Republican.

- De re*: $\exists x_n[x_n = \iota y_m Py_m \wedge \Diamond Rx_n]$
'Obama could have been a Republican'

⇒ Optimal resolution: x_n ranges over *naming cover*

- De dicto*: $\Diamond \exists x_n[x_n = \iota y_m Py_m \wedge Rx_n]$
'A Republican could have won the last elections'

⇒ (values of n, m irrelevant here)

- ▶ As in Kaplan, (50) predicted to be ambiguous

Deviation triggered by relevance: the burglar example

- ▶ Deviation from default resolution licensed if necessary to avoid violation of Gricean principles of conversation:

(51) Why did you open? I could have been a burglar. (used by Hans Kamp)
'A burglar could have been knocking at the door'

- a. *De re*: $\exists x_n[x_n = I_m \wedge \diamond Bx_n]$
- b. *De dicto*: $\diamond \exists x_n[x_n = I_m \wedge Bx_n]$

\Rightarrow Optimal resolution: $\lambda w \llbracket \text{the person knocking at the door} \rrbracket_w \in n, m$

- ▶ Descriptive reading predicted because default resolution would have led to relevance violation.

'I' vs 'the speaker'

- ▶ Nunberg's observation: deferred reference readings not available for definites:

(52) Why did you open? I could have been a burglar.
'A burglar could have been knocking at the door'

(53) Why did you open? The speaker could have been a burglar.
'A burglar could have been knocking at the door'

- ▶ Desiderata:

The person knocking at the door can serve as identifying concept in (52), but not in (53).

- ▶ What distinguishes the two cases?

RELEVANCE-justified deviation licensed in (52), but **blocked** in (53) by the availability of a more efficient form for the target content

Blocking effects

- (54) a. Target *content*: 'The person knocking at the door could have been a burglar'
- b. Alternative possible *forms*:
- (i) The person knocking at the door could have been a burglar.
 - (ii) I could have been a burglar.
 - (iii) The speaker could have been a burglar.

- Interpretation (54-a) **blocked** for (iii) by more efficient forms (i)-(ii):

(55) The speaker could have been a burglar.
'The person knocking at the door could have been a burglar'

⇒ non-default resolution NOT licensed here

- Nothing is strictly more effective than form (ii) given the circumstances of the utterance ('I' preferred referential device):

(56) I could have been a burglar.
'The person knocking at the door could have been a burglar'

⇒ non-default resolution licensed here

The referential device principle

A referential device can be selected only if the application criteria of the classes above in the following hierarchy do not apply
(cf. Gundel et al 1993)

NP type	selection condition
reflexive	c-command
1st and 2nd pers. pron.	conversation participant
anaphors demonstratives short definites proper names ...	high salience through mention presence in attention space old, dependence on high salient familiarity ...
long definites	new and unique
indefinites	new

(57) X is meeting a woman this evening. [from Grice 1975]

The woman cannot be X's mother, sister, but neither speaker, hearer...

Lorenzo's mother

Miss Jones, the new director of Lorenzo's school, would assent to 'Lorenzo's mother is Spanish'. She further has no idea who Lorenzo's mother is. Lorenzo's mother name is Maria.

C1 Maria to her husband:

(58) Miss Jones believes that *I* am Spanish.

C2 Maria's husband to Maria:

(59) Miss Jones believes that *you* are Spanish.

C3 Maria's husband to her mother:

(60) Miss Jones believes that *Maria* is Spanish.

C4 Lorenzo's teacher to a colleague:

(61) (?) Miss Jones believes that *Maria* is Spanish.

QUALITY triggered perspective shift justified in C1-C3, but not in C4, because only in C1-C3 alternative form (62) would violate RDP:

(62) Miss Jones believes that *Lorenzo's mother* is Spanish.

Lorenzo's mother: a closer look

- (63) Miss Jones believes that I am Spanish. [true in C1]
'Miss Jones would assent to 'Lorenzo's mother is Spanish''
- a. *De re*: $\exists x_n[x_n = I_m \wedge \Box Sx_n]$
 - b. *De dicto*: $\Box \exists x_n[x_n = I_m \wedge Sx_n]$

QUALITY justified deviation from default resolution for (63):

⇒ Optimal resolution: $\lambda w \llbracket \text{Lorenzo's mother} \rrbracket_w \in n, m$

- (64) Miss Jones believes that I am Lorenzo's mother. [false in C1]
'Miss Jones would assent to 'This individual (pointing at Maria) is Lorenzo's mother''
- a. *De re*: $\exists x_n[x_n = I_m \wedge \Box Sx_n]$
 - b. *De dicto*: $\Box \exists x_n[x_n = I_m \wedge Sx_n]$

No deviation from default resolution licensed in (64). Any

QUALITY-justified cover shift would lead to QUANTITY violation:

⇒ Optimal resolution: $\lambda w \llbracket \text{Lorenzo's mother} \rrbracket_w \notin n, m$

Conclusion

- ▶ Summary:
 - ▶ By letting indexicals and variables refer to elements of contextually supplied conceptual covers
 - ▶ we have accounted for a number of cases that have been presented against Kaplan
 - ▶ while maintaining Kaplan's basic insights concerning the meaning of 'you' and 'I'
- ▶ Open issues:
 - ▶ Axiomatization of $2D_{cc}$
 - ▶ Adding an "a priori" operator A : quantification into the scope of A ?
 - ▶ 'You' and 'I' in dialogues: multiagency, turn-taking, ...
 - ▶ ...