**De re interpretation in belief reports – An experimental investigation**

**Highlights**

- We present a series of three experiments about *de re/de dicto* readings, with continuous slider to quantify semantic judgments.
- Given contexts admitting both interpretations (Exp.1),
  - *de dicto* was always accessible;
  - the accessibility of *de re* was bimodal (i.e. highly disagree, highly agree).
- Given controlled manipulation of more complex contexts such that they admit only a single interpretation (Exp.2 & 3),
  - judgments were strongly bimodal;
  - the more *de re* DPs a sentence contained, the lower accessibility it had;
  - *de re* accessibility depended both on its syntactic position and idiosyncratic contexts.
- This study provides an experimental template to solicit nuanced semantic judgments.

Yuhan Zhang, Kathryn Davidson

*Department of Linguistics, Harvard University*

Contact info: yuz551@g.harvard.edu

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Background

**Definition of de re & de dicto**

When DPs appear in the domain of an intensional operator, they may be interpreted *de re* or *de dicto*.

1. Sue *wants* to marry *[a plumber]*.
   - **De re**: There’s an actual plumber that Sue wants to marry. She doesn’t have to know he is a plumber.
   - **De dicto**: Sue wants to marry someone who she thinks is a plumber; she doesn’t need know who he is.

**Complications & Formal approaches**

1. To specifically solve the conflicts between *de re* wide scope and quantificational scope restrictions of QNP:
   - **Scope theory** (Keshet 2008, 2011; Elliott, 2020).
   - **Intensional variable theory** (Percus, 2000).

2. Other approaches that don’t rely on scopes or deal with more complicated data points:
   - **Presupposition projection theory** (Romoli & Sudo, 2009).
   - **Concept generator** (Charlow & Sharvit, 2014).
     - Addresses nested DPs [DP [DP]]

**Need for quantitative studies**

While nuanced semantic judgments are fundamental for formal theories, *de re/de dicto* theories have been based on limited data points and/or consultants.

1. Disagreement about (un)availability of certain readings.
   1. # Sally believes that *[her brother]_{de re}* is happy.

2. Everyday language use may differ from preferences in other domains, e.g. *de re* over *de dicto* in legal settings.

**Research Questions**

Are *de re* and *de dicto* readings both accessible by naive participants given highly controlled contexts that strongly support each reading? Is one generally more accessible than the other? Does the accessibility depend on syntactic positions or other factors?

→ Controlled Experiments!
**Method & Exp.1**

**Experiment display of Exp.1**

**CONTEXT**

Julie is one of several judges of an ongoing poetry competition. The best poem that she’s read so far is an extremely intriguing poem about the ocean. She believes that this poem will win the competition. Julie remembers being told that Nicole, one of the best-known contemporary poets, submitted a poem about the ocean to the competition. Therefore, Julie concludes that the first prize will be going to Nicole. However, this poem was actually written by Elizabeth, a younger and lesser-known poet. It is just a coincidence that the two poets wrote on the same topic.

**JUDGMENT TASK**

According to this story, please use the slider bar to indicate to what extent you agree or disagree with the following statement.

S\_Target-1: Julie believes that [Nicole’s poem] is going to win the competition. *(de dicto interpretation)*  
S\_Target-2: Julie believes that [Elizabeth’s poem] is going to win the competition. *(de re interpretation)*  

[Each participant judges one of the two Ss.]

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**Research question of Exp.1**

When a context permits both *de re* and *de dicto* readings, do people access both equally successfully?

**Linking hypothesis & Prediction**

1. The context follows the spirit of the contexts in Romoli & Sudo (2009) where both *de re* and *de dicto* readings are theoretically available.  
2. Therefore, theoretically, both *de re* and *de dicto* readings should be agreed with as indicated by the slider bar. If not, we need better explanations for differences in accessibility of the reading.  
3. The advantages of continuous sliders: (1) provides directional data of “agree” and “disagree”; (2) is more sensitive to intermediate judgments, assuming judgments are not binary but continuous.

**Experiment procedure**

<table>
<thead>
<tr>
<th>Context 1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_Target</td>
<td>Random Display of Four Ss.</td>
<td>Random Display of Four Ss.</td>
<td>Random Display of Four Ss.</td>
</tr>
<tr>
<td>S_True</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S_False</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S_Uncertain</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Per participant, \(\frac{1}{2}\) S\_Target are *de re*; \(\frac{1}{2}\) are *de dicto*; the order of *de re/de dicto*, contexts order, S order are randomized.
Exp.1 Results

Implementation

The questionnaire was designed on Qualtrics; The recruiting design on Turkprime; The subject pool was from Amazon’s Mechanical Turk; 120 native English speakers participated.

Results

Histogram of agreement ratings across condition

Interim conclusions

When both de dicto and de re are available, de re readings are less agreed upon, harder to access, and exhibit bimodal distribution. Besides, context matters!

Exp.2 & Exp. 3

Research question

Could this controlled method be applied to test more nuanced and complicated de re readings, e.g. bound de re in Charlow & Sharvit (2014)? Can it be accessed across different scenarios? Is de re still less accessible compared with de dicto?

“Bound de re”

(4) John believes that every female student, likes her, mother.

• Both [every female student] = de re, [her] = de re
• John has different acquaintance relations with the two.

[Context for bound de re]

“John comes into contact with every actual female student more than once, and each actual female student appears each time in a different guise, ..., John fails to recognize this and thinks he came into contact with two different [people]...” (Charlow & Sharvit, 2014). Under this scenario, John believes that each in the first group likes the mother of the mapping one in the second group.

Predictions from Charlow and Sharvit (2014)

John believes that QNP loves PossessivePronoun Possessee.

bound de re ✓ de re de re de dicto

Although, they note that, for Keshet, possessee is biased de re.

Motivated by the bimodal distribution of de re reading, analysis transitioned from continuous to binary directional base.
Exp. 2 & 3 Design and Results

**Experimental display**

**Context** [with variations that admits only 1 reading]

[Written text supported by visual information]

**Judgment task** [with same instruction as Exp.1]

Looking at the second set, John believes that [every graduating student] shares the same smile as [their] [mother].

[Three other filler Ss. Four Ss displayed randomly.]

**Design & Conditions**

<table>
<thead>
<tr>
<th>QNP</th>
<th>PosPro within-s</th>
<th>Possessee within-s</th>
</tr>
</thead>
<tbody>
<tr>
<td>de re</td>
<td>de re</td>
<td>de dicto</td>
</tr>
<tr>
<td>Exp. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>de dicto</td>
<td>de dicto</td>
<td></td>
</tr>
<tr>
<td>Exp. 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

127 participants for Exp.2 and 120 for Exp.3.

**Exp.2 QNP [de re]**

![Graph showing rating distribution across conditions for de re QNP](chart1.png)

**Exp.3 QNP [de dicto]**

![Graph showing rating distribution across conditions for de dicto QNP](chart2.png)

**Conclusion**

1. **Bound de re** is available, but is less accessible than the baseline de dicto reading;
2. In general, de re is harder to access but the accessibility is affected by syntactic position;
3. Different scenarios matter;
4. The not-at-ceiling baseline de dicto condition might suggest the unnaturalness of the data.

In addition to various story effects.
Discussion

Major findings
- Given contexts admitting both interpretations (Exp.1),
  - *de dicto* was always accessible;
  - the accessibility of *de re* was bimodal (i.e. highly disagree, highly agree).
- Given controlled manipulation of more complex contexts such that they admit only a single interpretation (Exp.2 & 3),
  - judgments were strongly bimodal;
  - the more *de re* DPs a sentence contained, the lower accessibility it had;
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Implications
- The disaccord and confusion of *de re* availability among different scenarios/linguistic patterns in theory work might result from its varying accessibility.
- To attest *de re*, the judgment collection procedure needs to be a bit “experimental” (Davidson, 2020) to support theoretical development.
- The bimodal feature of *de re* accessibility calls for investigation as to why it is hard to access.
  - In Chomsky’s words, competence? performance?
  - Undiscovered covert semantic operator modulates the reading?
  - Processing and information tracking failure?

Selected References