NLG Lecture 8: Content planning 2

Adapted from slides by Jon Oberlander

With thanks to MATCH and ILEX projects

Text planning in MATCH

- MATCH (2002-7):
  - Multimodal (text, speech, graphics/gestures)
  - Restaurant recommendation
  - Uses a text planner to map from communicative goals to text plans
- Key points:
  - Can achieve two types of goal (compare, recommend)
  - Includes a decision-theoretic model of user preferences
  - Allows control of conciseness (important in a spoken dialogue context)
  - Given a goal and a user model, selects content, derives multiple possible text plans
- Related system:
  - ILEX (1996-2001) and MPIRO: multimodal museum object description
  - User modelling, discourse modelling, bottom-up
- Later in course:
  - Given (a set of) text plans, generate (a set of) sentence plans

MATCH goals

Make it easier for users to understand the tradeoffs between different options by:

1. Responding to requests for recommending one restaurant or comparing small sets of restaurants
2. Tailoring recommendations and comparisons to a model of the user’s individual preferences
   - Ranking options
   - Selecting attributes to mention
3. Making responses sufficiently concise for the user to understand and remember important information

MATCH: multimodal access to city help
MATCH architecture: focus on SPUR

MATCH: multimodal input-output

U1 “Show me Italian restaurants in the West Village”
S1 [zooms to the West Village, displays Italian restaurants. (Figure 3)]
U2 [circles a selection of restaurants and says “compare” (Figure 4)]
S2 “Among the selected restaurants, the following offer exceptional overall value. Uguale’s price is $35. It has excellent food quality and good decor. Da Andrea’s price is $28. It has very good food quality and good decor. John’s Pizzeria’s price is $20. It has very good food quality and mediocre decor.”
U3 [writes word “recommend”]
S3 “Uguale has the best overall value among the selected restaurants. Uguale’s price is $35.”

S1 - Response to “Show me Italian restaurants in the West Village”

U2 - multimodal comparison request

Fig. 3. MATCH’s graphical system response to “Show me Italian restaurants in the West Village.”

Fig. 4. User circles subset of Italian West Village restaurants for comparison.
Evaluative arguments:
Carenini & Moore on recommendation and comparison

1. Identifying supporting and opposing evidence:
   - evidence must be based on a model of the user's values and preferences, e.g., superb restaurant decor can only be used to support an argument for going to a restaurant if the user is oriented to decor.
2. Positioning the main claim:
   - placing the main claim first helps users follow the line of reasoning, but delaying the claim until the end of the argument can also be effective if the user is likely to disagree with the claim.
3. Selecting supporting and opposing evidence:
   - an argument cannot include all the possible evidence, so only strong evidence should be presented in detail, and weak evidence only briefly mentioned or omitted entirely.
4. Arrangement of supporting evidence:
   - the strongest support should be presented first but, if possible, one effective piece of supporting evidence should be saved for the end to leave the user with a final impression of the strength of the argument.
5. Addressing and ordering opposing evidence:
   - the choices are not to mention any opposing evidence, to acknowledge it without refuting it, or to acknowledge it and refute it. The opposing evidence should be presented so as to minimize its effectiveness with strong opposing evidence in the middle and weak evidence at the beginning and end.
6. Ordering between supporting and opposing evidence:
   - if the reader is aware of the opposing evidence, then it should come before the supporting evidence, otherwise after.

One dimension of variation: conciseness of output

Conciseness: mention only those restaurants and attributes that are most relevant to the user’s preferences

<table>
<thead>
<tr>
<th>User</th>
<th>Conciseness</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>CK</td>
<td>Concise (w = 0.3)</td>
<td>Bond Street has the best overall value among the selected restaurants. Bond Street has excellent food quality.</td>
</tr>
<tr>
<td>BA</td>
<td>Concise (w = 0.3)</td>
<td>Kono no has the best overall value among the selected restaurants. Kono no's price is $29. It's a Japanese, Latin American restaurant.</td>
</tr>
<tr>
<td>CK</td>
<td>Sufficient (w = -0.7)</td>
<td>Bond Street has the best overall value among the selected restaurants. Bond Street's price is $51 and it has excellent food quality and good service. It's a Japanese, Sushi restaurant.</td>
</tr>
<tr>
<td>BA</td>
<td>Sufficient (w = -0.7)</td>
<td>Kono no has the best overall value among the selected restaurants. Kono no's price is $29 and it has very good service and very good food quality. It's a Japanese, Sushi restaurant.</td>
</tr>
<tr>
<td>CK</td>
<td>Verbose (w = -1.5)</td>
<td>Bond Street has the best overall value among the selected restaurants. Bond Street's price is $51 and it has excellent food quality, good service, and very good decor. It's a Japanese, Sushi restaurant.</td>
</tr>
<tr>
<td>BA</td>
<td>Verbose (w = -1.5)</td>
<td>Kono no has the best overall value among the selected restaurants. Kono no's price is $29 and it has very good service, very good food quality and good decor. It's a Japanese, Latin American restaurant.</td>
</tr>
</tbody>
</table>

Another dimension of variation: user modelling

Multi-attribute utility theory:
- A preference for something is generated by a number of factors (attribute-value pairs)
- Weights can be attached to those factors by eliciting user preferences on a range of stimuli
- Good approximation of weightings via ranking of K attributes (what single attribute would you change to improve on worst restaurant? etc.)

Fig. 6. Structure of objectives for MATCH.

Three user models: BA, CK, OR

Differ in weights on attributes

<table>
<thead>
<tr>
<th>User</th>
<th>FQ</th>
<th>SVC</th>
<th>Dec</th>
<th>Cost</th>
<th>Nibol</th>
<th>FT</th>
<th>Nibol Likes</th>
<th>Nibol Dislikes</th>
<th>FT Likes</th>
<th>FT Dislikes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>0.10</td>
<td>0.16</td>
<td>0.06</td>
<td>0.24</td>
<td>0.03</td>
<td>0.41</td>
<td>Downtown, Midtown, E. Village, TrillBeCa, SoHo</td>
<td>The Bronx, Harlem</td>
<td>Cajan Creole, Greek, Italian, Japanese, Seafood</td>
<td>Coffeehouses, Desserts, German, Steak</td>
</tr>
<tr>
<td>CK</td>
<td>0.41</td>
<td>0.10</td>
<td>0.03</td>
<td>0.16</td>
<td>0.06</td>
<td>0.24</td>
<td>Midtown, Chinatown, TrillBeCa</td>
<td>Harlem, Bronx</td>
<td>Italian, Mexican, Chinese, Japanese, Seafood</td>
<td>Vegetarian, Vietnamese, Korean, Hungarian, German</td>
</tr>
<tr>
<td>OR</td>
<td>0.24</td>
<td>0.06</td>
<td>0.16</td>
<td>0.41</td>
<td>0.10</td>
<td>0.03</td>
<td>W. Village, Chelsea, Chinatown, TrillBeCa, E. Village</td>
<td>Upper E. Side, Upper W. Side, Uptown, Bronx, Lower Manhattan</td>
<td>French, Japanese, Portuguese, Thai, Middle Eastern</td>
<td>no-dislike</td>
</tr>
</tbody>
</table>
Normalizing attribute values

- Must turn real domain values of attributes into cardinal utilities
- Define a component value function for each attribute
  - Highest value mapped to 100, lowest to 0, others to values in interval 0-100
- User independent (cf. weights are user dependent)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Range of values</th>
<th>Mapping of values to cardinal utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food quality, Service, Decor</td>
<td>0–30</td>
<td>value × 3/10</td>
</tr>
<tr>
<td>Cost</td>
<td>0–90</td>
<td>100 – (100/9 × value)</td>
</tr>
<tr>
<td>Food type, neighborhood</td>
<td>e.g., Italian, French, West Village</td>
<td>Top values listed by user are mapped to 99, bottom ones to 10 and all others to 50</td>
</tr>
</tbody>
</table>

Computing value of options

- Utility of option, $h$, for particular user

$$U_h = \sum_{i=1}^{K} w_i \cdot v_i(x_i)$$

$(x_1, \ldots, x_K)$ vector of attribute values for an entity $h$,

$w_i =$ weight of attr $i$,

$v_i =$ component value function for attr $i$

(Assumes attributes are independent of one another)

- Order options according to predicted utility for that user model

Restaurant rankings: Japanese restaurant in East Village

- Utilities computed from values and attribute weightings

<table>
<thead>
<tr>
<th>User</th>
<th>Restaurant</th>
<th>$U_h$</th>
<th>FQ(wtd)</th>
<th>SVC(wtd)</th>
<th>DEC(wtd)</th>
<th>Cost(wtd)</th>
<th>Nhld(wtd)</th>
<th>FY(wtd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>Komodo</td>
<td>77</td>
<td>22(7)</td>
<td>22(10)</td>
<td>19(4)</td>
<td>29(18)</td>
<td>90(2)</td>
<td>90(36)</td>
</tr>
<tr>
<td>BA</td>
<td>Japanica</td>
<td>71</td>
<td>23(7)</td>
<td>18(7)</td>
<td>15(3)</td>
<td>37(16)</td>
<td>90(2)</td>
<td>90(36)</td>
</tr>
<tr>
<td>BA</td>
<td>Tabachiki</td>
<td>71</td>
<td>21(6)</td>
<td>17(6)</td>
<td>14(2)</td>
<td>27(10)</td>
<td>90(2)</td>
<td>90(36)</td>
</tr>
<tr>
<td>BA</td>
<td>Shubu-Tatsu</td>
<td>70</td>
<td>20(5)</td>
<td>18(7)</td>
<td>15(3)</td>
<td>31(17)</td>
<td>90(2)</td>
<td>90(36)</td>
</tr>
<tr>
<td>BA</td>
<td>Boul Street</td>
<td>69</td>
<td>25(8)</td>
<td>19(8)</td>
<td>22(1)</td>
<td>51(11)</td>
<td>90(2)</td>
<td>90(36)</td>
</tr>
<tr>
<td>BA</td>
<td>Dojo</td>
<td>66</td>
<td>15(2)</td>
<td>12(2)</td>
<td>8(1)</td>
<td>14(23)</td>
<td>90(2)</td>
<td>90(36)</td>
</tr>
<tr>
<td>CK</td>
<td>Boul Street</td>
<td>63</td>
<td>29(3)</td>
<td>19(3)</td>
<td>22(2)</td>
<td>54(5)</td>
<td>50(7)</td>
<td>50(12)</td>
</tr>
<tr>
<td>CK</td>
<td>Japanica</td>
<td>59</td>
<td>23(3)</td>
<td>18(3)</td>
<td>15(1)</td>
<td>37(7)</td>
<td>50(7)</td>
<td>50(12)</td>
</tr>
<tr>
<td>CK</td>
<td>Komodo</td>
<td>59</td>
<td>22(2)</td>
<td>22(4)</td>
<td>19(2)</td>
<td>29(8)</td>
<td>50(7)</td>
<td>50(12)</td>
</tr>
<tr>
<td>CK</td>
<td>Tabachiki</td>
<td>54</td>
<td>21(4)</td>
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<tr>
<td>CK</td>
<td>Dojo</td>
<td>50</td>
<td>15(10)</td>
<td>19(1)</td>
<td>8(0)</td>
<td>14(10)</td>
<td>50(7)</td>
<td>50(12)</td>
</tr>
</tbody>
</table>

Inputs

- SPUR (Speech Planning with Utilities for Restaurants) content planner takes as input:
  - a dialogue strategy goal
  - a user model
  - a conciseness parameter, $z$
  - a set of restaurant options returned by the database that match situational constraints specified in the user’s query

- Both option ranking and content selection are sensitive to user model
Content selection and planning: recommendation

- Given goal and user model, compute ranking of items
- Describe and justify selection of top item
- For each attribute, $z$ scores on its weighted values specify deviations from mean score:
  (a) other attributes for the same option (for recommend), or
  (b) the same attribute for other options (for compare).
- Select for expression those attributes that are “remarkable enough”
- Use these to justify recommendation

(1) Select the restaurant option $R$ with highest overall utility from returned options.
(2) Using the setting for $z$, identify the attributes $a_i$ whose weighted attribute values $v_i$ for that option are outliers.
(3) Construct a content plan with the claim that $R$ has the best overall value, because $R$ possesses attributes $a_i$ with values $v_i$, as exemplified in Figure 16.

Content plan: recommendation

content:
1. assert(best(Komodo))
2. assert(has-att(Komodo, cost(29)))
3. assert(has-att(Komodo, foodquality(verygood)))
4. assert(has-att(Komodo, service(verygood)))
5. assert(has-att(Komodo, foodtype(Japanese, Latin American)))

What is needed to justify a recommendation?

- BA and VM had Komodo at top of ranking, but for different reasons.
- CK had Bond Street at top of ranking
- Setting $z$ threshold at 0.3 lets through only those attribute-values that exceed that threshold for that user.

<table>
<thead>
<tr>
<th>User</th>
<th>$Z$ value</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>CK</td>
<td>0.3</td>
<td>Bond Street has the best overall value among the selected restaurants. Bond Street has excellent food quality.</td>
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<tr>
<td>BA</td>
<td>0.3</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s price is $29. It’s a Japanese, Latin American restaurant.</td>
</tr>
<tr>
<td>VM</td>
<td>0.3</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s price is $29 and it has very good food quality.</td>
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</tbody>
</table>

Conciseness varies as $z$ threshold varies

- Outliers wrt attribute-values for this option
- Note order in which extra attribute-values are added.

<table>
<thead>
<tr>
<th>User</th>
<th>$Z$ value</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>1.5</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s a Japanese, Latin American restaurant.</td>
</tr>
<tr>
<td>BA</td>
<td>0.7</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s a Japanese, Latin American restaurant.</td>
</tr>
<tr>
<td>BA</td>
<td>0.3</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s price is $29. It’s a Japanese, Latin American restaurant.</td>
</tr>
<tr>
<td>BA</td>
<td>-0.5</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s price is $29 and it has very good service. It’s a Japanese, Latin American restaurant.</td>
</tr>
<tr>
<td>BA</td>
<td>-0.7</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s price is $29 and it has very good service and very good food quality. It’s a Japanese, Latin American restaurant.</td>
</tr>
<tr>
<td>BA</td>
<td>-1.5</td>
<td>Komodo has the best overall value among the selected restaurants. Komodo’s price is $29 and it has very good service, very good food quality and good decor. It’s a Japanese, Latin American restaurant.</td>
</tr>
</tbody>
</table>
Restaurant rankings: Japanese example

- Utilities computed from values and attribute weightings

<table>
<thead>
<tr>
<th>User</th>
<th>Restaurant</th>
<th>$U_h$</th>
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<tr>
<td>BA</td>
<td>Komodo</td>
<td>77</td>
<td>22(10)</td>
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<td>90(2)</td>
<td>90(36)</td>
<td></td>
</tr>
<tr>
<td>BA</td>
<td>Japonica</td>
<td>71</td>
<td>18(7)</td>
<td>15(3)</td>
<td>37(16)</td>
<td>90(2)</td>
<td>90(36)</td>
<td></td>
</tr>
<tr>
<td>BA</td>
<td>Takahachi</td>
<td>71</td>
<td>21(1)</td>
<td>17(0)</td>
<td>14(2)</td>
<td>27(15)</td>
<td>90(2)</td>
<td>90(36)</td>
</tr>
<tr>
<td>BA</td>
<td>Shabu-Tatsu</td>
<td>70</td>
<td>18(1)</td>
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<td>31(17)</td>
<td>90(2)</td>
<td>90(36)</td>
<td></td>
</tr>
<tr>
<td>BA</td>
<td>Bond Street</td>
<td>68</td>
<td>18(1)</td>
<td>15(3)</td>
<td>31(17)</td>
<td>90(2)</td>
<td>90(36)</td>
<td></td>
</tr>
<tr>
<td>BA</td>
<td>Dojo</td>
<td>66</td>
<td>12(0)</td>
<td>8(1)</td>
<td>14(23)</td>
<td>90(2)</td>
<td>90(36)</td>
<td></td>
</tr>
<tr>
<td>CK</td>
<td>Bond Street</td>
<td>63</td>
<td>25(34)</td>
<td>19(3)</td>
<td>22(2)</td>
<td>51(11)</td>
<td>50(12)</td>
<td></td>
</tr>
<tr>
<td>CK</td>
<td>Japonica</td>
<td>50</td>
<td>23(29)</td>
<td>18(3)</td>
<td>15(1)</td>
<td>37(7)</td>
<td>50(12)</td>
<td></td>
</tr>
<tr>
<td>CK</td>
<td>Komodo</td>
<td>50</td>
<td>22(26)</td>
<td>19(2)</td>
<td>29(8)</td>
<td>50(7)</td>
<td>50(12)</td>
<td></td>
</tr>
<tr>
<td>CK</td>
<td>Takahachi</td>
<td>54</td>
<td>18(24)</td>
<td>17(2)</td>
<td>11(1)</td>
<td>27(8)</td>
<td>50(7)</td>
<td>50(12)</td>
</tr>
<tr>
<td>CK</td>
<td>Shabu-Tatsu</td>
<td>52</td>
<td>16(22)</td>
<td>13(1)</td>
<td>31(7)</td>
<td>50(7)</td>
<td>50(12)</td>
<td></td>
</tr>
<tr>
<td>CK</td>
<td>Dojo</td>
<td>30</td>
<td>15(10)</td>
<td>12(1)</td>
<td>8(0)</td>
<td>14(10)</td>
<td>50(7)</td>
<td>50(12)</td>
</tr>
</tbody>
</table>

Conciseness varies as z threshold varies

- Outliers wrt attribute-values for this option
- Note order in which extra attribute-values are added.

Comparisons - option selection

(1) If the number of restaurants is greater than 5 then
   (1a) Select the restaurant options $R_i$ that are positive outliers for overall utility (outstanding restaurants). Add a claim $C_j$ to the content plan that the elements of the set $R_i$ have outstanding value.
   (1b) If there are no outstanding restaurants, select the 5 highest ranked restaurant options $R_i$ for overall utility $U_h$. Add a claim $C_j$ to the content plan that the elements of the set $R_i$ are the top 5 in overall value.

Comparisons - content selection

(1) For each option $R_i$, for each attribute $a_i$
   (1a) If the weighted attribute value $v_i$ is an outlier when compared against the weighted attribute value for other options, then add attribute to $\text{OUTLIER-LIST}$.
(2) For each option $R_i$, for each attribute $a_i$ in $\text{OUTLIER-LIST}$, add an assertion $s_i$ to the content plan that $R_i$ has the attribute value $v_i$, and a relation that $s_i$ elaborates on the claim $C_j$.
(3) For each assertion $s_i$ about an attribute $a_i$, add a contrast relation to the content plan with the $s_i$ as joint nuclei.
Content selection and parallelism

- Different numbers of options meet \( z \) threshold for different users

<table>
<thead>
<tr>
<th>User</th>
<th>( z )-value</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>CK</td>
<td>0.3</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Bond Street’s price is $51. It has excellent food quality, good service and very good decor. It’s a Japanese, Sushi restaurant. Japonica’s price is $37. It has excellent food quality, good service and decent decor. It’s a Japanese, Sushi restaurant. Komodo’s price is $29. It has very good food quality, very good service and good decor. Takahashi’s price is $27. It has very good food quality, good service and decent decor.</td>
</tr>
<tr>
<td>VM</td>
<td>0.3</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Komodo’s price is $29. It has very good food quality, very good service and good decor. Takahashi’s price is $27. It has very good food quality, good service and decent decor.</td>
</tr>
<tr>
<td>BA</td>
<td>0.3</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Komodo has very good service, very good food quality and good decor.</td>
</tr>
</tbody>
</table>

From content to a text plan: recommendation

- Recommendation is easy:
  - Each attribute-value helps justify selection:
    • Nucleus plus multiple satellites

```
strategy: recommend
items: Komodo, Takahashi, Shabu-Tatsu, Bond Street, Dojo
relations: justify(nuc:1;sat:2); justify(nuc:1;sat:3); justify(nuc:1;sat:4); justify(nuc:1;sat:5)
content: 1. assert(best(Komodo))
          2. assert(has-att(Komodo, cost(29)))
          3. assert(has-att(Komodo, foodquality(verygood)))
          4. assert(has-att(Komodo, service(verygood)))
          5. assert(has-att(Komodo, foodtype(Japanese, Latin American)))
```

From content to a text plan: comparison

- Not quite so simple for comparison
  - Need Contrast (somewhere …)

```
strategy: compare
items: Komodo, Takahashi, Japonica, Shabu-Tatsu, Bond Street, Dojo
relations: elaboration(nuc:1, sat:2); elaboration(nuc:1, sat:3); elaboration(nuc:1, sat:4); elaboration(nuc:1, sat:5); elaboration(nuc:1, sat:6); elaboration(nuc:1, sat:7); elaboration(nuc:1, sat:9); elaboration(nuc:1, sat:9); contrast(nuc:2, nuc:3); contrast(nuc:4, nuc:5); contrast(nuc:6, nuc:7); contrast(nuc:8, nuc:9)
content: 1. assert(exceptional(Komodo’s, Takahashi’s))
          2. assert(has-att(Komodo, cost(29)))
          3. assert(has-att(Takahashi’s, cost(27)))
          4. assert(has-att(Komodo, service(verygood)))
          5. assert(has-att(Takahashi’s, service(good)))
          6. assert(has-att(Komodo, decor(good)))
          7. assert(has-att(Takahashi’s, decor(decent)))
          8. assert(has-att(Komodo, foodquality(verygood)))
          9. assert(has-att(Takahashi’s, foodquality(good)))
```
Some text plans work for limited amounts of data only …

<table>
<thead>
<tr>
<th>Z</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Kamode has very good service.</td>
</tr>
<tr>
<td>0.7</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Kamode has very good service and good decor.</td>
</tr>
<tr>
<td>0.3</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Kamode’s price is $29. It has very good food quality, very good service and good decor. Takahachi’s price is $27. It has very good food quality, very good service and decent decor.</td>
</tr>
<tr>
<td>0.94</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Kamode’s price is $29. It has very good food quality, very good service and good decor. Takahachi’s price is $27. It has very good food quality, very good service and decent decor. Japonesa’s price is $31. It has excellent food quality, good service and decent decor.</td>
</tr>
<tr>
<td>0.7</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Kamode’s price is $29. It has very good food quality, very good service and good decor. Takahachi’s price is $27. It has very good food quality, good service and decent decor. Japonesa’s price is $31. It has very good food quality, good service and decent decor. Shabu-Tate’s price is $31. It has very good food quality, good service and decent decor.</td>
</tr>
<tr>
<td>0.7</td>
<td>Among the selected restaurants, the following offer exceptional overall value. Kamode’s price is $29. It has very good food quality, very good service and good decor. Takahachi’s price is $27. It has very good food quality, good service and decent decor. Japonesa’s price is $31. It has very good food quality, good service and decent decor. Shabu-Tate’s price is $31. It has very good food quality, good service and decent decor. Bond Street’s price is $31. It has excellent food quality, good service and very good decor. Dojo’s price is $31. It has decent food quality, mediocre service and mediocre decor.</td>
</tr>
</tbody>
</table>

29

So, what are the text structural options?

strategy: compared
items: Above, Carmine’s
relations: elaboration(nuc1,sat:2); elaboration(nuc1,sat:3); elaboration(nuc1,sat:4); elaboration(nuc1,sat:5); elaboration(nuc1,sat:6); elaboration(nuc1,sat:7); contrast(nuc2,nuc:5); contrast(nuc1,nuc:7)
content: 1. assert(exceptional(Above,Carmine’s))
2. assert(has-att(Above, decor(good))))
3. assert(has-att(Carmine’s, decor(decent))))
4. assert(has-att(Above, service(good))))
5. assert(has-att(Carmine’s, service(good))))
6. assert(has-att(Above, cuisine(New American))))
7. assert(has-att(Carmine’s, cuisine(Italian))))

30

Some text plans are seemingly better than others …

<table>
<thead>
<tr>
<th>All Realization</th>
<th>A</th>
<th>B</th>
<th>AVG</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Human ratings:</td>
<td>1 = worst, 5 = best</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ILEX: Informal learning in the museum

ILEX: a generated page

A Silver Metal, Gold And Mahogany Brooch

Silver, gold, mahogany, walnut and pewter. Martin Page, 1998. Price: showing unknown. This is a brooch and was made by Martin Page. It is also in the Organic style. It was made in 1998. Although Organic style jewels usually have a coarse texture this jewel has smooth surfaces. Organic style jewels usually draw on natural themes for inspiration; for instance the previous item uses natural pearls. Organic style jewels are usually encrusted with gems; for instance the previous item has silver links encrusted asymmetrically with pearls and diamonds. Other jewels in the style include:

- a Bjorn Weckstrom pendant-necklace
- a Frances Beck finger ring
- a Jacqueline John finger ring
- a Kirdyindy finger ring
- an Enresyl finger ring
- a Gillian Pethard finger ring
- a John Donald brooch

ILEX: a generated page (close-up)

This jewel is a brooch and was made by Martin Page. It is also in the Organic style. It was made in 1998. Although Organic style jewels usually have a coarse texture this jewel has smooth surfaces. Organic style jewels usually draw on natural themes for inspiration; for instance the previous item uses natural pearls. Organic style jewels are usually encrusted with gems; for instance the previous item has silver links encrusted asymmetrically with pearls and diamonds. Other jewels in the style include:

- a Bjorn Weckstrom pendant-necklace
- the previous item
- a Frances Beck finger ring
- a Jacqueline John finger ring
- a Kirdyindy finger ring
- an Enresyl finger ring
- a Gillian Pethard finger ring
- a John Donald brooch
ILEX: possible and preferred discourse structures

- ILEX uses a bottom-up text structuring with rhetorical relations, but does not require whole discourse to be connected via RR (compare Marcu 1997.)
- On top of the rhetorical/focussing model, we propose a set of evaluation heuristics to rank possible text structures:
  - Avoid entity chains that are very short
  - Prefer a resumption which is close to the fact which introduces it over one which is distant.
  - Prefer entity-chains whose order of appearance is the same as the order of the facts which introduced them.
  - Disprefer two entity-chains with the same focus.

ILEX: a generated example

- (1) This piece is a necklace. (2) It was designed by a jeweller called Jessie King. (3) It was designed in 1905. (4) It is made of silver and enamel.
- (5) Jessie King was a famous designer. (6) She was Scottish, (7) but she worked in London. (8) It was in London that this piece was made.
- (9) Like the previous piece, (10) this piece is in the Arts-and-Crafts style. (11) Although the previous piece had a simple shape, (12) Arts-and-Crafts style jewels tend to be elaborate; (13) for instance, this piece has detailed florals.
- Note the resumption from (5-8) back to (1-4)

(Sidenote) M-PIRO: a front page

(Sidenote) NLG: we speak your language
Final point: Does a single text plan get a single sentence plan?

- Anticipating lectures on sentence planning ...
Single text plan, multiple sentence plans

- Who says the core claim comes first?

**PERIOD-justify**

**PERIOD-infer**

**WITH-NS-infer**

**PERIOD-infer**

**assert-reco-best**

**assert-reco**

food-quality

**assert-reco**

service

**assert-reco**

price

Another dimension of variation ...

back to the user!

**relations-justify(nuc1; sat:2); justify (nuc1; sat:3 ); justify(nuc1; sat:4); justify(nuc1; sat:5)**

**content:**
1. assert(best (Chapen Thai))
2. assert(is (Chapen Thai, cuisine(Thai)))
3. assert(has-att(Chapen Thai, food-quality(good)))
4. assert(has-att(Chapen Thai, service(good)))
5. assert(is (Chapen Thai, price(24 dollars)))

Summary

- Content planning takes goals and user models, and selects and organises content.
- Selection and structuring can be top-down or bottom-up:
  - Goal directly drives structure; or structure emerges from possible connections among content.
- Even when content is fixed, multiple text structures are possible.
  - Not all relations need be expressed.
- Even when subset of relations is chosen, some text structures are “better” than others
  - And sometimes the difference is (only) in the eye of user
- Even when text plan is chosen, multiple sentence plans are possible.
- Variation is the spice of NLG.
From content to a text plan: recommendation

- Recommendation is easy:
  - Each attribute-value helps justify selection:
    - Nucleus plus multiple satellites

<table>
<thead>
<tr>
<th>strategy</th>
<th>recommend</th>
</tr>
</thead>
<tbody>
<tr>
<td>items</td>
<td>Komodo, Japonica, Takahashi, Shabu-Tatsu, Bend Street, Dojo</td>
</tr>
<tr>
<td>relations</td>
<td>justify(nuc:1:sat:2); justify(nuc:1:sat:3); justify(nuc:1:sat:4); justify(nuc:1:sat:5)</td>
</tr>
<tr>
<td>content</td>
<td>1. assert(best(Komodo))</td>
</tr>
<tr>
<td></td>
<td>2. assert(has-att(Komodo, cost(20)))</td>
</tr>
<tr>
<td></td>
<td>3. assert(has-att(Komodo, foodquality(verygood)))</td>
</tr>
<tr>
<td></td>
<td>4. assert(has-att(Komodo, service(verygood)))</td>
</tr>
<tr>
<td></td>
<td>5. assert(has-att(Komodo, foodtype(Japanese,Latin American)))</td>
</tr>
</tbody>
</table>