Grammar Transformations: Using Composite Grammars to Understand Hybridity in Design

With an Example from Medieval Islamic Courtyard Buildings

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Outline

- Hybridity
- Related work
- Composite grammars
- Caravanserai ‘composite’ grammar example
Hybridity

- ‘Blending of two diverse traditions into something heterogeneous in composition’
- Cultural & linguistic forms
- Often an outcome of colonialism
- Current buzzwords: multiculturalism, syncretism, creolisation
Hybridity in contemporary art

Enid Ratnam Keese (1995)
Malaysian & Australian
Hybridity in Asian architecture

India: Jehangiri Mahal (16th C.) (Hindu & Islamic)

Thailand: Chakkri Hall (1882) Siamese and European ‘classical’ elements

India: Victoria Memorial Hall (1902-21) (Indo-Saracenic)

Britain: Royal Pavilion, Brighton (1808) (Indo-Saracenic)
Related work

- Grammar transformations (Knight 1994)
- Redesign via grammar transformations (Chase / Liew 2001)
- ‘Genetic’ hybrid designs (Schnier & Gero 1998)
- Caravanserai grammar (Ahmad 2004)
- Structure grammars (Carlson & Woodbury 1992)
Stylistic change: Prairie to Usonian

(Knight 1994)
‘Genetic’ hybrids

(Schnier & Gero 1998)
Caravanserai grammar

(Ahmad 2004)
Composite grammars

- Analogy in natural language
  - borrowing, e.g. English borrows from French & Latin

- Creole languages
  - Structure & vocabulary from different source languages
  - Amharic: semitic vocabulary & non-semitic syntax

- Structure grammars (Carlson & Woodbury 1992)
Structure grammars (Carlson & Woodbury 1992)

Structure & Motif
Structure grammars (2)
# Composite grammar 1

<table>
<thead>
<tr>
<th>Shapes</th>
<th>Spatial Relation</th>
<th>Initial Shape</th>
<th>Rule</th>
<th>Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Grammar A Shapes" /></td>
<td><img src="image2" alt="Grammar A Spatial Relation" /></td>
<td><img src="image3" alt="Grammar A Initial Shape" /></td>
<td><img src="image4" alt="Grammar A Rule" /></td>
<td><img src="image5" alt="Grammar A Designs" /></td>
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<td><img src="image6" alt="Grammar B Shapes" /></td>
<td><img src="image7" alt="Grammar B Spatial Relation" /></td>
<td><img src="image8" alt="Grammar B Initial Shape" /></td>
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<td><img src="image11" alt="Composite Grammar 1 Shapes" /></td>
<td><img src="image12" alt="Composite Grammar 1 Spatial Relation" /></td>
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## Composite grammar 2

<table>
<thead>
<tr>
<th>Shapes</th>
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<th>Initial Shape</th>
<th>Rule</th>
<th>Designs</th>
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</thead>
<tbody>
<tr>
<td>Grammar A</td>
<td>![Shape A]</td>
<td>![Initial Shape A]</td>
<td>![Rule A]</td>
<td>![Designs A]</td>
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<tr>
<td>Grammar B</td>
<td>![Shape B]</td>
<td>![Initial Shape B]</td>
<td>![Rule B]</td>
<td>![Designs B]</td>
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<tr>
<td>Composite</td>
<td>![Composite A]</td>
<td>![Initial Shape Composite]</td>
<td>![Rule Composite]</td>
<td>![Designs Composite]</td>
</tr>
</tbody>
</table>

![Composite Grammar 2 Diagram]
## Composite grammar 3

<table>
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<th>Shapes</th>
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<tr>
<td><img src="image" alt="Composite Grammar 3 Shapes" /></td>
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<td><img src="image" alt="Composite Grammar 3 Rule" /></td>
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Creation of composite grammars

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<td>Grammar A</td>
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<tr>
<td>Composite 1</td>
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<tr>
<td>Composite 2</td>
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<tr>
<td>Composite 3</td>
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Caravanserais

- Rest house/ Inn
- Primary elements
  - courtyard, cells, corner towers, bastions, entrances

_Ribat e Karim_
Medieval caravanserai
Caravanserais

Dair-i-Gachin

Ribat-i-karim

Darzin-Fort

Ribat-i-sharif_1154AD

Ribat-i-Sipanj
Roman fortifications

Fort Eski Hisar
Fort Qasr al Quwaira
Fort Mughayir
Fort Khirbat al Khan
Parthian houses

Merv, 9th-11th c

Merv, 9th-11th c

Merv, 11th-12th c.

Reconstruction of a Palatial residence
Caravanserai ‘hybrid’ language

Language A
Fortifications

Language B
Parthian houses

Language C (Hybrid)
Caravanserais
Grammar rules

<table>
<thead>
<tr>
<th></th>
<th>Grammar A</th>
<th>Grammar B</th>
<th>Grammar C</th>
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<tr>
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<tr>
<td><strong>Orthogonal Bay Development</strong></td>
<td><img src="image4.png" alt="Development" /></td>
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<td><img src="image6.png" alt="Development" /></td>
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<td><strong>Corner Tower Definitions</strong></td>
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<td><img src="image8.png" alt="Definitions" /></td>
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# Grammar rule sets

<table>
<thead>
<tr>
<th>Rule sets</th>
<th>I. Interior</th>
<th>II. Exterior</th>
<th>III. Articulation</th>
<th>Term.</th>
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<tbody>
<tr>
<td></td>
<td>Central space</td>
<td>Orthog. cell</td>
<td>Corner cell</td>
<td>Cell division</td>
</tr>
<tr>
<td>A Forts</td>
<td></td>
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<tr>
<td>B Parthian houses</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<tr>
<td>C Caravan serais</td>
<td>●</td>
<td>●</td>
<td>●</td>
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Summary

- Contributions
  - Analysis of the historic evolution of hybrid designs
  - Generation of new styles through conscious mergers and transformations
- Future work
  - Blending dissimilar grammars/languages
  - Genetic approaches