ARTICULATING ELEGANCE

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Princeton University

WORKSHOP ON
ADVANCING THE DISSEMINATION OF THE CREATIVE ART OF STRUCTURAL/CIVIL ENGINEERING
PRINCETON UNIVERSITY – JUNE 3-5 2015
COMPARATIVE CRITICAL ANALYSES

Scientific: form and materials
    cantilever, column and arch

Social: costs and utility
    construction cost, capacity and maintenance

Symbolic: appearance and meaning
    form, details and ideas
Iron Bridge vs. Craigellachie

**efficiency:** semi-circular vs. “parabolic”
100 foot span vs. 150 foot span
-------     1/3 less material

**economy:** many parts vs. mass production
Symbolic:
Iron Bridge vs. Craigellachie

Curve = semi-circular vs. “parabolic”
  arch       arch

Shape = mutilated… vs. …..unbroken

Spandrel = circles… vs. ….triangles
  décor     for support
## Britannia vs. Saltash

<table>
<thead>
<tr>
<th></th>
<th>Efficiency: Hollow Box</th>
<th>Lenticular</th>
</tr>
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<tbody>
<tr>
<td>Span</td>
<td>460 foot span</td>
<td>455 foot span</td>
</tr>
<tr>
<td>Weight/foot</td>
<td>7000 #/foot</td>
<td>4700 #/foot</td>
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<table>
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<tr>
<th></th>
<th>Economy: £ 198./foot</th>
<th>£ 102./foot</th>
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<tr>
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<th>Elegance: Closed Form</th>
<th>Open Form</th>
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<tr>
<td></td>
<td>Unexpressive</td>
<td>Ambiguous</td>
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68B
Pia Maria Bridge (160 m)
1877 – **deck merges** into the top of arch

Garabit Viaduct (165 m)
1884 – **deck is above** the arch
Pia Maria Bridge (160 m)
1877 – deck merges into the top of arch

Garabit Viaduct (165 m)
1884 – deck is above the arch
Garabit Viaduct (165 m)

- Separate pier
- Hinged support

Müngstener (170 m)
(NOT Eiffel)

- Pier into arch
- Fixed support
Garabit Viaduct (165 m)

Müngstener (170 m)  
(NOT Eiffel)
Garabit Viaduct (165 m)
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<th><strong>Bayonne</strong> (Ammann)</th>
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<td>span</td>
<td>977 ft</td>
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<td>loads</td>
<td>train (24 k/ft)</td>
<td>car (7 k/ft)</td>
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<td>37.0 million lb</td>
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<td>arch profile</td>
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<td>constant</td>
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image: Dave Frieder/Wikipedia commons
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International Orange

Wikimedia commons/public domain
Navy’s idea!

International Orange
Architect: Irving Morrow
Art Deco
Facade conceals the structure

Architect: Irving Morrow
Art Deco
Façade conceals the structure

Architect: Irving Morrow
Art Deco

Art Deco Piers by arch
If the GGB towers had the form of the VNB towers, the GGB bridge would be:

(A) More elegant  
(B) Less elegant  
(C) Equally elegant  
(D) Equally ugly
bridge in CA (not Menn)
Both bridges are efficient and economical. Both are elegant (subjective). What are the visual differences between these bridges that could be used to argue that Felsenau is more elegant than the CA bridge?

*Take a minute, come to a consensus with your neighbor, and then type/text response*

PollEv.com/cee262 OR
Text CEE262 to 37607 once to join then type response.
What advantages (scientific, social, or symbolic) does Menn’s design proposal have over Piguet’s design proposal for the Felsenau Bridge? Take a minute, come to a consensus with your neighbor, and then type/text response.

PollEv.com/cee262 OR
Text CEE262 to 37607 once to join then type response.
Some advantages to Menn’s design:

- No column/pier in the river (economical)
- Fewer piers (economical, efficiency of material, elegance of transparency – less clutter of piers)
- Symmetry about the valley (not river)
Creativity does not necessarily take a lot of money. Creativity is not proportional to the amount of money spent.
Which bridge is more attractive?

A. Alamillo
B. Barqueta
C. Both are equally attractive
D. Both are equally ugly
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<th>ALAMILLO</th>
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<td><strong>Scientific (form)</strong></td>
<td>tied arch (bowstring)</td>
<td>‘incomplete’ cable-stayed</td>
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<td><strong>Social (cost)</strong></td>
<td>$2,400/m²</td>
<td>$19,800/m²</td>
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<td><strong>Symbolic (aesthetics)</strong></td>
<td>quiet, humble</td>
<td>loud, showy</td>
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Alamillo Bridge (Calatrava)

Barqueta Bridge (Arenas)
B.P. Station, Deitingen (1968)
Kresge Auditorium (MIT)  
(not Isler – sliced dome, construction & maintenance issues)

B.P. Station, Deitingen (1968)  
(Isler – hanging membrane)
Kresge Auditorium (MIT)
(not Isler – sliced dome, construction & maintenance issues)
Kresge Auditorium (MIT)
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