housing for a changing climate

Peter Keyes
winter spring 2020
Arch 4/585/6 comprehensive studio
Studio premises

• the hope for a “sustainable” built environment is gone. Climate change is happening faster and stronger than we expected.
• architects need to focus on resilient shelter - to help humans (and perhaps civilization) survive what is coming.
• need to change typical patterns of building.
• housing & settlement pattern are critical
• design responds to global parameters - technology, production, economics, environment, society, demographics
• this response leads to clear housing types
• these types should then be adapted to local (environment, site, market, program) conditions
• whys and hows: a clear set of intentions should be complemented by strong technical knowledge and capability
housing which:

builds upon the cultural knowledge of the past (typology)

is feasible to build in the present (current practices and economics)

anticipates the conditions and problems of the future (triple bottom line and climate change)
principles for studio process

- this is a comprehensive studio - students will be expected to use, build upon and integrate the knowledge they have gained in prior courses (especially technology courses).
- the required fall term Resilient Housing class will provide an overview of housing design issues and constraints.
- considerations of environmental performance goals, resilient design strategies and quantitative energy analyses must be present from early in the winter term. Studio funds are being sought to engage experts who are already working on resilience.
- this studio is geared towards first producing a kit-of-parts, which will then be applied to individual project design (as well as future projects in your career).
- individual programs will be developed by students - focussed on housing, not other uses.
- climate zone and site selection determined by individual students.
- the final project will comprise both an architectural design proposal, and documentation of quantitative analyses of economic, energy and environmental performance.
The typical terminal studio process involves the following steps:

**Fall Term**
- **Site**
- **Analysis**
- **Program**

**First Term**
- **Parti**
- **Schematic Design**

**Second Term**
- **Design Development:** Building systems, major spaces / units, details
<table>
<thead>
<tr>
<th><strong>global / societal</strong></th>
<th>demographics</th>
<th>real estate industry</th>
<th>development processes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>region</strong></td>
<td>market</td>
<td>transit / services</td>
<td></td>
</tr>
<tr>
<td><strong>district</strong></td>
<td>feasibility</td>
<td>zoning</td>
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<tr>
<td><strong>neighborhood</strong></td>
<td>site selection</td>
<td>site constraints</td>
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<td><strong>block</strong></td>
<td>site design</td>
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<td><strong>site</strong></td>
<td>building type</td>
<td>building code</td>
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<tr>
<td><strong>building</strong></td>
<td>construction type</td>
<td>accessibility</td>
<td>economic pro-forma</td>
</tr>
<tr>
<td><strong>cluster</strong></td>
<td></td>
<td>household needs</td>
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<tr>
<td><strong>unit</strong></td>
<td></td>
<td>unit type</td>
<td></td>
</tr>
<tr>
<td><strong>room</strong></td>
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<td></td>
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<tr>
<td><strong>space</strong></td>
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</tbody>
</table>

**fall term - resilient housing class**
Resilient housing course

Student research team topics

Earthquakes
Floods
Severe storms
Droughts
Famines
Increased temperatures
Wildfires
Water supply and waste processing
Pandemics
Economic disruption or decline
Utility outages and disruption
Transportation and supply chain disruptions
Demographic changes and population shifts (refugees)
<table>
<thead>
<tr>
<th>Scale</th>
<th>Terms</th>
</tr>
</thead>
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<td>Global / Societal</td>
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<td>economic pro-forma, household needs, unit type</td>
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<tr>
<td>Space</td>
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</table>

**Kit of Parts**

- **Structure**
  - building type
  - building construction
  - cluster / outdoor
  - EC systems
  - unit types
- **Resilient Strategies**
  - resilient strategies
- **Room Partis**
  - room partis
- **Space / Shell**
  - oriented spaces

**Timeline**

- Fall Term
  - 4/585 studio
- Winter Term
  - conceptual design
1.1 oriented rooms: Playfulness | Humor | Variety | Connection | Shelter | Privacy | Light | Wind | Thermal Delight

2.1-2.4 occupant study: ONE & TWO PERSONS

1.2 room parti

Room of Celebration
Room of Transit
Room of Gathering
Room of Security
Room of Contemplation
Room of Arrival and Departure

2.1-2.4 occupant study: FAMILY & ROOM
4.1 cluster: ORIENTATION STUDY

Seasonal Strategy

Water Heating Backup System
- Domestic Hot Water Tank
- Solar Hot Water Panel
- PV Panel
- Compost Toilet
- Ventilator & Heat Exchange
- Rainwater Harvest
- Backup Pallet Burner
- Compost & Methane collector
- Geothermal Heating & Cooling System

3.1 structural system: CONCRETE DOUBLE ENVELOP W/ WOOD STUD PARTITIONS

3.2 mechanical system: DECENTRALIZE SYSTEMS w/ SEASONAL USAGE

Alexandra Yang            Winter 2013
Evan Goodwin - Winter term kit-of-parts

Winter 2015
<table>
<thead>
<tr>
<th>Global/Societal</th>
<th>Region</th>
<th>District</th>
<th>Neighborhood</th>
<th>Block</th>
<th>Site</th>
<th>Building</th>
<th>Cluster</th>
<th>Unit</th>
<th>Room</th>
<th>Space</th>
<th>Winter Term 4/585 Studio</th>
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<td>Site Selection</td>
<td>Structure</td>
<td>Building Type</td>
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<td>Unit Types</td>
<td>Passive Strategies</td>
<td>Room Partis</td>
<td>Space/Shell</td>
<td>Oriented Spaces</td>
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<tr>
<td>Winter Term 4/585 Studio</td>
<td>Spring Term 4/586 Studio</td>
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</table>
Caitlin Milson Gilman      a new suburban courtyard type 2011
PORTLAND SITE
On an urban Portland site, the clustered units address the street face. The shifted typology recalls the traditional courtyard house, while still maintaining a sense of individuality. The shift also addresses the need for on-street parking, as parking occurs between units.

EUGENE SITE
On the more suburban Eugene site, the clusters face inward toward each other. Density is still maintained, but the arrangement creates an intimate neighborhood.

SALEM: LOW-INCOME MODEL
Sustainability through futureproofing
Sustainability in low-income housing begins with futureproofing. Today, the market demands high-performance, affordable housing. Regulations for energy efficiency must be adhered to, but flexibility is key. Designing with an open, adaptable design allows for flexibility and future upgrades, such as adding solar panels or a rooftop garden.

SHIFT&CLUSTERING

GUTTER SYSTEM
MECHANICAL
VENTILATION
DAYLIGHT FACTOR
LUMINANCE FALSE COLOR
LUMINANCE CONTOURS
Ian Korn  passively ventilated housing in Manhattan  spring 2013
The Spaces In Between
Applying the Italian Town to Affordable Housing

Michelle Vander Heyden
Spring 2013
### Possible Water Collection

<table>
<thead>
<tr>
<th>Annual Rainfall</th>
<th>Max Surface Area</th>
<th>TOTAL Possible Water Collection per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 inch/yr</td>
<td>60,000 SF</td>
<td>40,000.00 ft^3/yr</td>
</tr>
<tr>
<td>0.6 ft/yr</td>
<td></td>
<td>299,220.80 gal/yr</td>
</tr>
</tbody>
</table>

### Domestic Water Usage w/ Toilets

#### Residential Water Use (gallons per capita per day) San Diego

<table>
<thead>
<tr>
<th>Category</th>
<th>US Average</th>
<th>Percentage</th>
<th>San Diego Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor</td>
<td>124.0 gal/day</td>
<td>58.00%</td>
<td>73 gal/day</td>
</tr>
<tr>
<td>Indoor - Potable</td>
<td>35.8 gal/day</td>
<td>21.70%</td>
<td>27 gal/day</td>
</tr>
<tr>
<td>Shower</td>
<td>11.6 gal/day</td>
<td>32.40%</td>
<td>9 gal/day</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>1.0 gal/day</td>
<td>2.79%</td>
<td>1 gal/day</td>
</tr>
<tr>
<td>Baths</td>
<td>1.2 gal/day</td>
<td>3.35%</td>
<td>1 gal/day</td>
</tr>
<tr>
<td>Faucets</td>
<td>10.9 gal/day</td>
<td>30.45%</td>
<td>8 gal/day</td>
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<tr>
<td>Other (ie. Leak)</td>
<td>11.1 gal/day</td>
<td>31.01%</td>
<td>8 gal/day</td>
</tr>
<tr>
<td>Indoor - Nonpotable</td>
<td>33.5 gal/day</td>
<td>20.30%</td>
<td>12 gal/day</td>
</tr>
<tr>
<td>Clothes Washer</td>
<td>13.0 gal/day</td>
<td>44.78%</td>
<td>12 gal/day</td>
</tr>
</tbody>
</table>

#### Total Indoor Use

- **Indoor Potable**: 6,901.20 gal/day
- **Indoor Non-potable**: 3,067.20 gal/day

#### Water Usage in Building Per Day w/o Toilets

<table>
<thead>
<tr>
<th># of Residential Occupants</th>
<th>Total Residential Use per day</th>
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<tr>
<td></td>
<td>Total Indoor</td>
</tr>
<tr>
<td></td>
<td>Indoor Potable</td>
</tr>
<tr>
<td></td>
<td>Indoor Non-potable</td>
</tr>
<tr>
<td>256</td>
<td>9,968.40 gal/day</td>
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<tr>
<td></td>
<td>6,901.20 gal/day</td>
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#### Water Usage in Building Per Year w/o Toilets

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<td>Indoor Non-potable</td>
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<tr>
<td>256</td>
<td>3,638,466.00 gal/yr</td>
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<tr>
<td></td>
<td>2,518,938.00 gal/yr</td>
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<tr>
<td></td>
<td>1,119,528.00 gal/yr</td>
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#### Water Harvesting Potential Per Year w/ Toilets

<table>
<thead>
<tr>
<th>Total possible water collection per year</th>
<th>% of Total Indoor Use Per year</th>
<th>% of Total Indoor Potable usage per year</th>
<th>% of Total Indoor Non-Potable Usage per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>299,220.80 gal/yr</td>
<td>8.22%</td>
<td>11.88%</td>
<td>26.73%</td>
</tr>
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</table>
FOODSPACE
A FOOD-CENTERED, MICROENTREPRENEURIAL, AFFORDABLE CO-HOUSING COMMUNITY
olivia mae asuncion | instructor: peter keyes |
comprehensive thesis studio project |
university of oregon | 2015

finding a home
oakland, califo

OAKLAND’S DISTRICT
REDLINING IN 1950

OAKLAND’S 2010
DEMOGRAPHICS BY RACE
- African American
- Asian and Pacific Islander
- Hispanic and Latino
- White

MAP OF FOOD DESERTS
The shade of orange becomes more saturated as the area becomes more prone to unavailability of healthy food

Olivia Asuncion
Oakland food co-op housing
spring 2015
Case Study: Deep lot on West Amazon

R1 ZONING - 19,166 SF VACANT LOT

Clay Neal
SE Eugene “missing middle” infill
spring 2017