MARK CHAMBERLAIN
SD-7620-SP18 The Practice of Sustainable Design
April 22, 2018
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ABOUT THE COVER

The cover illustration is a photomerge of an image of Earth and ink moving through water. The word “green” is crossed out, and the word “good” has been added.

You might interpret the green ink as representative of climate change, water eutrophication or ecotoxicity. However, the main point of the illustration is that the term “green” is subjective and doesn’t help to define the desired state of the graphic design industry. If the green ink represents the negative impact produced by the industry, how does the state of “green” help us build the road map to the desired state?

It doesn’t.

An overarching goal of this project is to move toward “good.” “Good” graphic design is about looking at the whole-life system of visual communication products. Many graphic designers need to have their blinders removed for them to see the impacts they are helping to create as well as to see opportunities to understand better how these products do their job of communication and persuasion. Therefore, “good” graphic design is both effective in achieving the product goals and more eco-efficient.
WHY THIS PROJECT?

As a graphic designer, there have been many times I have talked about what I deliver in terms of schedule, budget, and quality.

I’ve said things to clients and co-workers similar to:

“If you need that tomorrow, it’s either going to cost you more or the quality will suffer.”

“If you give me more time, I can do a better job for you and save you money.”

Anyone delivering a product has constraints – things that limit the project outcome. If we look at the triple constraints in Figure 2 for graphic design projects, we see that there are limits to any project. Those limits created by the definition of the product scope play a critical role in the actual outcome because they put pressure on the other two aspects of the project management balancing act.²

A simple version of this is the joke, “Good, fast, and cheap; you can pick any two.”

The problem with this management system is that sustainability (mostly nature and people) are too often ignored in the definition of the product scope. We need to expand our system.

The reason I start with this concept is that I believe many graphic designers use this as their basic framework for the work they design and how they approach production.

However, the root problem with this perspective is that it separates the work of a graphic designer from the larger system through which the work flows. It even ignores the effectiveness of the created design in accomplishing the goal.

Taking that idea one step further, it ignores ecological and social impacts of what is being produced with very little framework or consideration around the responsibility of the designer to do no harm or at least minimize any harm.

Designers need to be able to see their work through multiple lenses.

AIGA’S THE LIVING PRINCIPLES ⁵

People Culture Economy Nature

Figure 3 – Living Principles Four Lenses ⁵
To arrive at our destination, we need to know where we are going. A critical first step is to answer the question, “What kind of graphic design should we be doing?”

To start to answer this question, we need to move past broad terms, such as “green” or “eco-friendly,” because they are ambiguous and fail to define what we are seeking to understand. In contrast, we can start with “sustainability” because we have foundational work we can build upon to better understand the complex challenges graphic designers face.

An influential definition was published in the Brundtland Report by the United Nations in 1987 and defines sustainability as meeting “the needs of the present without compromising the ability of future generations to meet their own needs.”

This definition is significant because it requires a broadening of the scale at which we need to look at graphic design. We need to examine all of the connected systems, as well as their products and impacts indefinitely into the future.

Another way to understand where we want to go is to use a framework. AIGA’s The Living Principles (modified triple-bottom-line) suggests a four-part approach which weaves together environmental protection, social equity, economic health, and cultural vitality. These parts become lenses that graphic designers can use to apply context to the impacts of their work and take action to avoid harmful effects.

While helpful, the Brundtland definition and Living Principles framework doesn’t provide an operational definition specific to graphic design.

"Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

WHAT IS SUSTAINABLE DESIGN?

Sustainable communication design is the application of sustainability principles to communication design practice. Practitioners consider the full life cycle of products and services, and commit to strategies, processes and materials that value environmental, cultural, social and economic responsibility.7

PRINCIPLES AND VALUES (ABRIDGED)

Encourage the evolution of the GDC and the graphic design practice by:

• acknowledging that we are part of an interdependent world;
• accepting responsibility for the consequences our actions have on our natural environment;
• developing and building sustainable strategies and practices;
• participating with the international design community in developing global best practices;
• working to create products and services that are re-usable and/or provide long term value;
• and by purchasing recycled, local and non-toxic materials wherever possible.

Demonstrate our commitment to improve the natural environment by:

• integrating environmental criteria into all design processes and organizational decision making;
• employing accountable and transparent processes and procedures;
• reviewing our environmental impacts regularly and continually working to reduce them;
• adopting practices that use materials in continuous cycles;
• seeking suppliers who use sustainable practices;
• acting as community and industry advocates for environmentally-responsible design practices;
• and by developing and providing products and services that improve the quality of life of all beings and support the health and well-being of the planet.

Raise and foster awareness of sustainable communication design practice by:

• promoting the intrinsic and greater value of sustainable communication design;
• encouraging clients to integrate sustainable principles into their communication projects;
• providing education and information resources to our members and the community at large to inform environmentally responsible design decisions;
• and by championing sustainable communication solutions for our communities.7

LIVING PRINCIPLE’S

Mapping of framework

- Economy
- People
- Nature
- Culture
DEFINITION, FRAMEWORK AND PRINCIPLES

The Graphic Designers of Canada’s (GDC) definition, principles and values help to push our perspective of sustainable graphic design to a more practical and granular level.

The rough mapping of AIGA’s The Living Principles onto the principles and values of the GDC helps to show areas of strength and possible areas for improvement. There seems to be a primary focus on sustainability as it relates to nature and less emphasis on economic, people, and cultural sustainability. However, there were a few broad statements that addressed those areas.

What the GDC definition, principles and values help to do is push real change through encouraging extended producer responsibility, changing the products and services produced to be more sustainable, and advocating for more education. The whole product system is considered around the graphic designer, which is essential in making the kind of profound change required to achieving sustainability. Both upstream and downstream constituents are regarded in the GDC principles and values (see Figure 4).

The definition also allows for future evolution in the industry as our digital-designed environment changes through technological advances and the role of the graphic designer changes within that context. One significant impact of this change is the need to understand the different environmental effects as they relate to the various products.

![Figure 4 – Stakeholders upstream and downstream](image-url)
“One serious problem for designers is that, even with a systems approach, there are few tools in existence that wrap these issues together. Instead, designers must learn to match together a series of disparate approaches, understanding, and frameworks in order to build a complete solution.”

- Nathan Shedroff, author of “Design is the Problem”

DEFINING THE PROJECT

Sustainable graphic design is challenging. Even the definition is incomplete at best. However, good graphic design can be achieved through a community that is dedicated to sustainable principles and values. This project will examine a few products created for a conference event – a brochure, program booklet, and way-finding signs. Using a systems approach, we will explore the best options for each design project through a measured reduction in environmental impacts. The most significant design change will be recommended with its justification.
Like the GDC sustainable graphic design definition states, graphic designers need to understand the major parts of the full life cycle of products and services to be able to find key leverage points to affect change throughout the system.

Impacts from packaging and transport happen at almost every stage of manufacturing and product delivery.

Energy

Energy from power-grid that comes from biomass, coal, hydroelectric, natural gas, nuclear, wind, or solar. The production of this energy has various impacts, such as CO₂ emissions.
APPLYING INTEGRATIVE DESIGN PROCESS

Looking at the whole systems map, I want to know what leverage points and solutions I can find that could be then collected into an approach for graphic designers. See Appendix A for exploratory work.

My process is to look at three basic print examples that were part of an actual event and look at their impacts. If I can find a significant reduction in environmental impact, I can direct design work to make specific changes that maintain the project requirements and demonstrate a better ecological outcome. My hope is that I can find a specific modification to one of the items below. Once identified, I can explore design options.
MATERIAL BREAKDOWN

I looked at the three major print pieces created for a conference that was held on March 3, 2018. The first is a mailed brochure that was created a few months prior to the event. The second was the program booklet that was created for the event date. The last item was a sign created for the event date.

MATERIAL LIST:

BROCHURE SELF-MAILER (20,000 qty)
- Paper
- Ink
- Coatings
- Cardboard packaging
- Packaging tape

EVENT BOOKLET (1,300 qty)
- Paper
- Ink
- Staples
- Cardboard packaging
- Packaging tape

CONFERENCE ROOM SIGNAGE (25 qty)
- PVC substrate (Sintra)
- Ink (UV)
- Laminate (adhesive and polyfilm)
- Cardboard packaging
- Packaging tape

Note: My assumption is that the biggest environmental impacts will be the largest amounts of physical material. This assumption is based on the life cycle map and looking at the amounts of related impacts in the supply chain. I would guess the second biggest contributor would be any toxic material. I am guessing inks or the PVC board.

The next step is to break each piece down into more detail to identify parts that could embed a greater negative impact.

MATERIALS TO EXAMINE DEEPER

#1 Paper
#2 PVC board
MATERIAL: PAPER

The assumption is that the biggest environmental impact in a printed job comes from the largest amount of material. In this case, the paper used in the brochure creates the structure and surface for the printed information.

- Program Booklet – 17” x 11”, folds to 8.5” x 11” finish size (1,300 printed)
  Paper: Verso Anthem Plus 100# Dull Text (no 10% PCW option, FSC certified)

NATURAL ENVIRONMENT

<table>
<thead>
<tr>
<th>RAW MATERIAL EXTRACTION</th>
<th>MATERIAL PROCESSING</th>
<th>COMPONENT MANUFACTURING</th>
<th>ASSEMBLY &amp; PACKAGING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where does it come from?</td>
<td>VIRGIN</td>
<td>MATERIAL</td>
<td>PROCESS</td>
</tr>
<tr>
<td>Virgin Material</td>
<td>INPUT</td>
<td>INPUT</td>
<td>INPUT</td>
</tr>
<tr>
<td>Paper</td>
<td>Verso Anthem Plus 100# Dull Text (no 10% PCW option, FSC certified) 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Forests** (North America and regionally sourced)
  - **OUTPUT** Deformation
  - **INPUT** Energy to find, cut, and transport trees to mill
  - **Process** Chemical Pulping
  - **Detail** Energy: Heating, transport, etc.

- **OUTPUT** Habitat Destruction for many types of species
  - **INPUT** Chemicals needed in process to treat wood pulp
  - **OUTPUT** SLURRY – Wood pulp ready for paper production
  - **OUTPUT** Mill Broke – “waste” cellulose material that can re-enter the mill production process and used to make paper
  - **OUTPUT** Water eutrophication in harvest areas due to increased chemical run-off in affected areas
  - **INPUT** Water intensive process

- **OUTPUT** Watershed protection loss to deforestation
  - **INPUT** Reduced biodiversity to deforestation
  - **INPUT** Sodium hydroxide 5

- **OUTPUT** Increase in CO2 emissions to deforestation
  - **INPUT** Increase in CO2 emissions to deforestation
  - **INPUT** Sulfur dioxide which contributes to acid rain

- **OUTPUT** Decreased drought resiliency to deforestation
  - **INPUT** Oil and other chemicals needed to maintain equipment used in cutting trees (chainsaw, etc.)
  - **OUTPUT** Turpentine

- **OUTPUT** Accelerated soil erosion due to deforestation
  - **INPUT** Fresh water depletion
  - **INPUT** Ecotoxicity from chemicals released in pulping

- **OUTPUT** Oil and other chemicals needed to maintain equipment used in cutting trees (chainsaw, etc.)
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- **OUTPUT** Oil and other chemicals needed to maintain equipment used in cutting trees (chainsaw, etc.)
  - **INPUT** Ecotoxicity from chemicals released in pulping

- **INPUT** Chemical Pulping
  - **OUTPUT** Energy: Heating, transport, etc.

- **INPUT** Pulp skurry (from pulping)
  - **OUTPUT** Finished Paper (not cut)
  - **OUTPUT** Mill Broke – “waste” cellulose material that can re-enter the mill production process and used to make paper
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  - **INPUT** Fresh water depletion
  - **INPUT** Ecotoxicity from chemicals released in pulping
### MATERIAL: PAPER (CONTINUED)

<table>
<thead>
<tr>
<th>Process</th>
<th>Input/Output</th>
<th>Detail</th>
<th>Process</th>
<th>Input/Output</th>
<th>Detail</th>
<th>Process</th>
<th>Input/Output</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>OUT-PUT</td>
<td>Fossil fuel depletion</td>
<td>Brochure Mailing</td>
<td>INPUT</td>
<td>ENERGY: electricity, fuel for transport, sorting machines, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUT-PUT</td>
<td>Air pollution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INPUT</td>
<td>ENERGY: mostly in the form of fossil fuel based oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TRANSPORT / DISTRIBUTION / PURCHASE**

**CONSTRUCTION / INSTALLATION**

**USE PHASE**

**MAINTENANCE / UPGRADING**

**END OF LIFE SCENARIOS**

- Material Recycling OUTPUT: Residential recycling program. Because fibers are degraded through pulping process, only lower grade paper materials can be created.
- Landfill OUTPUT: The printed material is thrown in residential landfill collection system. Chemicals, as well as wood pulp, will be housed in a landfill. It will likely be an anaerobic environment and, thus, it will breakdown slowly.
- Incineration OUTPUT: For communities that have an incinerator, a potential outcome might mean burning of the paper and other chemicals on and in the paper sheet. Thus releasing toxic chemicals and ash into the air or filter.
MATERIAL: POLYVINYL CHLORIDE (PVC) SIGN BOARD

The large-format signs were printed directly onto a substrate made from moderately expanded closed-cell polyvinyl chloride (PVC). Common brand names are Sintra or Komatex.11

- Conference Room Signs - 25 qty (printed with UV inks on a flatbed inkjet printer)

<table>
<thead>
<tr>
<th>NATURAL ENVIRONMENT</th>
<th>RAW MATERIAL EXTRACTION</th>
<th>MATERIAL PROCESSING</th>
<th>COMPONENT MANUFACTURING</th>
<th>ASSEMBLY &amp; PACKAGING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin Material</td>
<td>Input</td>
<td>Output</td>
<td>Detail</td>
<td>Process</td>
</tr>
<tr>
<td>Gulf of Mexico, domestic crude, Canada, Saudi Arabia, Mexico</td>
<td>Crude Oil</td>
<td>INPUT</td>
<td>Energy to drill, for transport, trucks, trains, etc.</td>
<td>Polyvinyl Chloride (PVC foam)</td>
</tr>
<tr>
<td></td>
<td>OUTPUT</td>
<td>Habitat Destruction for many types of species</td>
<td>INPUT</td>
<td>Polyurea, phthalates, bisphenol A (BPA), lead</td>
</tr>
<tr>
<td></td>
<td>OUTPUT</td>
<td>Risk to habitat degradation due to oil spills</td>
<td>OUTPUT</td>
<td>dioxins are release in manufacturing, which are carcinogens</td>
</tr>
<tr>
<td></td>
<td>OUTPUT</td>
<td>Worker safety due to exposure to harmful chemicals</td>
<td>OUTPUT</td>
<td>Physically changed environment due to built oil infrastructure</td>
</tr>
<tr>
<td></td>
<td>OUTPUT</td>
<td>Oil spills, damage to marine life</td>
<td>OUTPUT</td>
<td>Exposure to PVC dust may cause asthma and affect lung function</td>
</tr>
<tr>
<td></td>
<td>OUTPUT</td>
<td>Ecotoxicity due to infrastructure of oil extraction process</td>
<td>OUTPUT</td>
<td>Heating the material releases hydrochloric acid and dioxins</td>
</tr>
<tr>
<td></td>
<td>OUTPUT</td>
<td>Worker safety due to exposure to harmful chemicals</td>
<td>OUTPUT</td>
<td>Physically changed environment due to built oil infrastructure</td>
</tr>
</tbody>
</table>

11 Conference Room Signs - 25 qty (printed with UV inks on a flatbed inkjet printer)
### MATERIAL: POLYVINYL CHLORIDE (PVC) SIGN BOARD (CONTINUED)

<table>
<thead>
<tr>
<th>TRANSPORT / DISTRIBUTION / PURCHASE</th>
<th>CONSTRUCTION / INSTALLATION</th>
<th>USE PHASE</th>
<th>MAINTENANCE / UPGRADING</th>
<th>END OF LIFE SCENARIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process</strong></td>
<td><strong>Process</strong></td>
<td><strong>Detail</strong></td>
<td><strong>Process</strong></td>
<td><strong>Detail</strong></td>
</tr>
<tr>
<td>Transportation</td>
<td>OUTPUT</td>
<td>Fossil fuel depletion</td>
<td>PRINTED MATERIAL OUTPUT</td>
<td>Some mild VOCs would be emitted to people near the printed items.</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>Air pollution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INPUT</td>
<td>ENERGy: mostly in the form of fossil fuel based oil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td><strong>Process</strong></td>
<td><strong>Detail</strong></td>
<td><strong>Process</strong></td>
<td><strong>Detail</strong></td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>OUTPUT</td>
<td>Recycling PVC is toxic and cannot be handled with other types of plastics.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Landfill</strong></td>
<td>OUTPUT</td>
<td>The printed material is thrown in residential landfill collection systems. PVC is very stable and takes many years to start to break down.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Incineration</strong></td>
<td>OUTPUT</td>
<td>Burning PVC foam board will release dioxins</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TRANSPORT / DISTRIBUTION / PURCHASE**
- **Process**: Transportation
- **Input/Output**: OUTPUT
- **Detail**: Fossil fuel depletion

**CONSTRUCTION / INSTALLATION**
- **Process**: PRINTED MATERIAL
- **Input/Output**: OUTPUT
- **Detail**: Some mild VOCs would be emitted to people near the printed items.

**USE PHASE**
- **Process**: Material Recycling
- **Input/Output**: OUTPUT
- **Detail**: Recycling PVC is toxic and cannot be handled with other types of plastics.

**MAINTENANCE / UPGRADING**
- **Process**: Landfill
- **Input/Output**: OUTPUT
- **Detail**: The printed material is thrown in residential landfill collection systems. PVC is very stable and takes many years to start to break down.

**END OF LIFE SCENARIOS**
- **Process**: Incineration
- **Input/Output**: OUTPUT
- **Detail**: Burning PVC foam board will release dioxins
TARGETED LIFE CYCLE ASSESSMENT

To better understand the actual impacts of the paper and PVC board, we will use a targeted life cycle assessment using information from the Okala Impact Factors. Along with the baseline information for what was used in the original product, alternatives will be compared to uncover options with better results.

#1 Paper for Event Booklet

#2 PVC Board for Event Signs
Baseline Scenario

**EVENT BOOKLET PAPER**

**SYSTEM BOUNDARY //**
Raw materials, manufacturing, use, and end-of-life

**FUNCTIONAL UNIT //**
This assesses one conference booklet that was used for a one-day conference with an estimated delivery of 16 hours of service. The functional unit is an hour of use.

**Notes and References**
1. The lifespan is based on the actual use of the booklet for a two-day conference and then it was disposed.
2. Assuming no electricity during use phase.
3. The weight is based on actual measurements.
4. Assuming that the virgin wood was sourced in Canada. Will use the distance from Vancouver to Minneapolis via truck transport is 1,792 miles. 13
5. To calculate the ton-miles, I took 17 pounds and converted it into tons, which equals 0.00027 tons and then multiplied that by the number of miles for each transportation type.
6. Assuming incineration end of life because it will be disposed of in Minneapolis.
Okala Impact Assessment Form

**SYSTEM BOUNDARY //**
Raw materials, manufacturing, use, and end-of-life

**FUNCTIONAL UNIT //**
This assesses one conference booklet that was used for a one-day conference with an estimated delivery of 16 hours of service. The functional unit is an hour of use.

Notes and References
1. The lifespan is based on the actual use of the booklet for a two-day conference and then it was disposed.
2. Assuming no electricity during use phase.
3. The weight is based on actual measurements.
4. Assuming that the virgin wood was sourced in Canada. Will use the distance from Vancouver to Minneapolis via truck transport is 1,792 miles.\(^1\)\(^2\)
5. To calculate the ton-miles, I took 0.17 pounds and converted it into tons, which equals 0.00027 tons and then multiplied that by the number of miles for each transportation type.
6. Assuming incineration end of life because it will be disposed of in Minneapolis.

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**BILL-OF-MATERIALS**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>AMOUNT</th>
<th>UNIT</th>
<th>OKALA FACTOR</th>
<th>UNIT</th>
<th>OKALA IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycled Paper</td>
<td>0.17</td>
<td>pound</td>
<td>0.97</td>
<td>pound</td>
<td>0.16</td>
</tr>
<tr>
<td>Electricity</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck Transport</td>
<td>0.15</td>
<td>ton-miles</td>
<td>0.32</td>
<td>ton-mile</td>
<td>0.049</td>
</tr>
<tr>
<td>Incineration</td>
<td>0.17</td>
<td>pounds</td>
<td>0.012</td>
<td>pounds</td>
<td>0.002</td>
</tr>
</tbody>
</table>

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**Alternative Scenario: Booklet paper**

**RECYCLED PAPER**
Baseline Scenario: Sign substrate

**PVC CONFERENCE SIGN**

**SYSTEM BOUNDARY**
Raw materials, manufacturing, use, and end-of-life

**FUNCTIONAL UNIT**
This assesses one conference booklet that was used for a one-day conference with an estimated delivery of 16 hours of service. The functional unit is an hour of use.

**Notes and References**
1. The lifespan is based on the actual use of the sign for a two-day conference and then it was disposed.
2. Assuming no electricity during use phase.
3. Distance from board manufacturer in Shanghai to Vancouver is 5,853 miles.
4. Distance from Vancouver to Minneapolis via truck transport is 1,792 miles.
5. To calculate the ton-miles, I took 1.2 pounds and converted it into tons, which equals .0006 tons and then multiplied that by the number of miles for each transportation type.
6. Assuming incineration end of life because it will be disposed of in Minneapolis.
Alternative Scenario: Sign substrate

PVC BOARD TO LANDFILL

SYSTEM BOUNDARY //
Raw materials, manufacturing, use, and end-of-life

FUNCTIONAL UNIT //
The conference sign delivered 16 hours of service.
The functional unit is an hour of use.

Notes and References
1. The lifespan is based on the actual use of the sign for a two-day conference and then it was disposed.
2. Assuming no electricity during use phase and none accounted for during manufacturing.
3. Distance from board manufacturer in Shanghai\(^\text{17}\) to Vancouver is 5,853 miles.\(^\text{18}\)
4. Distance from Vancouver to Minneapolis via truck transport is 1,792 miles.\(^\text{19}\)
5. To calculate the ton-miles, I took 1.2 pounds and converted it into tons, which equals 0.0006 tons and then multiplied that by the number of miles for each transportation type.
Alternative Scenario: Sign substrate

**REPLACE PVC WITH VIRGIN CARDBOARD**

**SYSTEM BOUNDARY**
Raw materials, manufacturing, use, and end-of-life

**FUNCTIONAL UNIT**
The conference sign delivered 16 hours of service.
The functional unit is an hour of use.

**Notes and References**

1. The lifespan is based on the actual use of the sign for a two-day conference and then it was disposed.
2. Assuming no electricity during use phase.
3. To calculate the different weight of the board, I measured cardboard that I had in my house and measured out the equivalent size – about 20” x 30”.
4. Assuming that the virgin wood was sourced in Canada. Will use the distance from Vancouver to Minneapolis via truck transport is 1,792 miles.\(^2\)
5. To calculate the ton-miles, I took 54 pounds and converted it into tons, which equals 0.00027 tons and then multiplied that by the number of miles for each transportation type.

---

<table>
<thead>
<tr>
<th>Example: White paper</th>
<th>Corrugated Board</th>
<th>Electricity</th>
<th>Truck Transport</th>
<th>Landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount (lb)</td>
<td>.54</td>
<td>0</td>
<td>.48</td>
<td>.54</td>
</tr>
<tr>
<td>Unit (pound)</td>
<td>.76</td>
<td></td>
<td>.32</td>
<td>.39</td>
</tr>
<tr>
<td>Impact / lifetime</td>
<td>.41</td>
<td></td>
<td>.1536</td>
<td>.2106</td>
</tr>
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**Okala Impact Assessment Form**

<table>
<thead>
<tr>
<th>Date</th>
<th>March 31, 2018</th>
</tr>
</thead>
</table>

**Design**
Mark Chamberlain

**Product Type**
Corrugated Cardboard for Sign Substrate

**Sign Substrate**

<table>
<thead>
<tr>
<th>Lifecycle Impacts</th>
<th>Functional Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The conference sign delivered 16 hours of service.</td>
</tr>
</tbody>
</table>

**Notes and References**

1. The lifespan is based on the actual use of the sign for a two-day conference and then it was disposed.
2. Assuming no electricity during use phase.
3. To calculate the different weight of the board, I measured cardboard that I had in my house and measured out the equivalent size – about 20” x 30”.
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5. To calculate the ton-miles, I took 54 pounds and converted it into tons, which equals 0.00027 tons and then multiplied that by the number of miles for each transportation type.
Summary for event booklet – paper

DIRECTION BASED ON RESULTS

PAPER IMPACT FOR CONFERENCE BOOKLET //

The results of the assessment showed a small improvement in the environmental impact using a recycled paper versus a virgin paper for the booklet. The recycled paper should meet the technical project requirements. However, it would likely increase the cost of the paper and thus demand a larger budget. Given the increase in cost, this might not be the first place to make a change for the overall event.

There were a few other observations:

• Controlled incineration had a better performance versus a controlled landfill for the paper. I did not expect that result. I would guess that the benefit of energy generation from the incineration had a more significant offset to the harmful effects of placement into a landfill.

• The de-inking process negated much of the benefits of removing virgin material from the paper manufacturing process, which was noted in the impact factor list.

• Because the event was so short (only a day), it became hard to find ways to extend the usefulness of the booklet.

• Despite not having the LCA results to back up the choice, I would still suggest using vegetable- or bio-based inks, a Forest Stewardship Council (FSC) certified paper, and a recycled paper stock that contained 10 to 30 percent post-consumer content. I would also check to make sure that it does not use toxic chemicals during the paper manufacturing process. For example, the paper should be processed chlorine-free. However, I can’t account for all of those factors using the data provided.

• Another scenario that the data could possibly support would be reducing the number of pages of the program booklet if the content could be reduced. This material reduction should reduce overall impact.

Base Scenario
Recycled Paper

.014 Pts
.013 Pts
ALTERNATIVES TO PVC BOARD

The results of the assessment show a notable improvement in impact when using a cardboard substrate versus the original closed cell polyvinyl chloride (PVC) board (Sintra brand). This significant change would make this option very desirable. A cost estimate for a comparable cardboard option showed that it actually reduced cost as well.

The combination of reduced environmental impact and reduced cost make the switch to a cardboard substrate the strongest option that we have explored. This is the strongest recommendation that is backed up by the results of the limited lifecycle assessment.

There were a couple of other observations:

- I did a scenario using a landfill versus burning because PVC gives off dioxins and other hazardous chemicals when burned. I was thinking there would be a greater difference between the two.
- The short functional life of the sign makes me wonder about options for using a temporary substrate, no substrate or a reusable substrate. I hope to explore some of those options generally in the part of this report.
- Finally, another major benefit of the cardboard substrate is that it can be easily recycled and can make it easy to dispose of the sign when the use is completed. The cardboard scenario was calculated using a landfill end-of-life.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>PVC Board to Incineration</td>
<td>.36</td>
</tr>
<tr>
<td>PVC Board to Landfill</td>
<td>.358</td>
</tr>
<tr>
<td>Cardboard Sign to Landfill</td>
<td>.048</td>
</tr>
</tbody>
</table>
Since there seemed to be a significant impact reduction using a different substrate for the signs, I wanted to explore additional alternatives that could push that idea further.

1. Use biological substrate for signs that can be composted after use.

Chilean industrial designer Genoveva Cifuentes has designed a biodegradable gardening aid called InPlum that turns plum pits into plant pots and seedbeds. Upcycling a biological material – such as plum pits – can add value to a biological material. If the biological material can be sourced regionally or locally, the reduction in transportation costs could also help reduce negative impacts.

If the surface of the composite material could be smooth enough, a flatbed, large-format printer should be able to print effectively on the material. Large-format printers can print on cork, wood, and tile. It would be recommended to check validate that binders used in material do not add technical nutrients or toxic chemicals to the substrate. If this could be achieved, the ideal end of life scenario would be composting. This would keep the product within the biological nutrient cycle.
TAKING THE DESIGN FURTHER

ALTERNATIVES TO PVC FOAM BOARD

2. Extend the useful life of a sign substrate by planing the material prior to printing in the sign shop

This idea would extend the number of times a substrate could be used for printing. This would extend the useful life of the same material and result in a reduced impact. A lifecycle assessment would need to be performed to understand the changes in the impact over the life of the product. While less substrate material would be needed for more signs, there would be additional impacts due to the operation of the planing machine and the process of recovering the used material.

The process could be used on a variety of materials (technical or biological) and would create a smooth, ink-free surface for the large-format printing to create a new imprint upon.
TAKING THE DESIGN FURTHER

ALTERNATIVES TO PVC FOAM BOARD

3. Eliminate the need for a substrate by using washable surfaces to silk screen design onto at the needed location

Another alternative to a sign substrate is to remove the need for a substrate. Since the life span for this sign is short – only 16 hours – a temporary solution could be achieved using a screen-printed sign. Once the sign is no longer needed, the ink could be removed using water and sponge. There would still be impact using this process and there would need to be some considerations.

- The ink would need to be water-based (not plastisol or solvent ink).
- It would likely not be practical to have a full-color imprint.
- Use water-based adhesives and soy or citrus-based chemicals.
- There is still a considerable amount of other material used during the process (rags, unused chemicals and ink, containers, used film, and more).
- The installation takes time and could add complications to an already complex day of activities during the event.

I don’t think this would replace a traditional printed sign. However, it might be the right solution for an application needing a unique and eye-catching marketing solution.
As previously mentioned, the limited lifecycle assessment did not show a significant reduction in impact for the event schedule booklet. As stated previously, I would still suggest vegetable- or bio-based inks, a Forest Stewardship Council (FSC) certified paper, and a recycled paper stock that contained 10 to 30 percent post-consumer content. I would also check to make sure that the paper does not use harmful chemicals during the manufacturing process. For example, it should be processed chlorine-free. However, I can’t account for all of those factors using the data provided.

For the event signage, the best scenario based on the Okala results was the cardboard substrate. When combined with cost-savings for the signs, there is a strong case for the switch. It also is a product that already exists and could be put into the recycling stream after its use.

Good graphic design is about pushing possibilities and understanding how products created through the design process move through and interact with other sub-systems throughout the lifecycle.

**Common questions should be:**
- How is a material manufactured?
- Do manufacturing materials use harmful chemicals?
- Is a vendor willing to work with you?
- Does that vendor adhere to certain best practices?
- How will this create a value for the product's user?
- Will there be an increased cost?

This project examines a real-life scenario and uses a limited lifecycle assessment tool to reasonably determine the best design option to maximize the reduction in negative environmental impact.

This is part of good graphic design.

It’s about asking the right questions and being able to balance the needs of various stakeholders within the graphic design product system to maximize value and reduce negative impact throughout the lifecycle.
END NOTES

1 AdobeStock photo used: © Nadalina, #69838148 and © picsfive, #109434956
12 Google. 2018. Google Maps - Distance between Vancouver and Minneapolis. Accessed April 22, 2018. https://www.google.com/maps/dir/Vancouver,+BC,+Canada/@46.0901163,-117.1980621,5z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1s0x52b333903777b7bb0x939f9842f7ae0727m21d!-39.2650108!2d44.977753!1m5!1m1!1s0x548673f143a94f3b0x9b1919ea9b8if38b!2m2!1d-93.2650108!2d44.977753!1m5!1m1!1s0x548673f143a94f3b0x9b1919ea9b8if38b!2m2!1d-.
15 Google. 2018. Google Maps - Distance between Minneapolis and Vancouver. Accessed April 25, 2018. https://www.google.com/maps/dir/Minneapolis,+MN/Vancouver,+BC,+Canada/@46.0901163,-117.1980621,5z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1s0x52b333903777b7bb0x939f9842f7ae0727m21d!-39.2650108!2d44.977753!1m5!1m1!1s0x548673f143a94f3b0x9b1919ea9b8if38b!2m2!1d-93.2650108!2d44.977753!1m5!1m1!1s0x548673f143a94f3b0x9b1919ea9b8if38b!2m2!1d-.
THE PROBLEM

Graphic designers don’t understand all of the sustainability aspects of their job. There is significant opportunity to decrease environmental impacts through educating and motivating graphic designers to embed sustainability through their design process.

The desired outcome of this process change is to increase sustainability practice by graphic designers. The overarching scope of this project is to look at common design processes and the lifecycle of the products produced by graphic designers to find key leverage points to make significant change in impact.

KEY ISSUES AND HOW DO WE QUESTIONS

1. What motivates and limits graphic designers embracing sustainability
   - **How do we** break down barriers for graphic designers to learn sustainability?
   - **How do we** motivate graphic designers to embrace sustainability?

2. Sustainability can be overwhelming for graphic designers
   - **How do we** find key leverage points in the graphic design process to improve sustainability outcomes?
   - **How do we** target training on sustainability to the leverage points identified?

GET A STAR

For ideas that merit further thinking and exploration – look for the teal star. The applying of the star was part of the final step after the brainstorming information was organized.
I talked through my problem with my wife, who has a background in communication, and a family friend. We looked through my problem and identified some key questions that paralleled each other to discern possible special considerations for the graphic design industry.

After the brainstorming, I organized the answers based on three categories that were identified as important:

- Active (requires action)
- Passive (observation)
- Dialog (requires action)

The desire was to find connections between similar strategies. Here are the final notes from my first set of questions.

**OBSERVATION:** Designers learn about sustainability through education regardless of profession. The educational programs may differ.

**OBSERVATION:** Graphic designers learn about sustainability through many of the same ways non-designers do. However, they have deeper knowledge about visual design production and process.

**OBSERVATION:** Active ways of learning seem to be much deeper experiences than observation alone.

**OBSERVATION:** The ways in which professionals adopt and learn about sustainability seem to parallel other industries. Applying what other disciplines would be critical for more insight.
The second part of the mind map brainstorm was to focus on motivation and barriers to sustainable changes.

A key part to changing behavior of graphic designers is to see what motivations they could have to implement change.

This organization was done post-brainstorm from the Word doc that I took notes from.

**What motivates people to learn about sustainability?**

- Personal experience with negative environmental impacts
- Have an appreciation for nature (Hiking, Hunters, climbers)
- Culture of community
- Fear
- Economic struggles
- Personal relationships
- Economic
- Economic and/or personal ability to care (Maslow's needs)
- Professional curiosity
- Motivation to deal with materialism
- Anger
- Culture of religious community
- Geographical location that you live
- An understanding of scope of impact
- Knowledge of environmental impacts

**Observation:** Because culture, fear and personal experience are deeply part of motivation – consider narratives to motivate.

**Observation:** Lack of resources, whether perceived or actual, dominate the barriers that we came up with and should be key parts of a solution to change graphic designers professional behaviors.

**Observation:** There seems to be something related to mastery in a profession that motivates people to learn and grow.

**Observation:** It is interesting that fear is both a motivator and a barrier.

**Observation:** Culture, like fear, can promote and hinder embracing sustainable practices. Context is important. I also think narratives would be important to help communicate the need for change.

**A closer look at motivation and barriers**

**What prevents people from learning about sustainability?**

- Fear of the problem
- Fear of change
- Fear of failure
- Self-interest
- Not knowing where to start
- Misconceptions
- Lack of resources
- Lack of interest
- Lack of tools
- Lack of rules and regulations
- Lack of education
- Lack of empathy
- Lack of understanding
- Lack of knowledge
- Lack of time
- Cultural values
- No availability of services
- Guilt
- Not understanding self-impact
- Status quo
## GAP FILLING

Identify your current spot and your end goal.
What is the gap that exists?
What are all the things you need to fill up this gap?

<table>
<thead>
<tr>
<th>Point A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Many designers consider paper choice to be the biggest sustainable issue that relates to their work.</td>
</tr>
<tr>
<td>There seems to be a lack of responsibility for things (postcards, posters, signs) that are produced by graphic designers (extended producer responsibility)</td>
</tr>
<tr>
<td>There seems to be a lack of understanding that most of the embodied impact from a designed product (postcard, poster, website, etc.) is “baked” into a product in the design phase – making it essential to address sustainability</td>
</tr>
<tr>
<td>Printers have embraced several certifications and sustainable products (FSC, ISO 14001), Inks, Paper, etc.) However designers haven’t uniformly responded to these things by making them a priority of purchasing decisions.</td>
</tr>
<tr>
<td>Cost seems to be the main driver</td>
</tr>
<tr>
<td>The design process doesn’t drive by sustainability</td>
</tr>
<tr>
<td>The design process doesn’t leverage sustainability as a way to add value to the delivered end product or service</td>
</tr>
<tr>
<td>Stakeholders aren’t always aligned to ensure that their expectations include sustainable outcomes</td>
</tr>
<tr>
<td>This might be reflective of a company or organization value put on sustainability</td>
</tr>
<tr>
<td>Poor overall process weakens the designers ability to leverage sustainability options (gang print runs, design for press sheet, etc)</td>
</tr>
<tr>
<td>An overall strategy for printing and production allows for better</td>
</tr>
<tr>
<td>There is a lack of knowledge about sustainable options and practices.</td>
</tr>
<tr>
<td>Many designers have a “not my job” attitude when it comes to sustainability</td>
</tr>
<tr>
<td>Focus only on visual communication or aesthetics</td>
</tr>
</tbody>
</table>

## GAP

To move to Point B from A we would need to:

- Identify key print partners to help identify and implement sustainability goals |
- Conversations around value need to happen at the beginning of projects. This might be around the return rate of a direct mail campaign or what the most effective methods for achieving marketing success. |
- Having a well-thought out project management process that records key data points help to baseline critical information to make the case for certain initiatives and show that sustainability helps the business financially and in many other ways. |
- Mapping process to understand opportunities for success. |
- Regular conversations about sustainability with vendors to keep it fresh |
- Sustainability needs to be part of strategic goals of the company. It helps to define values and makes a broad case for what the company hopes to accomplish. This also communicates to external constituants the values of the company and becomes part of the value narrative. |
- The development of a solid design process helps to educate stakeholders about how to work effectively with marketing and specifically the graphic designers. What questions need to be answered? What value am I looking to be delivered? |
- It encourages more non-traditional solutions because product delivery is de-emphasized and value-delivery is part of the opening discussions of a product |
- Graphic designers need a solid foundational education around sustainability and systems thinking – they will end up being leaders in ensuring the success of adding value to their work. |
- Transparency is critical. A process similar to The Natural Step could help this transition process. |

## A CLOSER LOOK AT POSSIBLE KEY LEVERAGE POINTS IN THE GRAPHIC DESIGN PROCESS

### Point A

- Having a well-developed strategy for printing and production allows for efficiency to accomplish sustainable goals and metrics |
- There is a focus on defining value in the early design process |
- Key stakeholders are pushed to think long-term and envision the lifecycle of products and services produced to see greater opportunities |
- The graphic designer can be a key connector of ideas and is skilled in design thinking and systems to help guide the larger group of stakeholders to sustainable practices |
- The graphic designer – because of their unique position and ability to understand patterns and system – can help stakeholders focus on value throughout the system. |
- The larger system that the graphic designer works within understands how to use the design process in order to be effective in accomplishing goals |
- The design process is a way to reflect the greater stated values of the company or organization |
- Sustainability goals of the company should be “baked” into the design process. |
- There are ways to include stakeholders from different parts of the company and clients into the design process in order to allow for feedback. In addition to gaining feedback, this allows the stakeholder to become part of the work to increase sustainability. It becomes an educational opportunity and bring people together behind shared goals and initiatives. |
- There is an understanding of the impact of common product choices made. |
- Criteria for sustainable production are clearly defined across the system. This might include definitions and banned material (PVC)
TRIGGER METHOD

Brainstorm as many ideas based on one of your “How might we ...” questions. Select the best ones and brainstorm deeper on those ideas.

How do we target training on sustainability to the leverage points identified?

- Make it part of their professional development.
- Provide Lynda.com style videos
- Drill down the design process to identify the key leverage points that truly reduce impact.
- Use a TOP 5 things you can do strategy to simplify sustainability to new graphic designers
- Develop material that explains how to leverage systems thinking
- Use The Natural Step and modify the process to be specific to a graphic design, marketing department or ad agency.
- Find compelling narratives and produce videos to show examples of change within the industry (like Story of Stuff)
- Use sustainable graphic design systems in action to show the benefits of using a smart and sustainable design process
- Get beyond “climate change” and “global warming” as dead-end discussions with folks who have negative perceptions of those topics.
- Sustainability needs a new definition for graphic designers
- Value is the most important thing to deliver. Show how sustainability process can add value and make you look like a rock star.
- Apply eco-design strategies in ways that specifically apply to graphic designers.
- Showcase print vendors who have embraced sustainable processes (FSC, ISO 14001) and show how the entire product is better because of it
- Have the value and cost discussion with stakeholders
- Find ways for companies to develop sustainability strategic planning
- Develop a list of banned materials (like PVC board)
- Add sustainability to job descriptions

Make it part of professional development

- Certification
- Help pay for training
- Create a lead sustainability officer
- Embrace The Natural Step
- Maybe go back to school for grad or undergrad courses
- Attend conferences
- Look to established professional groups

Apply eco-design strategies

- Could marketing and communication best practices be compatible with eco-design strategies? What would that look like? Lightweighting?
- What other benefits could be gained by looking at eco-design through the lens of business profit
- Does the discussion around value make eco-design strategies more relevant?

The Natural Step or other ...

- Since the designer is just one person, does there need to be cultural change within an organization in order to see major change?
- Could focus on using a framework, such as The Natural Step, help to move an organization or company to a place where strategy and metrics are being applied to sustainability?
- How would that change the focus of the graphic design professionals and marketing / communication staff?
- Can a unified definition of “Sustainability” be a key starting point to making change in an organization?

Certification

- The assumption is that most people wouldn’t invest a substantial amount of money and time into learning about sustainability unless there seemed to be an equal return.
- What kind of returns could be imagined.
- Would it help if sustainability was part of job descriptions?

Creating value

- Can value be at the core of what a graphic designer does?
- How do you bake value into a design process?
- How do you consistently define value (only money?)

The definition of “sustainability”

- Like The Natural Step, the process starts with a shared definition of what is sustainability?
- Core concepts are then explored and what they mean
- Can the same approach be used in looking at the graphic design process? Could this be the fundamental process for education around introducing a new graphic design process?
- Do we agree that organizational change is just as important as process change?
- Can you have process change without culture and organizational change?
- Do values need to be defined and adopted as part of YOUR STORY