FRAMEWORKS & STRATEGIES: PART 3

Environmental Graphic Design

Paula Welling / MASD Fundamentals of Sustainable Design / Spring 2023

Un/Filtered, University of Houston. Design by University of Houston students. Image: segd.org

Environmental Graphic Design (EGD) embraces many design disciplines including graphic, architectural, interior, landscape, and industrial design, all concerned with the visual aspects of wayfinding, communicating identity and information, and shaping the idea of creating experiences that connect people to place.

—Society for Experiential Graphic Design (SEGD)

Background & Impact Overview

Environmental graphic design spans a broad array of applications: from way finding signage in an airport, to branded graphics in a sports auditorium, to interpretive graphics for a museum exhibition. These installations can be short-lived—think a museum exhibition that is only on display for a month or two. Or they can be relatively permanent—for example, way finding signage in a public space.

Waste
While the materials used can also vary widely—digital displays, plexiglass, vinyl, etc.—almost all environmental graphic design has one thing in common: waste. Designers and stakeholders often do not consider the end-of-life impacts of the materials used. Most materials used are impossible or difficult to recycle (e.g. plastics) and are likely landfilled or incinerated after disposal.

Toxic Materials
Environmental graphic design also often relies heavily on toxic materials. For example, polyvinyl chloride (PVC) is used widely for a range of applications, including banners and large-scale wall murals or decals. According to Greenpeace, PVC is toxic at all stages of its life cycle, and the toxins it releases are accumulating in our bodies and in natural systems.

High Turnover & Materials Use
Because many installations have a short lifespan, high turnover creates high materials use. For example, in a museum setting, each exhibition may only be on view for a few months, and then it must be replaced by the next exhibition. Multiply this by the number of museums and public spaces in our world, and the scale of the impact becomes clear. Even setting aside the issues of waste and toxicity, such a high level of materials use creates significant greenhouse gas emissions and places high demand on natural resources and systems.

Opportunities
Though the negative impacts are significant, environmental graphic design also creates many positive impacts. Like SEGD states, at its core, environmental graphic design connects people to place. It adds interest and inspiration to our public spaces. It communicates information clearly so we can navigate our world more easily. And it helps share knowledge and foster education. The opportunity is to overcome the negative impacts while maintaining the positive social benefits that inspiring spaces create.

NEGATIVE IMPACTS:

- Waste (landfill, incinerated, non-recyclable)
- Toxic materials (health impacts during manufacture, use, and disposal)
- High turnover = high materials use (emissions, high demand on natural resources)

POSITIVE IMPACTS:

- Storytelling and inspiration in public spaces, connection to place
- Education (exhibition/interpretive design)
- Communication (way finding)

STAKEHOLDERS:

- Designers
- Clients (e.g. museums, airports)
- Manufacturers/vendors
- The public (i.e the people who experience the spaces and who are impacted by the positive and negative effects)

Part 1:

The Natural Step Analysis and Visioning

Analysis:
The Natural Step

The Natural Step outlines four principles for sustainability. It states that, **in a sustainable society, nature is not subject to systematically increasing:**

1. concentrations of substances from the earth's crust
2. concentrations of substances produced by society
3. degradation by physical means
4. And in that society there are no structural obstacles to people's health, influence, competence, impartiality and meaning.

The following pages analyze Environmental Graphic Design according to these four principles.

Graphics for Hildreth Elementary School, Harvard, MA. Design by Arrowstreet. Image: segd.org

In a sustainable society, nature is not subject to:

concentrations of substances from the earth's crust

In this category, emissions from fossil fuels are probably create the most significant impact. Fossil fuels are used at almost every stage of environmental graphic design:

- Resource extraction and processing (e.g. timber harvesting, paper and plastic production)
- Energy use during manufacturing (e.g. printing)
- Transportation of raw materials along the supply chain
- Transportation of finished graphics from manufacturers
- Energy use during installation (e.g. lighting, lifts, power tools)
- Energy use in the designed space (e.g. to power lighting or digital displays)
- Transportation of discarded graphics to waste facilities (i.e. landfills, recycling centers)
- Energy use to recycle any recyclable materials

Many materials used in environmental graphic design also contain substances from the earth's crust, including:

- Petroleum-based plastics
- Inks, which are commonly petroleum-based and can contain heavy metals
- Petroleum-based solvents and additives used in the printing process
- Latex paints, which often contain metals like titanium dioxide and zinc oxide
- Digital displays rely on technology that contains minerals and heavy metals

These substances can be released into the environment during production and disposal in landfills and incinerators.

KEY IMPACTS:

- Fossil fuel extraction and emissions from fossil fuel consumption
- Petroleum-based products (e.g. plastics, inks, solvents)
- Heavy metals used in materials (e.g. pigments in latex paints) and technology

In a sustainable society, nature is not subject to:

concentrations of substances produced by society

Plastics are used widely in environmental graphic design (e.g. PVC for murals, polypropylene for signage) and increase the concentration of many concerning human-created substances:

- Endocrine disruptors (e.g. BPA, phthalates, PFAS)
- Chlorine-based toxins (organochlorines) created during PVC production
- Dioxin released in the manufacture and incineration of PVC
- Unknown chemicals found in plastics, with unclear health and environmental impacts
- Microplastics created during production, use, and disposal of plastic products

Other sources of human-created substances include:

- The production of chlorine-bleached paper, which creates dioxins
- Compounds used in latex paint, like polyvinyl acetate (PVA), acrylic polymers, and triclosan
- Leachate released from landfilled waste

KEY IMPACTS:

- Endocrine disruptors and other chemicals found in plastics
- Microplastics created during production, use, and disposal of plastic products
- Dioxin released primarily by PVC and also bleached paper

In a sustainable society, nature is not subject to:

degradation by physical means

Physical environmental degradation is mainly caused by the production of raw materials used to create products for environmental graphics:

- Paper production can contribute to deforestation and/or contribute to declining old-growth forests
- Paper production requires large amounts of water
- Oil extraction disrupts, degrades, and fragments habitat
- Oil extraction can lead to oil spills, which have long-term ecosystem impacts
- Mining degrades habitats through tailings, erosion, acidification, and long-term landscape damage
- Landfills contribute to habitat loss and groundwater pollution

---

KEY IMPACTS:

- Habitat loss and degradation from mining, logging, and oil extraction
- Water use for paper production
- Habitat loss and contamination cause by landfills

And in a sustainable society, there are no:

structural obstacles to people's health, influence, competence, impartiality and meaning

Environmental graphic design mainly contributes social benefits: storytelling, sense of place, inspiration, education, and communication. Those benefits will be higher for certain applications over others—for example, you could argue that the positive social impacts created by interpretive graphics for a children's museum are higher than those created by trade-show graphics for a processed food company.

But, overall, good environmental graphic design contributes to several of the basic human needs outlined by Manfred Max-Neef:

- Leisure
- Understanding
- Participation
- Creation
- Identity

The main negative social impact created by environmental graphic design is its effect on health—or its participation in systems that systematically degrade human and ecosystem health:

- Contribution to climate change via fossil fuel emissions
- Use of toxic materials, like PVC
- Degradation of ecosystems via mining, logging, and fossil fuel extraction
- Contribution of waste to landfills and incinerators, which create air and water pollution

---

KEY IMPACTS:

- Positive social benefits, including contributions to leisure, understanding, participation, creation, and identity
- Negative health impacts from toxic materials and contributions to air and water pollution
- Contribution to climate change

Visioning: Sustainable Environmental Graphic Design

A sustainable future for environmental graphic design would be one in which all installations are:

- **Circular** — all materials can fully and safely return to biological and technical nutrient cycles
- **Non-physical** — where possible, physical materials are replaced by digital experiences, light, sound, etc.
- **Permanent and/or reusable** — materials are installed with longevity in mind and/or can be easily reused in future installations
- **Participatory** — installations are based on and encourage meaningful engagement, and/or are created by participants
- **Connected to nature** — installations foster a connection to nature through plants, outdoor spaces, windows/light, etc.

Museums Victoria Learning Lab, design by Grumpy Sailor, image: segd.org

Moodboard

Clockwise from top left: Museum of New Zealand Climate Converter, design by DOTDOT, image:segd.org / Houston Bayou Greenways Park, design by Minor Design, image: segd.org / Museums Victoria Learning Lab, design by Grumpy Sailor, image: segd.org / Social Lab at The Museum of Tolerance, design by Unified Field, image: segd.org / Cleveland Museum of Art Gallery One, design by Local Projects, image: ArtMuseumTeaching.com

Approaches and Impacts

A sustainable vision for environmental graphic design maintains the positive social benefits that inspiring spaces create: leisure, understanding, participation, creation, and identity.

Sustainable environmental graphic design should prioritize non-toxic and fully circular materials—improving both human and ecosystem health. Some of these material replacements may not be available yet, but present-day designers should strive to find alternatives to materials like PVC whenever possible.

A sustainable approach to environmental graphic design should focus on dematerialization, replacing physical materials where possible with light, sound, or digital experiences. Designers and institutions should also prioritize permanence and/or reusability to maximize the lifespan of materials when they are needed.

A sustainable approach to environmental graphic design should prioritize participation and engagement. How can spaces and exhibitions be shaped and "owned" by the people who interact with them? For example, on a college campus, a painted mural created by students could be a replacement for a branded vinyl wall mural designed offsite.

Finally, sustainable environmental graphic design should connect people to nature whenever possible. I think designers often tend to imagine installations in indoor spaces—but what if we brought those experiences outdoors more often? Those spaces should reflect the unique landscapes they are situated within, and environmental graphic designers should work in tandem with landscape designers to incorporate ecologically beneficial plantings.

If we can move toward this future, we can continue to create access to inspiring spaces and experiences—while also eliminating or at least minimizing the negative impacts created by our current approach (toxicity, waste, ecosystem degradation, and climate change).

KEY IMPACTS:

- Circular, non-toxic materials eliminate waste and negative health/ecosystem impacts
- Dematerialization and design for permanence/reuse reduces demand for materials
- Participatory design creates more engagement and meaning
- Nature-focused design creates ecosystem benefits and connects people to nature

Part 2:

The Natural Step Backcasting + Strategies for Sustainability

The Natural Step: Backcasting

What steps should we take to reach our vision of success?

SHORT TERM:

- Organizations should account for impacts from EGD installations in ESG/sustainability reporting
- Designers should use alternatives to the worst materials (e.g. PVC) whenever possible and should become familiar with strategies to analyze impact. Options currently available are limited but could still offer improvements:
  - 3M Envision Film—the only non-PVC film on the market, Greenguard certified *(reductions in toxicity)*
  - Textile banners rather than PVC *(reductions in toxicity)*
  - Rigid paperboard panels for interior display, rather than foamcore, sintra, etc. *(reductions in toxicity and impacts from plastics)*
  - Wood and metal wayfinding signage (e.g. GreenDot) *(reductions in toxicity and impacts from plastics)*
  - Recycled aluminum signage to replace PVC banners and signs—or aluminum substrate with 3M Envision wrap *(reductions in toxicity and possibly waste)*
- Encourage innovation to develop non-toxic, biodegradable or fully recyclable materials to replace PVC and plastics, especially in contexts where long-term durability is required
- Prioritize industry-wide education and resources:
  - Mission statement for sustainable EGD from a key network org (e.g. SEGD)
  - Network of sustainable designers and vendors to share resources and approaches
  - Education of designers and client stakeholders — impacts, alternatives, durability, reuse, dematerialization
  - Project-agnostic innovation/activities (workshops, etc.) to work through sustainable alternatives without the pressures of timeline and budget

LONG TERM:

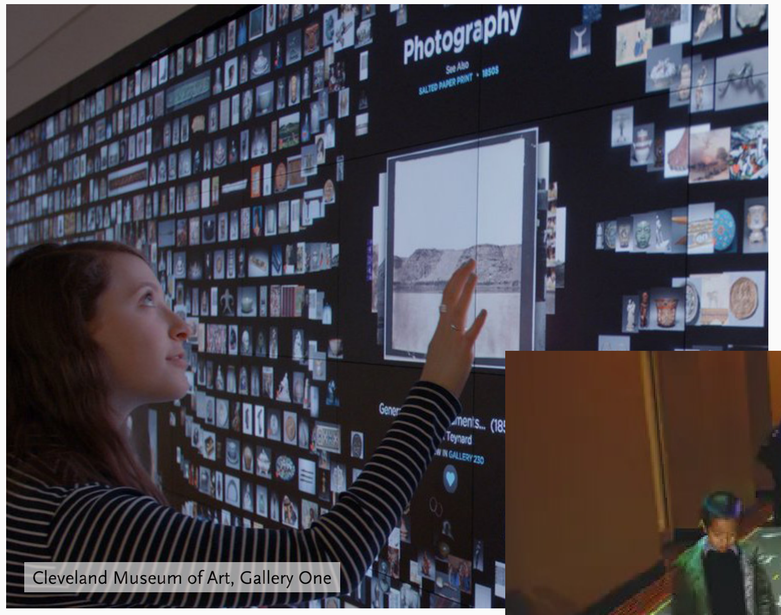
- Adoption of innovative alternative materials (non-toxic and biodegradable or fully recyclable)
- Legislation that bans or restricts very toxic/harmful materials, like PVC
- Dematerialization and design for reuse and recycling are standard practice in the industry
- Foster deeper collaboration between EGD and related fields, like architecture and landscape architecture

Design for Sustainability Strategy 1: Dematerialization

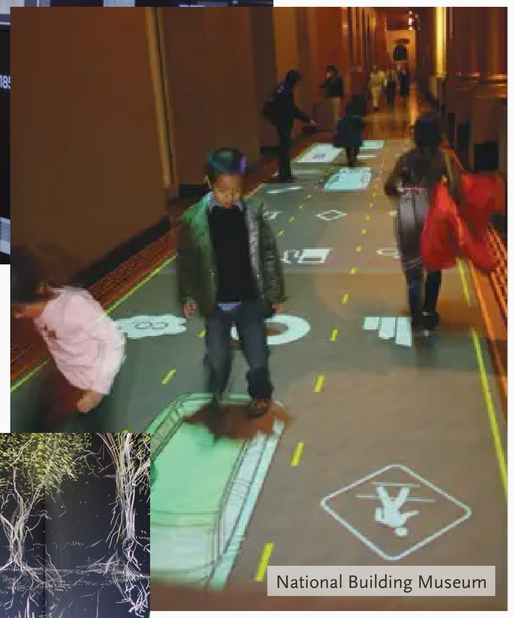
Because the negative impacts created by EGD—waste, toxic materials, and emissions and environmental degradation—are heavily materials-based, dematerialization would minimize or eliminate those impacts.

STRATEGIES TO APPLY DEMATERIALIZATION:

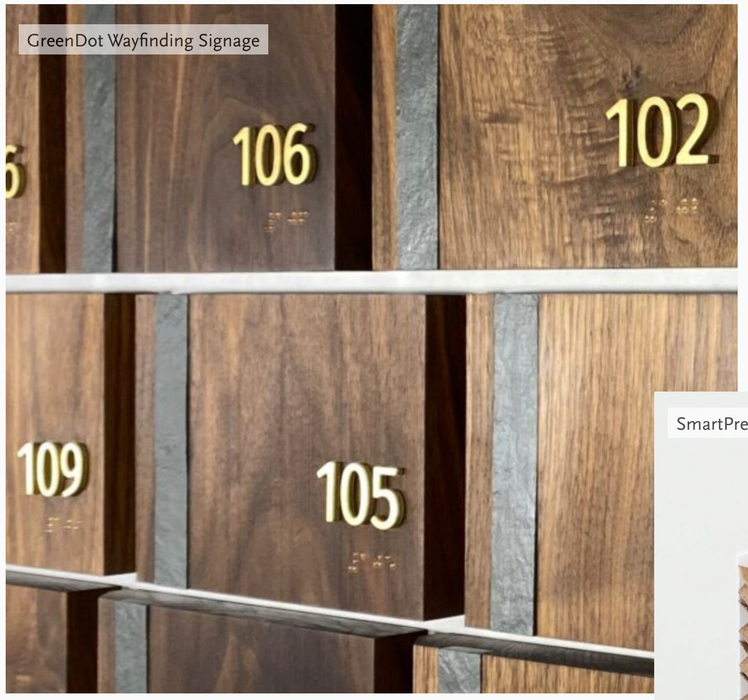
- Replace physical displays with light, sound, or digital displays:
  - projections to create immersive full-room experiences
  - projections to replace standard wall texts (i.e. in museums)
  - projections to replace floor wayfinding
  - immersive sound experiences rather than intensive physical displays
  - permanent/reusable digital displays rather than physical displays that must be replaced/refreshed on a regular basis
- Replace large signs with much smaller signs that link people to digital content (e.g. via QR codes or audio guides).
- Question the extent of physical graphics required to achieve a goal. What is essential? What is unnecessary?



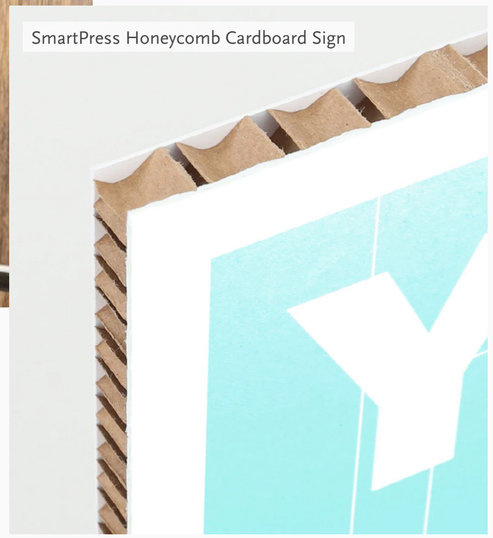
Cleveland Museum of Art, Gallery One


National Building Museum


Museums Victoria Learning Lab



GreenDot Wayfinding Signage


SmartPress Honeycomb Cardboard Sign

Howard Industries Aluminum Perma-Banner

Design for Sustainability Strategy 2: Substitution

When designers need to spec physical materials, they should substitute less-impactful materials whenever possible. This can especially help mitigate the harmful effects of toxic materials, like PVC.

STRATEGIES TO APPLY SUBSTITUTION:

- Build awareness and facilitate innovation and collaboration:
  - Designers/stakeholders need to understand impacts of commonly-used materials
  - Develop a vendor-designer network to support adoption of new materials
  - Design firms should give designers the space to learn about and experiment with alternative materials in project-agnostic workshops
- Innovation is needed to develop new, non-toxic, biodegradable or fully recyclable materials. In the meantime, designers can source improved alternate materials:
  - 3M Envision Film—Greenguard certified, non-PVC film *(reductions in toxicity)*
  - BioFlex and similar bioplastics *(reductions in toxicity and impacts from plastics)*
  - Textile banners rather than PVC *(reductions in toxicity)*
  - Rigid paperboard panels for interior display *(reductions in toxicity and plastics)*
  - Wood and metal wayfinding signage (e.g. GreenDot) *(reductions in toxicity and impacts from plastics)*
  - Direct-to-substrate printing on recycled aluminum or plywood *(reductions in toxicity and possibly waste)*
- Use soy-based, low-solvent inks and low-VOC paints

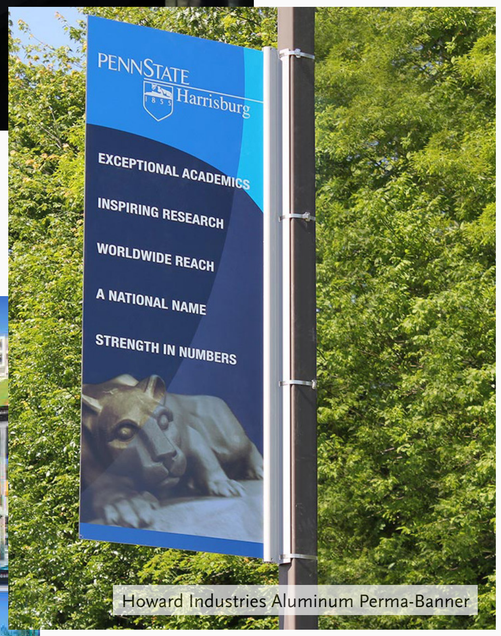
Design for Sustainability Strategy 3: Design for Reuse

EGD installations are often short-lived—for example, special exhibitions in a museum may only be on display for a few months. Designers and their clients should prioritize ways to reuse materials from installation to installation to reduce waste generation.

STRATEGIES TO APPLY DESIGN FOR REUSE:

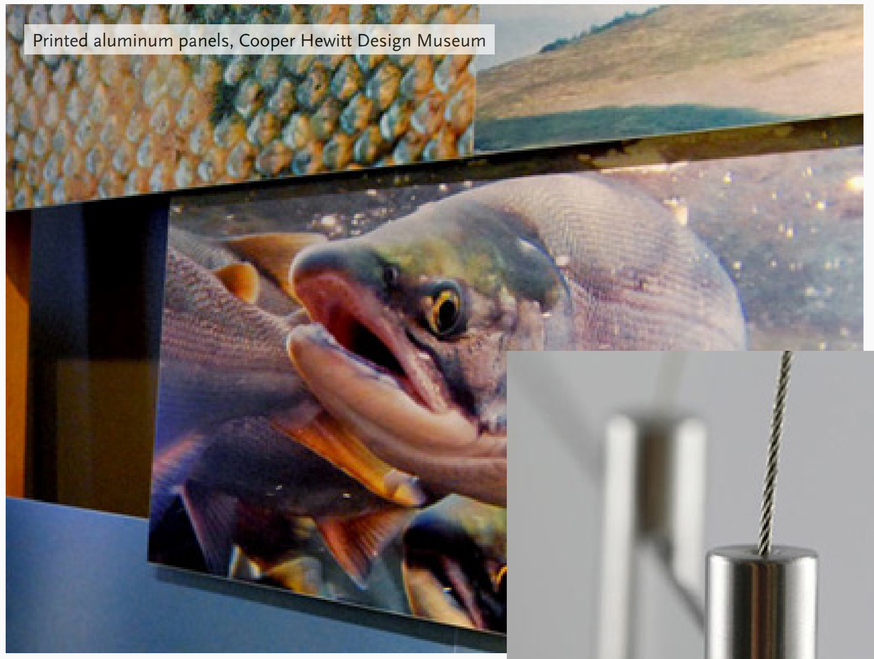
- Apply removable films or paints to reusable substrates:
  - instead of vinyl banners that cannot be reused, use 3M Envision Film on long-lasting, reusable aluminum panels and swap only the film when needed
  - use a standard panel size system for museum wall texts and reapply text/repaint for new exhibitions
- Standardize panel sizes and use reusable mounting systems, then lightweight the panels (e.g. paperboard instead of sintra)
- Install permanent digital displays and refresh graphics for new exhibitions
- Modular, reusable wall systems to replace custom-built standing gallery walls
- Modular cases (acrylic, wood) to allow museum cases to be disassembled and reused for future exhibitions
- Donate construction materials that cannot be easily reused by the museum/institution

The Museum of Tolerance Social Lab



Howard Industries Aluminum Perma-Banner


A&S Hanging Display Systems



Printed aluminum panels, Cooper Hewitt Design Museum

Metal panel hangers

Pole-pocket banner

Design for Sustainability Strategy 4: Design for Recycling

Environmental graphic designers should consider the impacts of materials once they're no longer in use. If a physical material is required and cannot be reused, designers should spec a fully recappable material whenever possible—and should ensure the final product can be easily disassembled for recycling.

STRATEGIES TO APPLY DESIGN FOR RECYCLING:

- Create displays that can be easily disassembled into individual materials:
  - Use metal fasteners or display systems to attach/hang graphics, rather than adhesives, allowing panels to be easily removed and recycled
  - Avoid products that combine two non-separable materials (for example, aluminum signs with a plastic core—paperboard or Coroplast would be better choices)
  - Use pole-pockets rather than metal grommets on banners when possible
- Do not spec non-recyclable or difficult-to-recycle materials, like PVC or foamcore.
- Print directly on substrates (like aluminum) to increase recyclability.
- Avoid or minimize plastics, which have limited potential for recycling.
- Consider designs that minimize ink coverage to facilitate recycling for printed materials.

Analyzing the Strategies

Dematerialization

Because dematerialization removes the impacts from materials almost entirely, I think it holds the **most promise for long-term positive impact**. But, of all the strategies, I think it requires the most change—designers, clients, and the public will all need to shift their expectations and ideas around what public spaces look and feel like.

Most promising approaches:

- Projections: Projections are already in fairly wide use and can create both immersive experiences and more straightforward signage. LED bulbs and motion-activated displays could reduce energy use.
- Reduced signage paired with digital content: This approach is also already in use, and people are familiar with the tools (QR codes, etc.). Attention will need to be paid to accessibility and energy use from hosting content online.

Substitution

Substitution is the **most viable strategy in the immediate term**—as long as designers are aware of the issues created by commonly-used materials, they can make better (if not perfect) choices. Innovations in non-toxic and biodegradable or fully recyclable materials hold longer-term promise.

Most promising approaches:

- Replacements for PVC films (e.g. 3M Envision): These exist and should be the standard choice. These films are certainly not perfect, but they at least minimize exposure to the toxic substances in PVC. They could be a bridge solution for clients who are not yet willing to consider dematerialized approaches.
- Direct-to-substrate printing on wood or recycled aluminum to replace plastic panels (e.g. PVC, Coroplast)—aluminum is highly recyclable and wood is renewable.

Design for Reuse

Design for reuse holds **long-term promise, especially in transforming museum exhibition design** (where high turnover of materials is common). This strategy will require more holistic buy-in from institutions, for example by purchasing modular case or wall systems for exhibitions or implementing a system for standardized wall panels.

Most promising approaches:

- Modular case and wall systems: These systems could greatly reduce materials waste from custom-built cases and walls. Options already exist (e.g. Logic Exhibit System).
- Digital displays: Strategically-placed digital displays can be used to reduce the need for physical panels. Motion-activated screen brightness could reduce energy use.
- Aluminum Perma-Banners: Highly durable aluminum panels can be used indefinitely, reducing waste from PVC banners.

Design for Recycling

Design for recycling is not as transformative, but it still can create **positive impact in the shorter-term, especially when paired with substitution**. It also encourages designers to think through the full life-cycle of materials.

Most promising approaches:

- Fasteners rather than adhesives: Using fasteners to hang panels, etc. allows materials to be more easily disassembled and recycled. Again, this is only effective if substitution is used to ensure that materials can be recycled.
- Direct-to-substrate printing: Printing directly on the substrate means that the panel is manufactured from a single material. Because it can be recycled the most effectively, aluminum is promising for this approach, especially for longer-term installations. Paperboard is likely the next best option. Coroplast should only be used if a recycling center that accepts #5 plastics is available.

Part 3:

Design for Effectiveness, Systems, & Regeneration

Design for Effectiveness

According to Nathan Shedroff in D*esign is the Problem,* eco-effectiveness aims “create closed-loop systems, eliminate toxic material use, and erase trash,” and it requires us to “reframe and reconsider what customers, organizations, and systems of all types need.”

Shedroff makes the case that, in order to create truly eco-effective solutions, designers need to be fully involved and represented in the process, rather than simply brought in toward the end to execute an already-developed concept. I agree—and I think a shift in designers’ roles will be essential to achieving sustainable environmental graphic design. I explore this change in relationships more on the next slide.

If designers can be brought to the table earlier—while concepts and strategies are being formed—I think that the door can be opened more widely for some of the transformative, eco-effective ideas described earlier in this document, like dematerialization and design for reuse.

KEY APPROACHES:

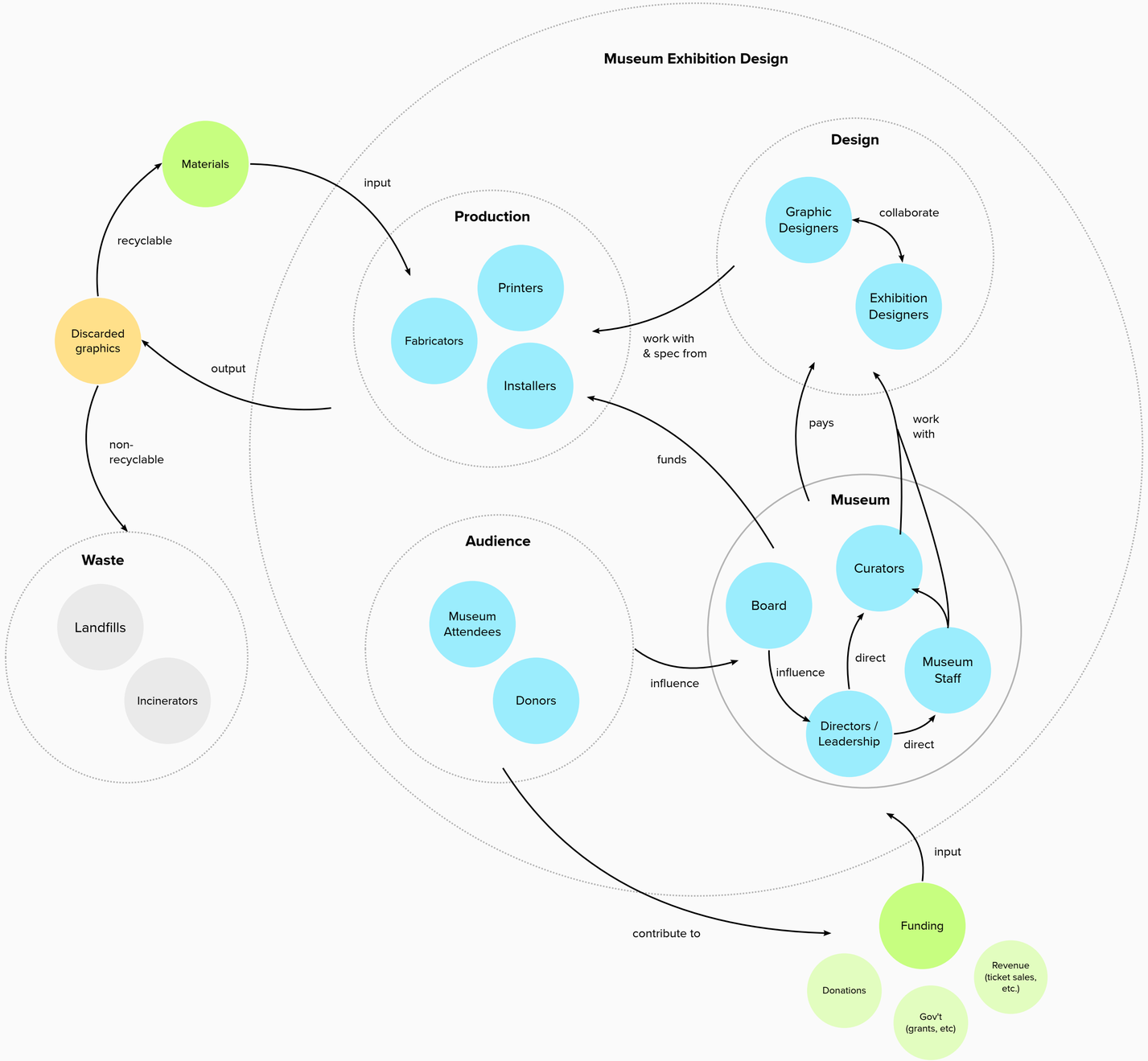
- Shift organizations and relationships so that designers are fully involved and represented from the beginning of the process
- Bring designers to the table while concepts and strategies are being formed
- Focus on transformative, innovative solutions (e.g. dematerialization and design for reuse)
- All members of the team/ organization should keep an open mind to new ideas

Design for Systems

This diagram represents the relationships and dynamics in a common environmental graphic design context: exhibition design by an external design agency.

In the current scenario, designers are distanced from leadership at the museum—this means that their ability to implement new and innovative approaches is limited.

Re-envisioning the relationship between the museum and designers—so that designers have a voice in strategic decision-making—could help foster eco-effective design.



Design for Regeneration

Design for regeneration aims not just to minimize or eliminate negative impacts—its goal is to create positive change in order to renew natural and social systems.

STRATEGIES TO APPLY DESIGN FOR REGENERATION:

- Choose materials that can return safely to biological nutrient cycles
  - For example, a fully biodegradable substrate that can be composted to create nutrient-rich soil
- Work in concert with landscape designers and architects to create immersive outdoor experiences that connect people to nature and restore habitats or to create permanent outdoor signage that integrates intentionally with native plantings
  - Ensure that the graphics designed for those spaces are non-toxic and cyclical
- Find opportunities for participation and community involvement
  - For example, on a college campus, facilitate a student-created painted mural rather than a branded vinyl mural

Painted mural, Ithaca College

Campus signage, Hunt Design

Houston Bayou Greenways Park

Analyzing the Strategies

While design for regeneration and effectiveness are certainly important, it's clear that systems change is needed in order to accomplish significant positive impacts.

There are several potential opportunities for systems change. Those opportunities will vary depending on the structure of the organizations and projects—for example, closer collaboration between external designers and museum staff and leadership seems important in a museum exhibition context. But, in any case, systems change should focus ideally on the three most impactful areas for systems intervention: the goals of the system, the mindset or paradigm of the system, and, ultimately, the power to transcend paradigms.

If we can intervene in those areas and shift expectations around how we should design for public spaces, I think that will open the door to the most impactful strategies, like dematerialization, design for reuse, and participatory, community-focused design.

REFERENCES

“7 Ways Oil and Gas Drilling Is Bad for the Environment.” Wilderness.Org. The Wilderness Society, July 9, 2021. https://www.wilderness.org/articles/blog/7-ways-oil-and-gas-drilling-bad-environment#.

Deziel, Chris. “The Toxicity of Latex Paint.” Hunker. August 5, 2022. https://www.hunker.com/13413054/the-toxicity-of-latex-paint.

"Due Diligence." Society for Experiential Graphic Design. November 28, 2010. https://segd.org/sustainable-exhibition-design.

“Environmental Risks of Mining.” The Future of Strategic Natural Resources. Massachusetts Institute of Technology, Accessed March 16, 2023. https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html.

“‘Green’ Exhibition Design.” Cooper Hewitt. Cooper Hewitt Design Museum, May 20, 2009. https://www.cooperhewitt.org/2009/05/20/green-exhibition-design/.

Jedlička, Wendy. 2010. *Sustainable Graphic Design*. Hoboken: John Wiley & Sons, Inc.

"Museum Exhibition Materials Pledge." Mindful Materials. July 1, 2022. https://www.mindfulmaterials.com/museum-pledge.

“Plastics Pose Threat to Human Health.” Endocrine.Org. Endocrine Society, December 15, 2020. https://www.endocrine.org/news-and-advocacy/news-room/2020/plastics-pose-threat-to-human-health.

“PVC: The Poison Plastic.” Greenpeace.Org. Greenpace, August 18, 2003.

"Questioning the Sustainability of Museum Exhibit Design – Expensive to Build, Difficult to Change." Coalition of Museums for Climate Justice. February 7, 2018. https://cmcj.ca/questioning-the-sustainability-of-museum-exhibit-design-expensive-to-build-difficult-to-change/.

“Trade Secrets: Dioxins/Furans.” PBS.Org. PBS, Accessed March 16, 2023. https://www.pbs.org/tradesecrets/problem/popup_group_01.html.

“What Is Environmental Graphic Design (EGD)?” Segd.Org. The Society for Experiential Graphic Design, Accessed March 16, 2023. https://segd.org/article/what-environmental-graphic-design-egd.