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O2. MATERIAL HEALTH AND TRANSPARENCY: *Methods for Improved Integration with Design Process* **Antonio Rodríguez-Argüelles, IIDA, LEED GA,** *antonioara07@gmail.com*

ABSTRACT

Material health is important for every designer, no matter if we specify construction and building materials, finishes for interiors, or ancillary items like furniture and equipment. Information about products and various types of material properties, including their impacts on health, is becoming more prominent. However, lack of guidelines and potential tools that could help us access this data makes the process of material and product search unintuitive for designers.

Knowing this, how can we make our research of material health, a subject essential to our practice and commitments as a firm, more natural, self-expanding and intuitive? This study applies findings found in different case studies and research to ultimately develop tools, such as a material database and improved material libraries, to facilitate integration of material research and design process.

KEYWORDS: material health; transparency; materials library; materials database; materials research

1.0 INTRODUCTION

The objective of this study was to investigate how we could improve integration of material health research with the design processes, and develop intuitive interfaces for the designers. Also, the process of ordering material samples was studied in an effort to reduce packaging waste, and possible improvements to the material libraries in our offices (using Perkins+Will New York office's library as a case study, shown in Figure 1). The methodology for this research included a literature review, the review of appropriate case studies for potential new interfaces, library spaces and packaging, and the creation of new design solutions supported by imagery. The later can be used as guidelines for future firmwide initiatives, although further study would be needed to gauge their effectiveness and outcomes on the design process.

1.1 Background

Perkins+Will's commitment to sustainability and healthy environments has produced valuable research and tools, such as the Transparency website launched in 2011. The website publicly shares valuable information, such as a precautionary list of substances known or suspected to cause harm to human health and the environment. This, in combination with other lists that target harmful flame-retardants and asthma triggers, contributed in placing at the forefront in our firm – and the design industry in general –conversations about material health and ingredients that we should actively avoid.

It is important for us to continuously expand the reach of these tools, making them a priority in our projects. Although material health is discussed regularly in design meetings and among team members, it is still not clear how we can integrate research more successfully in our design process. Can vetting materials against these lists for suspiciously harmful substances be something that becomes second nature to us and not an afterthought? Can we build with the knowledge acquired by our designers a material database that helps to make the process more efficient? Can we exert our influence not just in the process of selecting healthy materials, but also in doing something about the excessive amount of packaging produced in many cases from ordering material samples? Have we thought about the mission of each of our material libraries? Can they be designed as spaces of collaboration that encourage efficient research?



Figure 1: Conceptual image for the NY office's materials library re-design. A light color palette will make the space feel larger and brighter, while serving as a neutral background for palettes reviewed in the space. LED fixtures above the tables with the capacity to switch between color temperatures will make the room also work as a material's lighting lab. Barcode scanners will prompt at-a-glance transparency information for each product sample.

2.0 MATERIAL HEALTH AND TRANSPARENCY

Our society has seen a dramatic shift in the way we look into the components of everything we interact with and consume on a daily basis. Demand for healthier foods with more natural ingredients that avoid the use of artificial colorants and flavors has increased. Major manufacturers have been forced to rebrand themselves and relocate resources to create a market for healthy products with "clean labels". Now a major trend, clean labels answer the call for simpler ingredients in our foods. Three-fourths of consumers in the United States claim to read nutritional labels, and nearly as many "strongly agree" that it is important for food labels to contain mostly recognizable ingredients¹.

In the fashion and technology industries, the call for transparency of material composition has also increased. While creating different products that range in complexity from a cellphone to a shirt, cradle-to-cradle practices have been widely adopted in an effort to eliminate waste and optimize the use of every material. The increasing use of upcycling practices has put pressure on the research of every component present in these products. Many manufacturers are not fully aware of all of the chemicals present in their own products, particularly when complicated supply chains dilute their control and understanding of material components.

As recently as June 2016, U.S. Senate updated toxicchemical regulations to overhaul the nation's 40-year old law governing the use of toxic chemicals in homes and businesses². Public health advocates complained for decades that outdated laws left Americans exposed to harmful chemicals not subjected to testing or regulation. A new bill would require the Environmental Protection Agency (EPA) to begin conducting tests on as many as 64,000 chemicals used in everyday products². According to the EPA, Americans spend 93 percent of their lives indoors, inside either a building or a car (87 percent in the former). Concentrations of some pollutants are often 2 to 5 times higher than typical outdoor concentrations in interior environments³. As a result, the building industry's call for transparency of components has increased, becoming a major trend.

It is interesting to ascertain that the users or habitants of a building typically do not have direct access to material health information, or control over what building materials surround them. This represents a major problem since the same pressure fashion labels, technology manufacturers and food makers receive from people requesting transparency in their practices is not applicable to building products. Building specifications are not documents accessible to people in the same way ingredients lists are when reading nutrition labels, or the product information of electronic devices. The problem is heightened by the lack of a standard certification for healthy material ingredients and the continuous greenwashing of products and practices in our industry.

The lack of standardization and guidance for designers while specifying products is due in big part to how the green buildings movement came to place in the early 1990's with the founding of the U.S. Green Building Council (USGBC) and their Leadership in Energy and Environmental Design (LEED) program. The USGBC and LEED are widely regarded as the official framework in which buildings can achieve high performance and sustainable development. That said, the program, with its focus on achieving energy efficient buildings, lacks clear guidelines for how designers can avoid toxic chemicals in the process of selecting materials. LEED Version 4 made an effort to address material health, rewarding projects that use products with chemical ingredients inventoried by an accepted methodology, and rewarding project teams for selecting products that minimize the use and generation of harmful substances. Greenwashing, defined as deliberately representing a product or service as more environmentally friendly than it is, also adds convolution to the process of vetting any finishes for construction projects. A false impression of product sustainability, supported by false advertisement and socially irresponsible manufacturers and representatives, only exacerbates the lack of confidence when evaluating materials.

2.1 Perkins+Will Precautionary List and Product Certifications

Launched in 2011, the Transparency website was the first built environment's free, universally accessible database aimed at creating greater transparency into building materials. The database contains substances that are publicly known or suspected to be associated with an adverse finding in relation to human and environmental health. The database is the result of the review of published scientific papers, which identify "precautionary" substances. This research is based on the Precautionary Principle, the idea that in the absence of scientific consensus, an action merits precautionary treatment if it has a suspected risk of causing harm to humans or to the environment⁴. The intent of the list is to encourage the building product marketplace to be-

come more transparent from extraction to the end of lifecycle, from manufacturers to de-constructors. With this information, designers are empowered to make informed decisions when specifying products, also taking into account the products' maintenance and disposition. The website tool lists substances like phthalates and chlorinated polyvinyl chloride, where are they commonly found, their origin, how are they categorized, what are their known or suspected health effects, and offers alternative materials that can replace them.

In terms of product certifications, three of the most well-known are the Cradle to Cradle certification, the Declare product label, and the Healthy Product Declaration (HPD). The Cradle to Cradle Certified Product Standard guides designers and manufacturers through a continual improvement process that looks at a product through five quality categories-material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness⁵. A product receives an achievement level in each category - Basic, Bronze, Silver, Gold, or Platinum - with the lowest achievement level representing the product's overall mark. Product assessments are performed by independent organizations in North America, Europe and South America. One of the goals of the certification is to avoid architects and designers having to scrutinize every material for consistency with their sustainability goals. A product that is certified will give designers ata-glance information about its recyclability and safety for human health, an assessment of toxicity hazards of all of its ingredients through the supply chain, and an improvement path for an optimized design and manufacturing process. Selecting Cradle to Cradle Certified products can help earning points on LEED V4.

Declare, on the other hand, is a "nutrition-label" for building products, providing a clear and informative method to disclose ingredients⁶. The certification relies on the International Living Future Institute (ILFI) Red List as its primary basis for material evaluation. The Red List numbers 22 substances that are to be avoided in the products and materials used to build a Living Building Challenge (LBC) project, mainly due to health concerns. Because some of the items on the list describe families of chemicals, the actual number of individual substances identified at chemical level is much larger. LBC provides some "temporary exceptions" that allow project teams to use products with red-listed substances as long as they document their efforts to find compliant alternatives, and write to manufacturers expressing their interest in such alternatives. These products are deemed "LBC-compliant", not Red List free. In creating a Declare label for a product, a manufacturer must disclose all of that product's intentionally added constituent chemicals to the designated 100 parts per million (ppm) reporting threshold. Declare's website offers a product database that allows designers to see which products meet LBC's stringent material requirements.

Finally, the Healthy Product Declaration (HPD) is supported by the Health Product Declaration Collaborative (HPDC), a non-profit organization committed to the continuous improvement of the building industry's performance. The HPDC created, and continually seeks to evolve, the Health Product Declaration Open Standard as a format and set of instructions for the accurate, reliable and consistent reporting of product contents and any associated health information⁷. HPDs provide disclosure of the chemical composition of a product, including potential health hazards from those chemicals. Manufacturers with proprietary ingredients can publish an HPD that discloses hazards while concealing the proprietary chemical. HPD Version 2.0 was released on September 10, 2015 increasing the usability for both users and creators of the documents, and harmonizing the open standard specification with other standards and certifications used in the building industry. HPDs can also contribute points under LEED v4.

3.0 THE CHALLENGE

There are many reasons for a lack of knowledge and familiarity with product transparency among many designers. The reason for this is primarily due to the absence of standards in the building industry for the evaluation of material health. Missing an interface that helps research materials has also contributed to this lack of knowledge among them.

The challenge of researching material health can be tackled by the revision of many of our firmwide practices through the implementation of a better material search interface and the improvement of the design of our material libraries. The latter could also improve the way we handle the residue produced by the over-packaging of our samples.

3.1 The Interface

As designers have constant access to smart phones, tablets and personal computers, any type of information can be available in the middle of vetting and specifying materials. This unprecedented access can be both a blessing and a curse. Being able to gain access to product information through manufacturers' websites reduces our legwork considerably. It also guarantees that we have at least some extent of access to the most up to date information, right from the manufacturers' hands, as opposed to outdated printed material. That said, when we lose contact with the expertise of product representatives or other design professionals, grounding our choices only on online resources can be a potential danger. Unclear product information, greenwashing practices and different methods of reporting transparency, can all combine leaving us ultimately conflicted about our own material choices.

It is important to create the correct tools that will help us with this type of research. The interface we interact with while sorting through products and available materials should be simple and intuitive, put together in a comprehensive way that avoids multiple steps while remaining as close as possible to a "one stop shop" model⁸. This new tool can also work as a place where peers' recommendations and experiences with materials and products become a tangible and powerful resource.

3.1.1 Interface Case Study: Designer Pages

A good interface model to learn from in order to design our own would be the Designer Pages website, conceived in 2007. The tool helps designers to find products for their projects and build specification documents online, while also connecting them with manufacturers easily. The website has a database of around 350,000 products that represent more than 5,500 brands from across the globe⁹. Different filters can be applied while looking for products, some of them related to health and sustainability; filters can be applied to only show products that have HPDs identified on the database, Cradle to Cradle certifications, or the Declare label.

When users stumble upon a product that has not been added to the system, they can create a "product stub" that makes a placeholder in the database and notifies the website's content producing team. The team then proceeds to reach out to the corresponding brand and invites them to fill the product information and possibly upload the rest of their catalogs. This process helps the website grow, while giving users a say in what type of new products are added.

The Designer Pages Pro option offers more features to design firms. Project folders are easy to make and not only contain product's information, but also the project's location, budget, type and client. Options for creating and printing different types of schedules are also available. An augmented search component in the website allows designers to make better use of each of their firm's collective knowledge and insight. When specifying a product, being able to find out who else has used it and can vouch for it can prove time saving. Finally, a news feed adds social media characteristics to the database and allows users to get an overall picture of what products are trending amongst colleagues.

3.2 Material Libraries

Libraries have always been amongst the most important buildings in modern society, and beacons of knowledge that engage communities. Throughout history, their mission has evolved. Non-traditional libraries can still maintain at the core of their values a desire to help with research and education, but more and more they seem to shift focus on creating spaces for collaboration that put people at the forefront.

The move to a technological society has meant increased use of mobile apps and digital technology that bring information to a wired world. When libraries adapt to these new trends faster, they become more successful at maintaining their subscribers and remaining valuable and relevant. For many of them this means adopting a more community-driven identity. Some libraries are re-imagined as community centers that provide users with specific services relevant to their main local needs (assisting with overcoming economic, social and geographical hurdles for example). Others offer a combination of flexible meeting spaces with different technological outputs, innovative display systems and catalogues, and even cafés that fill out the need for a third space.

Material libraries for design firms can adopt some of these new tendencies and offer a fresher and more interactive experience. When we think about our material libraries, usually the first thing that comes to our minds are shelves full of binders and boxes with loose samples, many times outdated. These spaces are rarely seen as open to collaboration or traditional research. Material libraries are spaces for quick discovery and reference, complimentary to our daily routines and design processes that hinge in our computers.

Material libraries should move away from this model and involve every type of designer on a more personal level. Their engagement with research and learning has to be priority and reflect the needs of new generations of designers who could use the space as an escape from their workstations and highly structured daily routines. Libraries should be reinterpreted as material research labs with a curated environment of samples and products that remains current and has a constant dialogue with each designer's goals, and a general desire for an augmented transparency in everything that we do.

3.2.1 Material Libraries Case Study: The Material ConneXion

The Material ConneXion is a materials consultancy service that helps different companies source advanced materials to enhance the performance, aesthetics and sustainability of their projects¹⁰. Their online archive and material libraries, based in seven cities worldwide, feature over 6,500 of the world's most cutting-edge and commercially available materials. Each month an international panel of experts review 50 to 60 new materials for the library, selecting only a few. The archive of materials is organized by a category system, based on the materials' compositions: polymers, ceramics, glass, metals, cement-based materials, natural materials, carbon-based materials, and processes.

New York's Material ConneXion library, located in the global headquarters of Sandow, has over 7,500 individual materials. It serves different members of the design community, ranging from architects and interior designers to fashion designers, automotive companies, and industrial designers. Materials samples are displayed in the library using boards called MateriaTabula. These gray boards not only show the materials in an aesthetically pleasing way, but also provide key statistics related to sustainability, and contain QR codes and barcodes that give access to more in-depth information about their compositions. The powder-coated display system of interactive panels makes the space feel like an art exhibit, different from the usual dense material library stacks in architectural offices or design schools. Although only around 2,500 of the materials are displayed using these boards, the rest of them never disappear, as they are kept in a large material's vault in the premises that makes use of movable high-density storage.

3.3 Packaging

According to EPA, in 2013, Americans generated about 254 million tons of trash and recycled and composted about 87 million tons of this material, equivalent to a 34.3 percent recycling rate¹¹. Packaging material, particularly paperboard, makes up for a large percentage of this recycled material. The Paperboard Packaging Council reports that paper-based packaging accounts for 71 percent of the nearly 27 million tons of packaging material recovered for recycling, also based on numbers from EPA¹². A large number (96 percent) of the U.S. population can recycle paper and paperboard material through curbside or drop-off recycling programs, which has helped with the overall increase of the recy-

cling of packages, such as cartons and boxes (nearly doubled since 1990).

Even with an increasing rate of recycling, packaging materials sustainably is still a "hot-button" in the packaging industry. Companies often over-package their products for shipping and, without realizing it, create a surplus of packaging material left for consumers to handle. Many European countries have produced laws aimed at reducing packaging waste, but the U.S. still has not addressed this issue.

The design or type of package for shipping products can be re-conceptualized to help fill the void that unwritten laws and lack of recycling habits create. New bioplastics, and new 100 percent recycled paperboard packing products are all trends in the sustainable packaging industry to keep an eye on.

3.3.1 Packaging Case Study: eBay Sustainable Boxes In 2011, eBay developed a set of sustainable boxes as part of a pilot program that gave away 100,000 shipping boxes to different sellers, encouraging their re-use. If each box got used five times, the program could protect nearly 4,000 trees, save 2.4 million gallons of water, and conserve enough electricity to power 49 homes for a year¹³. One of the most interesting elements of the packaging was its series of illustrations that emphasized the benefits of a greener box. A section in the interior flap asks "Where has your eBay box been?" prompting the shipper to make a note on the box so that the next person who receives it knows how far and for how long it has traveled. The boxes are made with 100 percent recycled content, printed with water-based inks, and designed to require minimal tape. Once they reach the end of their useful shipping life, they are fully recyclable.

4.0 THE PERKINS+WILL SOLUTION

The first step to improve the way that we do transparency research of building materials and finishes is to create an easy to use materials database. The "Perkins+Will Materials Database" could be tested firmwide and later launched as a new service offered within the Transparency website, thus expanding its reach and becoming a more meaningful contribution to the design industry in general. The database would be an online resource that would function as a catalogue of the products we specify, each displayed prominently on its own product page.

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		MY ACCOUNT • MY MATER	RIALS • MY PROJECTS • MY INSPIRATION BOARD • HELP
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	USE	SEARCH RESULTS FOR "FELT WALLCOVERING"	
	CONTENT	34 ITEM(S)	SHOW 4 V PER PAGE
•.	MAINTENANCE		
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Figure 2: Layout for how the product search would look like.

The interface should be visually attractive and intuitive, designed in a clean and consistent layout that follows the Perkins+Will brand guidelines, as seen in Figure 2.

- **1** A search bar would be prominently featured, promoting easy product research.
- 2 Different categories, such as "Use", "Content", "Maintenance" and "Transparency", would help filtering the results. In the "Transparency" category, items like "Perkins+Will Precautionary List Free" or "LBC Red List Free" can be selected in order to narrow the search even further.
- **3** The results can be sorted in a variety of ways for enhanced clarity and comparative purposes.

- 4 An upvotes/downvotes feature, only usable by Perkins+Will designers in the testing stage, would show how products are reviewed across the office.
- 5 Relevant product information, imagery and the option to add to "My Materials" or "Inspiration Board" will be also quickly accessible. The "My Materials" or "Inspiration Board" tabs will give access to user-specific pages. On "My Materials" a catalogue of every product specified over time by each designer/user will be shown. "My Inspiration Board" would give access to a Pinterest-type component unique to participant firms and sharable between team members.



Figure 3: Layout for how the individual product profile would look like.

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- **6** Individual product information profiles would give designers the option to upvote and downvote a product based on a personal experience.
- 7 High quality photos of colorways and available finishes would be prominently displayed and updated regularly.
- **8** Available transparency documents would be highlighted and easy to download.

Two social features catered towards Perkins+Will designers, and later to be adapted for general audiences, would make the database more personable, as seen in Figure 3.

- **9** A comments section would allow designers to share their experiences with any product.
- **10** Another area would also be provided for designers to upload installation photos of the products on their projects.

Re-designed library spaces will work in conjunction with the Perkins+Will Materials Database to create a better workflow for any designer researching material health and finishes in general, shown in Figure 4. Proposed is the reconfiguration of the existing material library in our office in New York, expanding its footprint and taking over an adjacent printing area. This move allows making use of windows the library currently lacks, creating a sun drenched workspace where designers can lay out their palettes and perform research tasks.

11 A combination of fixed open shelves and highdensity storage would store loose samples and binders with tip cards and/or finishes representations. The fixed open shelves would host the more in demand finishes (carpet samples, fabric memos and wallcoverings) and the heavier samples (tile, stone, wood, etc.). The high-density files will store less frequently procured samples, doubling the capacity of our existing storage. The option to combine all these shelves together would keep the space less visually cluttered.



Figure 4: Isometric view of the proposed NY office material's library design.

- 12 Pinup space would be added to illustrate concepts in-process and create a more visually stimulating and inspirational space. A fixed cabinet with large, color-calibrated monitors would be designated as a research station where designers, product reps and librarians can collaborate.
- **13** A fixed cabinet with large, color-calibrated monitors would be designated as a research station where designers, product reps and librarians can collaborate. Codebooks, lighting

fixtures catalogues and plumbing fixtures catalogues would be uploaded and accessible on the computers, freeing valuable storage space elsewhere.

14 Project drawers would be removed from the current kitchen island to make space for stools and a cleaner flow of people. The area would still function as a hub where product representatives can host informal presentations and make use of the wall-mounted flat screen.



Figure 5: Another isometric view of the proposed NY office material's library design, design layout for the "Perkins+Will Materials Database" App, and suggested packing solutions.

Custom, counter height work tables with project drawers and seating would add space for laying out palettes and researching materials further. Barcode scanners would bring the product page of each of the scanned products immediately to any paired screen.

15 A Perkins+Will Materials Database App could also be used for scanning. The application would give access to each of the user's unique pages, also available in the browser version. Moreover, the app would be the main tool designers can use to add materials to the database. By taking a photograph of products not found in the catalogue, designers would be able to request the firmwide or outsourced content makers for more information about them.

An area for the disposal and storage of packaging material would be included in the re-designed library, as seen in Figure 5. New, outsourced packaging so-

lutions for mailing clients or returning samples would be tucked away in the cabinetry. Trash bins would be utilized for the overflow of wrapping paper, bubble wrap and smaller paperboard boxes that could be separated and either recycled or stored for future use

16 Instead of trying to revolutionize the packaging industry, Perkins+Will could standardize some packaging solutions through their different offices: (A) 100 percent recycled and biodegradable rigid mailers, (B) light weight companybranded eco bags for designers on the run and messengers, and (C) shipping labels with TrueBlock technology that completely block out any previous labels, can be all options to invest in and test.

Figure 6 shows a glass display that can be used to feature new materials added to the library.



Figure 6: A large and transparent glass display would be added facing the public corridor of the office. The glass case would be updated, highlighting only the latest and most exciting materials to arrive.

5.0 CONCLUSION

Material health should be a topic of conversation for everyone involved in designing our built environments. Creating the tools that will make the research of any product's transparency information easier and more intuitive can have a strong and meaningful effect in our industry.

We should plan better interfaces and a database for material research for all designers, and materials libraries that help facilitate the process and spur true collaboration. In the process, Perkins+Will can change the way that we look at healthy materials, bringing much needed clarity to the subject in a design industry that needs it.

Finally, even if the interface for researching materials and the design of our libraries both improve, education and training sessions (especially for new staff members) are needed in order to engage designers more in the process. Hiring full time librarians with a background in material health research can be a great strategic move that will assure libraries are kept to our standards, and the educational initiatives upheld.

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