Environment News Futures

Durability vs. Recyclability: Dueling Goals in Making Electronics More Sustainable

April 4, 2019—Georgia Institute of Technology: John Toon

Researchers have looked into the impact of government policies put in place to reduce the amount of electronics waste filling up landfills.

The falling cost of solar power has led to a boom in recent years, with more and more photovoltaic panels popping up on rooftops and backyard solar farms around the world.

But what happens to all of those solar panels in a couple of decades when they reach the end of their useful life? And what about electronic devices with even shorter life spans?

Those questions are at the heart of new research released by a team at Georgia Institute of Technology, where researchers looked into the impact of government policies put in place to reduce the amount of electronics waste filling up landfills.

"There is a lot of concern in sustainability circles that manufacturers are making things with shorter and shorter life spans, and products are perhaps even intentionally made to become obsolete to induce replacement purchases," said Beril Toktay, a professor at Georgia Tech's Scheller College of Business. The study, which was published on April 4 in the journal *Management Science*, focused on government policies used to encourage electronics makers to put more thought into what happens at the end of the product life cycle. Those programs, which are called extended producer responsibility (EPR) laws and are already in use in some states, have two common objectives: to have producers design their products to be easier to recycle or to boost their durability for increased device life span.

However, the researchers reported that those goals are often at odds. "What we have found is that sometimes when you design for recyclability, you give up on durability, and when durability is the goal, recyclability is sacrificed," Toktay said.

In theory, a product that is both easy to recycle and more durable would be the pinnacle of environmentally responsible product design. The researchers pointed to automobiles with thicker metal frames that last longer and also have more recyclable materials. In such a scenario, EPR policies emphasizing durability and recyclability work hand in hand. "Sometimes simple choices that product designers make, such as using glue or fasteners to put together a device, really impact recyclability at the end of life," said Natalie Huang, a former graduate student at Georgia Tech and now an assistant professor at the University of Minnesota.

More often than not, however, there is no such synergy. In the case of photovoltaic panels, the researchers highlighted how thin-film panels are much more cost effective to recycle than other panels because they contain precious metals. Meanwhile, crystalline silicon panels, which aren't as cost effective to recycle, have much longer life spans because their components degrade much more slowly.

"These kinds of trade-offs are common, and so from a policy-making perspective, there's not a one-size-fits-all approach that will work," said Atalay Atasu, a professor at the Scheller College

of Business. "You really have to distinguish between different product categories to consider the recyclability and the durability implications and make sure that your policy isn't conflicting with the objective." The researchers said that in some cases, EPR policies could actually lead to increased waste generation if product designers make products more recyclable but less durable, or lead to increased greenhouse gas emissions if products are made more durable but less recyclable.

To help determine how government policies could impact individual products, the researchers built a mathematical model to help predict the impact those policies would have on products based on their materials and design characteristics. Among the factors the model takes into account are the base production cost of the product, the degree of difficulty in increasing recyclability and durability, the degree of interaction between recyclability and durability in the product design, and the recycling properties of the product.

"Ultimately what we're after is to find a way to do scenario analyses to determine what would be the best policy for different product categories," Toktay said. "Fifteen to 20 years from now, a lot of panels are going to be coming off of roofs. Are they being designed with the end of life in mind and with consideration of what's the best way to reduce the impact of producing those panels?"

Poverty Leaves a Mark on Our Genes

Study's findings challenge understandings of genes as fixed features of our biology

April 4, 2019—Northwestern University: *k_e_n / Fotolia*

Previous research has shown that socioeconomic status (SES) is a powerful determinant of human health and disease, and social inequality is a ubiquitous stressor for human populations globally. Lower educational attainment and/or income predict increased risk for heart disease, diabetes, many cancers and infectious diseases, for example. Furthermore, lower SES is associated with physiological processes that contribute to the development of disease, including chronic inflammation, insulin resistance and cortisol dysregulation.

In this study, researchers found evidence that poverty can become embedded across wide swaths of the genome. They discovered that lower socioeconomic status is associated with levels of DNA methylation (DNAm)—a key epigenetic mark that has the potential to shape gene expression—at more than 2500 sites, across more than 1500 genes.

In other words, poverty leaves a mark on nearly 10 percent of the genes in the genome. Lead author Thomas McDade said this is significant for two reasons. "First, we have known for a long time that SES is a powerful determinant of health, but the underlying mechanisms through which our bodies 'remember' the experiences of poverty are not known," said McDade, professor of anthropology in the Weinberg College of Arts and Sciences at Northwestern and director of the Laboratory for Human Biology Research.

"Our findings suggest that DNA methylation may play an important role, and the wide scope of the associations between SES and DNAm is consistent with the wide range of biological systems and health outcomes we know to be shaped by SES." Secondly, said McDade, also a faculty fellow at Northwestern's Institute for Policy Research, experiences over the course of development become embodied in the genome, to literally shape its structure and function.

"There is no nature vs. nurture," he adds. McDade said he was surprised to find so many associations between socioeconomic status and DNA methylation, across such a large number of genes. "This pattern highlights a potential mechanism through which poverty can have a lasting impact on a wide range of physiological systems and processes," he said.

Follow-up studies will be needed to determine the health consequences of differential methylation at the sites the researchers identified, but many of the genes are associated with processes related to immune responses to infection, skeletal development and development of the nervous system.

Associating Colours with Vowels? Almost all of us do!

April 4, 2019—Radboud University, Nijmegen: Mark Dingemanse

Vowel-colour associations in two non-synesthete subjects (left) and in two synesthetes (right) (*see Snapshot 2*). Synesthetes more precisely chose the same colour for a particular sound. However, all four participants created groups of sounds that lay close to a particular Dutch vowel, such as "ee" [i:] (upper left), and they all chose lighter colours for "ee" than for "aa" or "oo". General principles for vowel-colour associations exist, whether one has synesthesia or not.

Does [a:] as in 'baa' sound more green or more red? And is [i:] as in 'beet' light or dark in colour? Even though we perceive speech and colour are perceived with different sensory organs, nearly everyone has an idea about what colours and vowels fit with each other. And a large number of us have a particular system for doing so. This is shown in research by linguists from Radboud University and the University of Edinburgh on similarities in the vowel-colour associations perceived by over 1,000 people.

Insect-deterring Sorghum Compounds May be Eco-friendly Pesticide

April 3, 2019—Penn State, US Department of Agriculture

The flavonoids are not present in the phloem—vascular tissue in plants that conducts the sugars aphids seek—but are in the epidermal cells that form the outermost layer of defense. When aphids repeatedly probe and puncture the epidermal cells with their stylets, or beaks, they take up the flavonoids that lead to their demise.

Compounds produced by sorghum plants to defend against insect feeding could be isolated, synthesized and used as a targeted, nontoxic insect deterrent, according to researchers who studied plant-insect interactions that included field, greenhouse and laboratory components.

Coral Study Traces Excess Nitrogen to Maui Wastewater Treatment Facility

Nutrient pollution has been blamed for algal blooms and degradation of coral reefs along Maui's west coast

April 3, 2019—University of California - Santa Cruz: Peter Swarzenski, USGS

Groundwater carrying excess nutrients from treated sewage enters coastal waters through submarine freshwater seeps in the reef off the coast of Maui.

A new method for reconstructing changes in nitrogen sources over time has enabled scientists to connect excess nutrients in the coastal waters of West Maui, Hawaii, to a sewage treatment facility that injects treated wastewater into the ground.