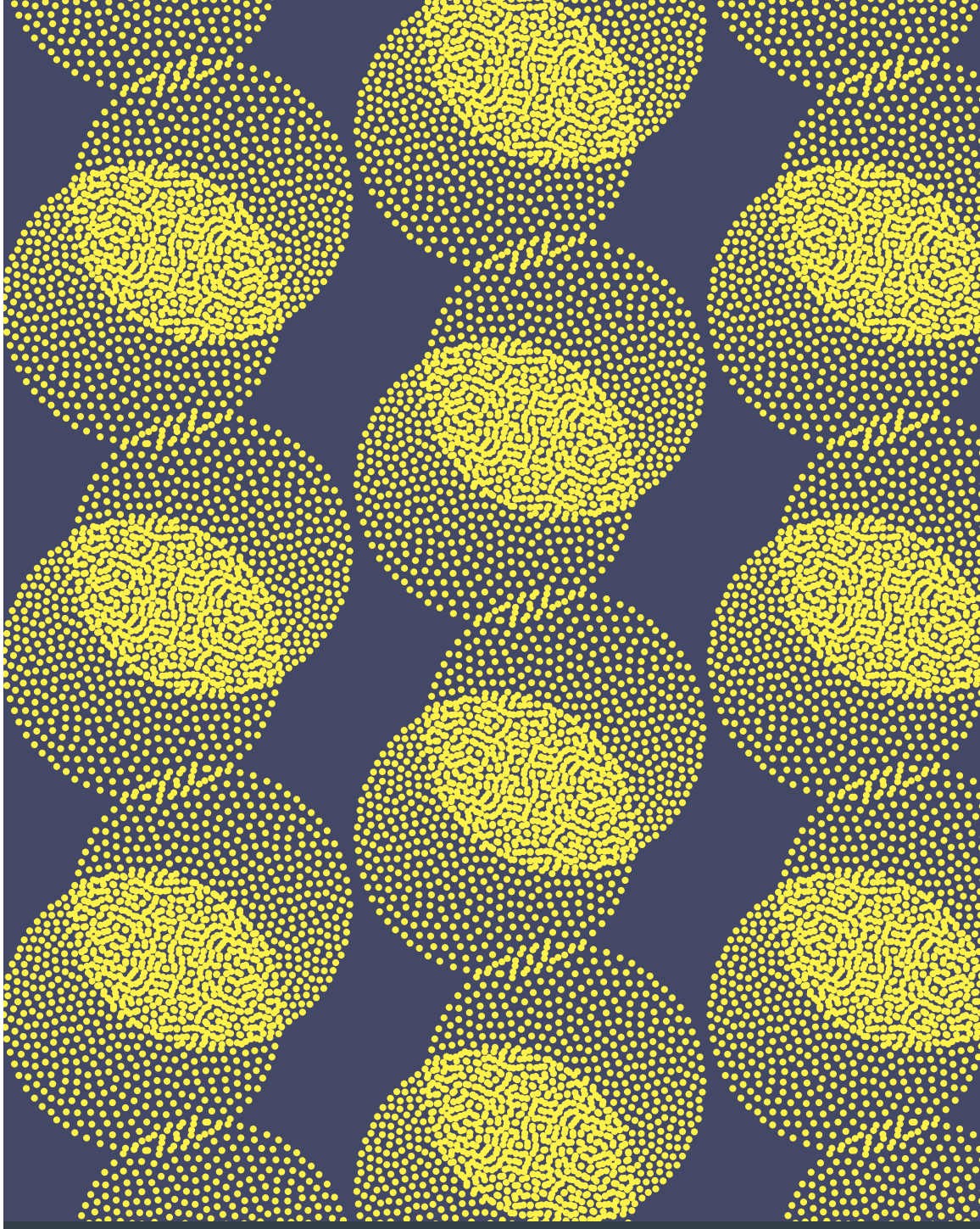
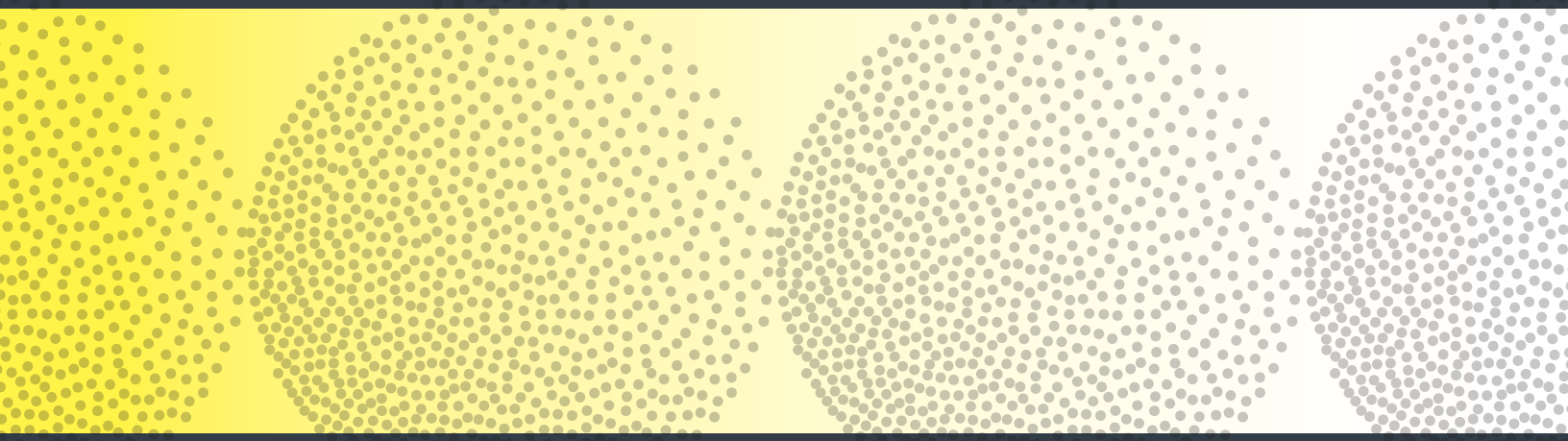
CAMPBELL INSTITUTE™



A Second Look: Update on Visual Literacy

NATIONAL SAFETY COUNCIL®



(Re)introduction to Visual Literacy

Last year, the Campbell Institute introduced the concept of visual literacy for occupational safety in its collaboration with the Center for Visual Expertise (COVE) and Institute member organizations. The purpose of this research collaboration was and is to evaluate the effectiveness of visual literacy training on workplace health and safety outcomes. That is, does "learning to see" improve our ability to identify hazards in the workplace, keeping us safer while on the job? Our hypothesis is simply that being more visually literate enables individuals to perceive and comprehend more about their work environments, allowing them to see hazards and visualize what could possibly occur should those hazards continue to exist. Having this increased ability to see and observe work areas can help workers to be more proactive about their work environment and take action to fix any hazards before they become an incident.

As a Campbell Institute member, Owens Corning introduced the work of the Toledo Museum of Art to the Institute as a potential collaborator for presentations and research projects. The initial talks to launch a multi-year research project to determine the effects of visual literacy training on increasing hazard awareness and recognition in the workplace began in early 2016. The proposed pilot project was designed to expand upon the collaboration and work that had already taken place at Owens Corning with a six-hour visual literacy session with OC's key EHS team.

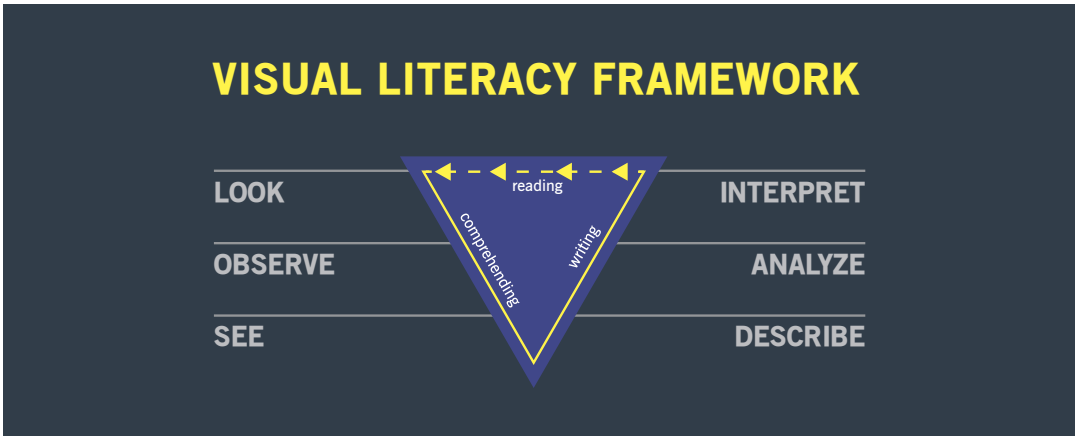
The pilot project set out to answer the question if learning to see improves ability to identify workplace hazards, thus keeping workers safer while on the job. To answer this research question and test our hypothesis that being more visually literate enables workers to perceive and comprehend more about their work environments, the Toledo Museum of Art invited representatives from Campbell Institute members to take part in a two-day workshop to understand the principles of visual literacy and how visual biases can impede the ability to truly "see" the important elements of a situation. The visual literacy framework involves three key elements: reading, comprehending, and writing visual language.

The Center of Visual Expertise, which was founded by the world-renowned Toledo Museum of Art, has combined art educators with safety experts to develop innovative methods to help you and your team better see the world around you. COVE believes that all incidents are preventable and we've partnered with the Campbell Institute at the National Safety Council and our industry partners to demonstrate how.

COVE
Center of Visual Expertise

The beginning of this connection between visual literacy and the field of environment, health, and safety dates back to 2015 when the Toledo Museum of Art (TMA) started working with several companies in the Toledo region, including Owens Corning, a Campbell Institute member. TMA spent a year developing the framework and curriculum for these Toledo-area companies to increase employees' powers of perception and hazard recognition, eventually piloting the curriculum with over 300 Owens Corning staff and volunteers in early 2015.

Toledo Museum of Art



To read visual language, you must first look or take an initial visual scan of a picture or an area, then observe to identify key details. Once looking and observing have taken place, you can then see the entire picture. To comprehend visual language, you describe the visual information in front of you and begin to assign meaning to what you see by analyzing and interpreting the visual data. Finally, to write visual language, you respond to what you have seen and analyzed, perhaps approaching your work in a new way. In a safety setting, a worker would ideally use this process of reading, comprehending, and writing visual language to report and remove a hazard that could cause an incident.

Understanding how our visual biases come into play is an important part of becoming more visually literate. Last year's research report provided examples of how we do not fully observe all details when we look at something, whether that is a piece of art or a workplace scene. We constantly use personal experiences and memory to fill in gaps and details, particularly if it is a place or a scene that we are accustomed to seeing often. If a machine operator looks at the same work area and piece of equipment every day for weeks, months, or years, it can be assumed that s/he knows the work area and machinery well, but is not necessarily seeing all the details anymore. Sometimes it is the fine details – and our inattention or "blindness" to them – that poses a hazard that can result in an injury or worse.

Visual literacy training can help in ways that go beyond just the recognition of hazards in the workplace. In addition to turning potential incidents into near misses, having more workers trained in using visual language can lead to more detailed and descriptive hazard and incident reports. Having improved visual language skills can help gather better evidence from the scene or from witnesses during incident investigations. Those conducting the investigations may see improved skill in asking questions of witnesses to help them fill in the visual details of what they observed.

Being more visually literate can help safety managers verify and audit the effectiveness of corrective actions, particularly if the corrective actions are making the desired impact. Finally, visual literacy training serves as an on-going safety training and learning for workers at every level. The interactivity of the visual literacy exercises serves as way to engage workers and leaders on a regular basis while receiving training that can positively affect their safety on the job.

Train-the-trainer workshop takeaways

The first train-the-trainer workshop for study participants took place in early October of 2017. During the two-day workshop, facilitators from the Toledo Museum of Art delivered visual literacy training to fourteen participants representing three companies and four different study locations. Over the course of the workshop, TMA facilitators used a variety of methods and activities to teach participants (1) the elements of visual literacy, (2) why being visually literate is important for workplace health and safety, and (3) how visual language can be used to improve health and safety outcomes.

Participants learned that about 90 percent of the information that individuals take in is visual information, yet this can cause us to have inattentional blindness. That is to say, there is so much visual data to consume at any given moment that we have to filter that information to see only what we deem is important to see, essentially becoming blind to innumerable details. This is not a tendency that humans can wholly overcome,

unfortunately – to truly take in and process all visual information would lead to sensory overload. What we can do, however, is be aware of our visual biases and use a step-by-step procedure to visually process a scene – and truly "see" as much detail as possible.

One of the takeaways from the discussion of inattentional blindness is that what we choose to prioritize visually will usually dictate how we start and go about our work, such as when completing Job Safety Assessments. To overcome visual biases and inattentional blindness, TMA facilitators recommended a structured way of looking at and observing work areas, which begins with taking in the big picture, or the whole scene, before zooming in to individual details. In other words, the process begins by looking at the perimeter of a visual scene and then moving inwards. This process made sense from a safety professional's perspective, because if an incident had occurred, proper procedure would be to first assess that the area is safe before moving in to collect more details and evidence.

Starting by looking at the perimeter of a visual scene or work area is only the first step. The next steps of this structured process are to look for the elements of visual literacy: line, shape, color, texture, and space. Observers should ask themselves what potential hazards they can see by looking for a variety of things within these five elements: horizontal/vertical or curvy lines, shapes or angles, warm or cool colors, rough or smooth surfaces, the amount or lack of space between objects. This procedure and the elements/tools for looking and observing are designed to slow down the thought process so that observations can be interpreted thoroughly without jumping to conclusions.

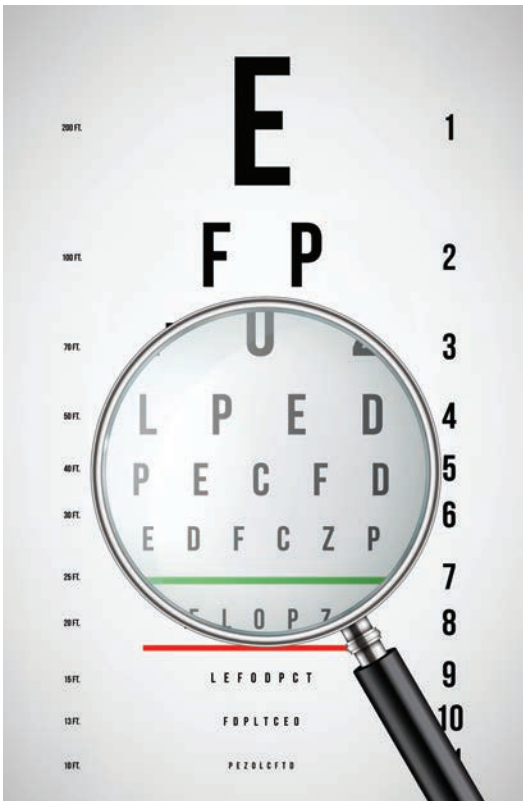
Using the template of line-shape-color-texture-space, Owens Corning created their own process and vocabulary for looking at and assessing a work area for hazards. They based this vocabulary on the top drivers and interactions that create hazards in Owens Corning facilities, such as tool usage, forklifts in close proximity to people, manual handling of product/material, and walking working surfaces (where workers have to stand). Owens Corning employees are trained to pay particular attention in these situations. Workshop participants were encouraged to think about the key elements or interactions in their own work environments that are the top drivers of injury, and to train workers to look for those elements when conducting hazard assessments.

Owens Corning also related that they are working with a data scientist to run analyses of hazard and incident reports in order to get a better sense of the number and percentage of hazards and incidents that are discovered through visual literacy training, or may have had visual inattentiveness as a contributing factor. Currently most companies do not collect the kind of data that can be used to evaluate the effectiveness of visual literacy training, and may be able to only indirectly measure the effect of visual literacy training on workplace safety. This data analysis for Owens Corning is a step towards discovering more of the impact that visual literacy has on occupational safety.

Evaluation Metrics and Implementation at Sites

Most of the Campbell Institute sites selected for the visual literacy pilot project, while they have received and delivered the training at their respective locations, are still in the process of fully integrating visual literacy as a component of their safety programs. This also means that they have not yet decided on the metrics to be used to evaluate the effects of the visual literacy training for hazard recognition. Upon beginning this project, educators at the Toledo Museum of Art and researchers at the Campbell Institute suggested that the evaluation metrics should roughly coincide with the kinds of safety data that are already being collected at participant sites. This would make it less burdensome for sites to collect numbers and/or generate reports to send to researchers for analysis. With this in mind, there are both quantitative and qualitative evaluation metrics that the researchers have suggested for participant sites. The first quantitative metric is the number of proactive hazard recognition or near miss reports filed. As more workers are trained in visual literacy and as their ability to see their work environments is enhanced, we can expect that workers will be observing and reporting more potential hazards. Similarly, we may expect workers to submit more stop work orders as a result of having their eyes opened to seeing more potential hazards. The number of stop work orders submitted is another quantitative metric suggested for participant sites to collect and report.

Other metrics are related to the Job Safety Analysis, which is an essential component of workplace hazard recognition. We have suggested that participant sites track how frequently JSAs are filled out and the number of JSAs completed by the full work crew. There are also qualitative metrics that are associated with JSAs, such as having a safety manager review the quality of the JSA report. How completely and how well is it filled out? Over time, can researchers track a convergence of vocabulary within the JSA reports as more people are trained in the use of visual language? The consistency and comprehensibility of language for JSA reports is important to ensuring that hazards are properly and proactively addressed.



The USG site has conducted the visual literacy training with its safety team and plans to roll out the training to the rest of the worker population when they launch a new program for hazard recognition called Take 5. The premise of the Take 5 program is to perform a five-minute safety check before work begins, and the structured process from the visual literacy training pairs nicely with this concept. For example, Take 5 may involve a point-by-point checklist to examine walls, floors, working surfaces, etc. Paired with the visual literacy process of starting with the perimeter and working inwards, the Take 5 program teaches workers to take a measured approach to performing a safety check and to remain open to seeing potential hazards that they may have overlooked before. In addition to looking at the evaluation metrics suggested by the research team, the USG is also considering collecting feedback from those who have received the visual literacy training for their thoughts on if and how visual literacy has enhanced their safety in the workplace.

A Cummins distribution site has rolled out the visual literacy training to managers on a bi-monthly basis in four separate modules: understanding visual bias and inattentional blindness, building a vocabulary with the elements of art, doing back-to-back drawings, and seeing the forest for the trees. The visual literacy training has prompted work teams to think a bit differently about the JSA process. Currently, JSA forms are pre-populated with hazards that are typical for a work area and equipment. With knowledge of selective attention and visual biases, however, we know that there could be another previously unknown hazard lurking. Workers are now being trained to do an initial systematic look using the structured process for seeing before moving on to the JSA form.

There are several metrics that the Cummins distribution site is tracking to evaluate the effect of the visual literacy training. One is the number of Job Safety Observations (JSOs) completed. Another quantitative metric is the number of "all safe" JSOs relative to the number of JSOs with at-risk hazards identified. Currently, the goal at this Cummins distribution site is to have at least one at-risk hazard identified per JSO. Having too many "all safe" JSOs may be a sign of pencil whipping and/or non-compliance with safety procedures. From a qualitative side, this site plans on analyzing the types of hazards found as part of the JSO process. Are the same hazards being found over and over again? Or are different hazards being discovered as a result of the visual literacy training?

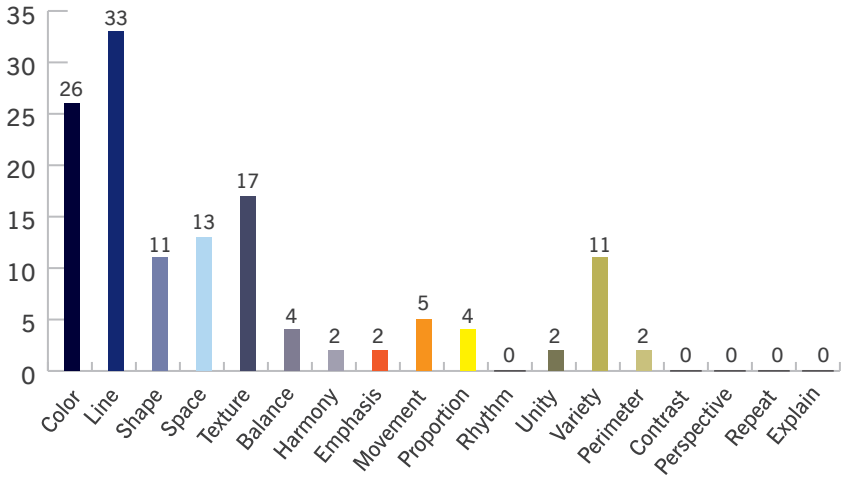
A Cummins manufacturing site delivered the visual literacy training through four trainers, two who attended the workshop at TMA and two other support staff. Machine operators work through the modules of the visual literacy training as they move from different work stations in cells, with about 7-8 stations per cell. This rotation method will eventually train everyone within a cell in visual literacy and the elements of art. Last year, the site noted that 60 percent of their recordable injuries was due to a lack of hazard recognition, particularly among new hires and temporary employees. For this reason, they are also delivering visual literacy training to new workers.

Like the Cummins distribution site, the manufacturing site is also tracking the types of hazards identified, and if workers have started to identify any new kinds of hazards after being trained in visual literacy. Another evaluation metric is the ideas that workers submit to mitigate the hazards identified. How many ideas are submitted, and what are the quality of those ideas?

Case Study Results

The Cummins manufacturing site already tracks many things about the hazard reports submitted, but have begun flagging and categorizing the hazards recognized as a result of the visual literacy training. As of the end of March 2018, 225 employees had been trained plant-wide. They identified 132 issues using the elements of visual literacy and submitted and corrected 25 hazards through the company "Find It Fix It" hazard recognition and correction initiative.

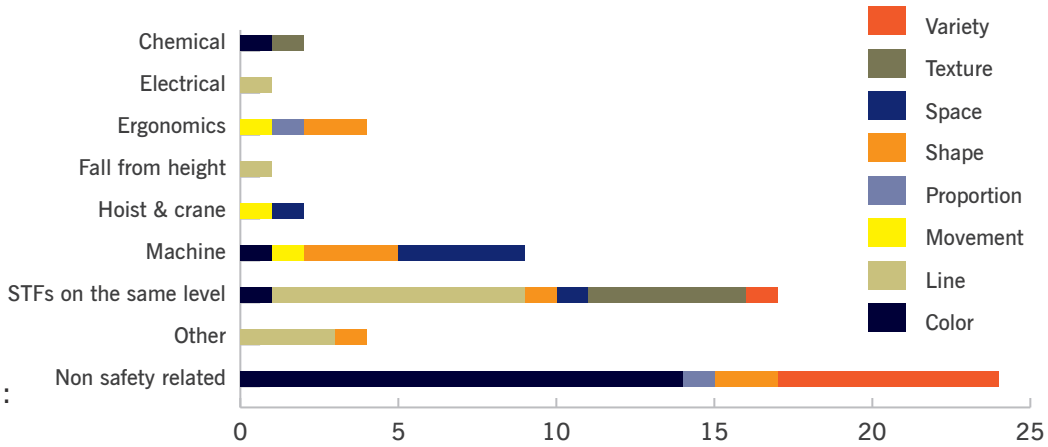
FIGURE 1:
Visual literacy elements used to identify hazards at Cummins manufacturing site, as of March 2017



The majority of the hazards identified so far (Figure 1) by the Cummins manufacturing site are through the visual literacy elements of Line and Color. This is followed by the elements of Texture, Space, Shape, and then a combination of elements (labeled as "Variety").

The types of hazards identified by using the elements of visual literacy (Figure 2) are varied and show the diversity of areas where visual literacy can be helpful in pinpointing potential hazards. So far, the workforce at the Cummins manufacturing site has identified 17 slip, trip, and fall (on the same level) hazards and nine machine-related hazards. The largest category is actually non safety-related hazards, which refer to hazards related to quality or production. The majority of these were identified through the visual literacy element of color.

FIGURE 2:
Types of hazards identified using visual literacy elements at Cummins manufacturing site, as of March 2017



In addition to tracking the number and types of hazards that have been identified by employees, the safety team at the Cummins manufacturing site has also compared the fundamental risk scores that employees have assigned to types of hazards before any controls. Risk is assessed using the factors of severity, exposure, and probability. It appears that the visual literacy training has heightened workers' risk perception and lowered their risk tolerance, resulting in higher scores for exposure, severity, and overall fundamental risk for certain hazards.

Fall from height

	Pre visual literacy	Post visual literacy
Exposure score	22	28
Severity score	35	50
Fundamental risk score	230	320

Machine hazard

	Pre visual literacy	Post visual literacy
Exposure score	242	260
Severity score	165	180
Fundamental risk score	1219	1300

STF on the same level

	Pre visual literacy	Post visual literacy
Exposure score	50	74
Severity score	45	105
Fundamental risk score	310	670

FIGURE 3:
Change in exposure, severity, and fundamental risk scores for selected hazards pre- and post-visual literacy training at Cummins manufacturing site

The Cummins manufacturing site has documented in photographs some of the hazards identified using the elements of visual literacy, and how these hazards were fixed.

Using the elements of line, shape, and texture (Exhibit 1), employees noticed that the rise and run of the steps were not consistent and to code, the treads of the steps were run down, and there was not a rail on one side of the steps. To fix the hazard, the steps were replaced to have the proper rise and run, new treading, and an added handrail.

EXHIBIT 1

Before and after
STEPS AND HANDRAIL

EXHIBIT 2

Before and after
HANDRAIL

EXHIBIT 3

Before and after
STEP TREADS

In Exhibits 2 and 3, employees at the Cummins manufacturing site used the element of texture to recognize that grips should be added to handrails and that the treads on steps should be replaced.

Using the element of shape, workers noticed that the failsafe for stopping an engine had sharp edges (Exhibit 4), which were ground down. Employees at the Cummins manufacturing site have also used the elements of visual literacy to see when certain things are unnecessary and can be removed for better housekeeping and efficiency. For instance, they noticed a basket (Exhibit 5) that did not have a purpose beyond holding some non-relevant items, so the basket was removed.

EXHIBIT 4

Before and after
FAILSAFE

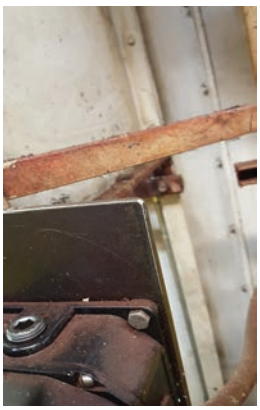


EXHIBIT 5

Before and after
BASKET

Conclusion and Next Steps

The visual literacy for hazard recognition pilot project launched in October 2017 with the initial train-the-trainer workshop at the Toledo Museum of Art. Since that time, the newly designated trainers from USG, Cummins distribution, and Cummins manufacturing have delivered the visual literacy training to their respective sites and have developed plans to further integrate the principles of visual literacy into existing safety programs for hazard recognition and identification.

The preliminary results from the pilot project at the Cummins manufacturing site are encouraging. It seems that employees who have received the visual literacy training have identified new types of hazards by using the elements and process of visual literacy, which has led to improvements and fixes in their work environments. There also appears to be an increase in the number of proactive hazard and near miss reports after the delivery of visual literacy training, which was an expected result.

Comparing the exposure, severity, and overall risk scores of certain types of hazards before and after the visual literacy training has showed that workers at Cummins manufacturing tend to have heightened risk perception after learning about the elements of visual literacy. The training has also served as a way to engage employees in an innovative and interactive manner.

To continue with the evaluation, the researchers at the Campbell Institute and the Center of Visual Expertise (COVE) hope to receive more data on Job Safety Analyses from all the project sites to test the hypotheses that visual literacy for hazard recognition can result in better quality JSAs. Once more data from JSAs are collected, we can begin to analyze the language of JSAs and hazard reports to determine if there is a convergence of language and description after workers have received visual literacy training.

The initial train-the-trainer workshop in October 2017 has not been the only training offered for this pilot research project. In March 2018, COVE held additional workshops in the Indianapolis area to bring training to two other Cummins locations. COVE continues to hold workshops at the Toledo Museum of Art for other Campbell Institute members seeking to join the pilot project and other interested organizations seeking to enhance their safety programs and engage employees.

COVE has begun conducting evaluations of the training workshops, and very positive results have been returned thus far. Based on the 55 evaluations received to date, 95 percent would recommend the workshop to a colleague, and 100 percent have endorsed the relevance of the visual literacy topic to the field of environment, health, and safety.

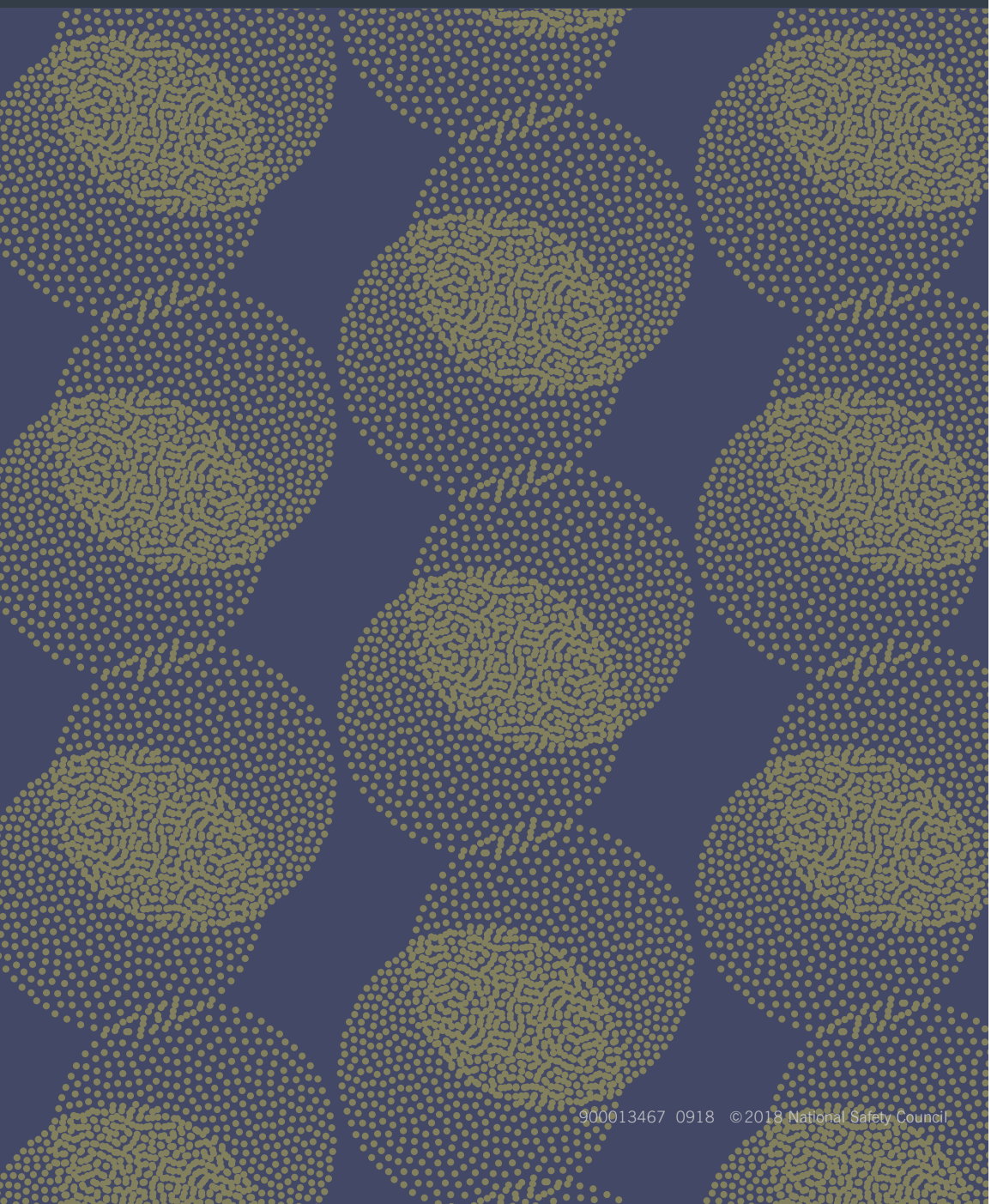
The first paper on the topic of visual literacy for hazard recognition attempted to establish the connection between what is primarily a skill/process in art education and the field of environment, health, and safety. The preliminary results from the research project so far and the initial feedback from workers and workshop attendees seem to confirm that this is a lasting connection and one with important implications for workplace health and safety outcomes. We expect to see more confirmation of these initial findings as the participant organizations continue implementing the visual literacy interventions at their locations. The Campbell Institute will continue to track the activities, results, and lessons learned from project participants and plans to publish these in a future report.

The Campbell Institute would like to gratefully acknowledge the Institute members participating in the project, the Center for Visual Expertise, and the Toledo Museum of Art for their partnership and collaboration in these efforts.

Author: Joy Inouye
Additional Campbell Institute Staff: John Dony, Magaly Flores, Katie Knee, and Katherine Smith

Campbell Institute
National Safety Council

+1.630.775.2283
thecampbellinstitute.org
campbellinstitute@nsc.org



900013467 0918

nsc.org

PRINTED WITH SOY INK 100% Recycled Fiber