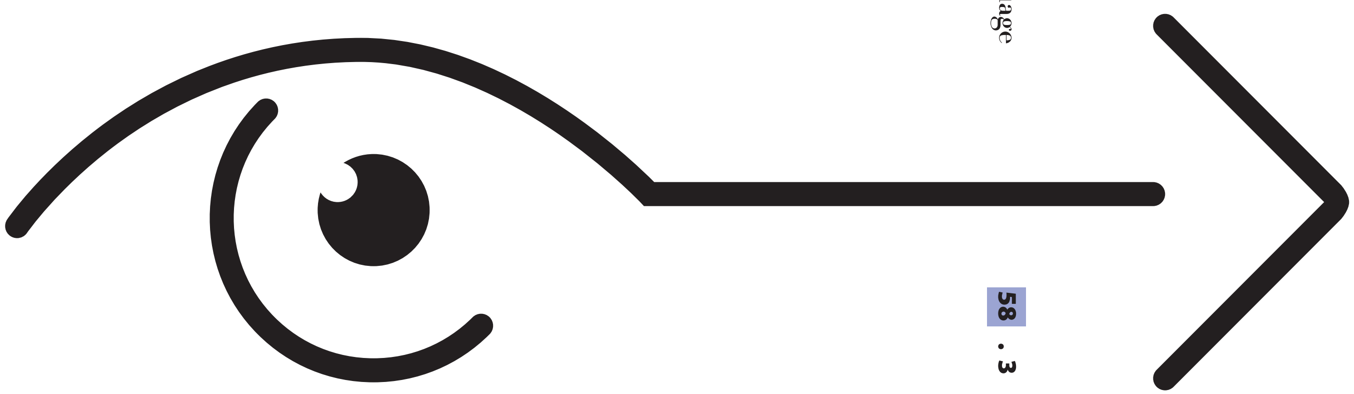

ISSN 0022-2224

Published continuously
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Visible Language

58 . 3

the journal of visual communication research

january . 2025

Visible Language

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a study exploring visual crowding within the frame of a pictogram, measuring the effect of spacing between two icons and between icons and an outline frame on icon recognition, concluding that the most limiting factor for recognition is two icons overlapping or placed in close proximity to each other

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reflection on upon the change from publishing *Visible Language* for 58 years under the direction of a single Editor to publishing *Visible Language* by a consortium of institutions and an editorial staff led by an Editor in Chief

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Contents

Crowding Impairs Recognition of Framed Icons

Pia Pedersen
Chiron Oderkerk
Sofie Beier

Abstract

Pictograms are graphic symbols designed to function within limited space. They are characterized by overlapping elements within a frame, which can lead to visual crowding, where neighboring objects merge and become indistinguishable. While visual crowding has been extensively studied in reading and vision research, its impact on pictograms remains underexplored.

This study aimed to measure the effect of spacing between two icons and between icons and an outline frame on icon recognition. Using Auckland Optotypes to construct fictive pictograms, we conducted an experiment within an object recognition experimental paradigm, involving 25 participants. Results showed significant interaction between the effects of icon-frame distance and the spacing between the two icons, with the most limiting factor for recognition being two icons overlapping or placed in close proximity to each other. Strategic spacing adjustments within framed pictograms can reduce the impact of crowding on recognition, particularly when icons are not overlapping.

Keywords
icons
crowding
psychophysics

1. Introduction

Pictograms are positioned within the broader category of graphic symbols and are defined by their capacity to visually echo the ideas, concepts, or objects they intend to convey through the use of simple, stylized, and figurative designs (Ota, 1987, s. 18; Tijus et al., 2007; Zender & Mejía, 2013). Functioning as efficient communicative tools, pictograms play a role in democratically disseminating information across diverse places and contexts, such as for wayfinding (Lee et al., 2014; Rousek & Hallbeck, 2011), warning (Roca et al., 2018; Waterson et al., 2012) and providing medical information (Merks et al., 2019; Ng et al., 2017; Pedersen, 2019) ii. Consider pharmaceutical pictograms, exemplified in Fig. 1, which convey significant messages about medications that are complicated or closely related. In such scenarios, the addition of specific details and information becomes essential to enable patients to distinguish and comprehend the nuanced meanings embedded in the pictograms (Pedersen, 2019, p. 75).

Figure 1.

Examples of United States Pharmacopeia (USP) pictograms, representing a large set of easily accessible pictograms that are frequently found in the research literature. The three examples provided, each concerning how to take medicines, illustrate the level of detail and information that may be necessary to inform patients.

It is well known that the design of pictograms can influence recognition, particularly in small visual sizes (Pedersen et al., 2022), visual search, and comprehension (Rousek & Hallbeck, 2011). The visual elements within the pictogram must be selected and combined to form the intended meaning and drawn in a way that is easily comprehensible (Strauss & Zender, 2017; Zender & Mejía, 2013) and legible (Pedersen, 2019). Whether the intended meaning of a pictogram is understood involves an interplay of these and other factors.

The present study focused on the legibility of pictograms and the spatial relationship of their elements. Strauss & Zender (2017) have developed a taxonomy that distinguishes between graphemes, icons, and pictograms, which will constitute the use of terminology in this study. Graphemes are small visual elements that do not necessarily have a meaning of their own; icons consist of graphemes and represent a simple concept or object; and pictograms typically represent more complex concepts or ideas, as depicted in Fig. 2. Thus, depending on the referent they represent, pictograms can either consist of one or a combination of icons. This distinction is relevant for evaluating pictogram legibility because it provides a framework for isolating elements and controlling stimuli.

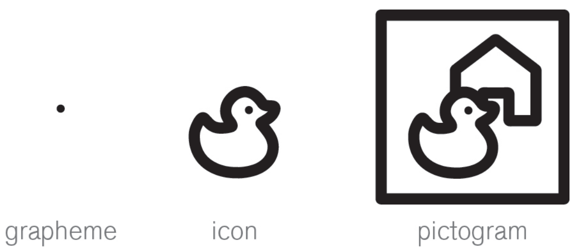


Figure 2.

The distinction between grapheme, icon, and pictogram according to the taxonomy by Strauss & Zender (2017).

Pictograms must function in different sizes, and because of the limitation of space, icons within the pictogram often overlap (exemplified in Fig. 1). In addition, they are often placed within a surrounding shape which is either indented to communicate a specific meaning or to protect and further separate a pictogram from surrounding elements. The surrounding shape is known to be an important component of warning signs specifically (Ma et al., 2018). As the 'ISO 7010 – Graphical symbols — Safety colours and safety signs — Registered safety signs' demonstrate, the square is used to provide information, the triangle for warnings, and the circle for prohibitions and requirements (see also Kepes, 1966). Despite the purpose of the background shape, we are yet to fully understand how to optimize the spatial relationship between the frame and the placement of icons within a pictogram. In this study, we used the square as a background shape because it is used for many types of pictograms and typically for framing the pictogram elements if not for conveying a specific meaning.

1.1 Frame and crowding

One fundamental limitation of visual perception is the phenomenon known as crowding, where individual objects placed in close proximity tend to perceptually merge. Research indicates that object framing increases the risk of crowding (Herzog et al., 2015). Crowding is strongest between objects with similar features, while between objects with, for instance, different shapes, crowding is reduced (Levi et al., 1994). Crowding has been found in the visual periphery (Bouma, 1970), at small visual angles in the center of vision (Coates et al., 2018), and with short exposure to stimuli (Lev et al., 2014), suggesting that most reading situations involving pictograms will be affected by some level of crowding between individual elements.

There is a consensus within vision research that object recognition is a two-stage process of first detecting individual features and second integrating features into an image (Levi, 2008; Pelli & Tillman, 2008). Crowding does not appear to affect the first stage of feature detection; however, it affects the second stage, where the feature integration can be disproportionately large so that separate neighboring parts appear connected (Pelli et al., 2004). In other words, the smaller features (graphemes and icons) of a pictogram can be individually identified; however, when the perceptual system tries to integrate these features into a whole pictogram, the features might perceptually merge, leading to failure of recognition or misinterpretation.

To avoid this crowding effect, placing objects at considerable spatial distances is recommended (Pelli, 2008). However, this isn't always feasible in pictogram design, where multiple icons frequently need to coexist within a relatively confined spatial area. Consequently, the intentional overlap of icons is frequently adopted in the design of complex pictograms.

1.2 Legibility of graphic symbols

From a broad perceptive, graphic symbols (including pictograms and icons) have been extensively studied across subjects and contexts. However, only a few studies have explored approaches for enhancing their legibility. One possible explanation for this gap could be the tradition of testing graphic symbols at larger sizes, where comprehension is less affected by visibility issues (Pedersen, 2019, p. 88). Some studies that investigate visibility make use of a blurring filter to clarify how to redesign a graphic symbol effectively.

For instance, research addressing the visibility of symbolic highway signs demonstrated improvement through shape modification. This involved maximizing contour size and increasing contour separation within a fixed diamond-shaped frame (Kline & Fuchs, 1993). Additionally, symbol signs with high levels of blur tolerance—meaning symbols not heavily reliant on high spatial frequencies to convey critical information—prove more legible at greater viewing distances (Schieber, 1994). This suggests that the deliberate manipulation of negative space within a frame could be an effective strategy for optimizing the visibility of graphic symbols.

Other studies address the challenges posed by overlapping elements within limited space, particularly in the recognition of prohibitive symbols, a scenario influenced by the interaction between the negation slash and the pictorial (Murray et al., 1998; Shieh & Huang, 2004). In conditions of reduced luminance contrast or limited exposure time, the size of the graphic symbol within the circle and the thickness of the negation have been found to significantly impact glance legibility (Shieh & Huang, 2004). In our previous study (Pedersen et al., 2022), we demonstrated an effect of skeleton simplification on the recognition of USP pictograms, indicating that pictograms with crowded and overlapping elements performed significantly worse. Building on this, the current experiment aimed to optimize the use of space within the pictogram frame by minimizing the effects of crowding.

1.3 Optotypes as stimuli

Compared to letters, testing the effect of crowding in pictograms poses a challenge due to their diverse shapes, strokes, areas, varying numbers of elements, and variations in the complexity levels of the shapes. Using controlled stimuli rather than "real-life" pictograms becomes essential to determine the crowding effect.

Several validated methods exist for measuring visual acuity (VA) through pictures, such as LEA symbols, Kay Pictures, and Auckland Optotypes. The LEA symbols (Hyvärinen et al., 1980) are commonly employed for pre-literate children, featuring four objects, a square, an apple, a house, and a circle. Similarly, the Kay Picture test of VA (Kay, 1983; Milling et al., 2015) includes six picture optotypes – a house, a car, a star, an apple, a shoe, and a duck. In this experiment, we utilisized the Auckland Optotypes (Fig. 3) as stimuli because it is an open-access set with 10 icons designed for more consistent assessments. Developed with considerations for uniform stroke width, a 1:1 aspect ratio, perimetric complexity, and mean overlap, each Auckland Optotype has been designed to be adequately unique to ensure easy and unambiguous identification (Hamm et al., 2018). With more items than common pictorial VA methods, the Auckland Optotypes achieve higher reliability, particularly concerning the percentage of guessing answers (Ibid.). Using two Auckland Optotypes as icons surrounded by a frame, we constructed fictive pictograms.

While the Auckland Optotypes still await testing in crowded settings, the recommended practice of using Lea symbols in visual acuity tests for preschool children involves flanking each optotype with four bars. This specifically creates a crowding rectangle, enhancing the detection of lazy eyes (amblyopia) (Cotter et al., 2015, p. 9).

Our hypothesis suggests that as the distance between two icons decreases, while maintaining a consistent distance between the icons and the frame through a proportional frame size, the crowding effect is expected to increase, resulting in a decline in recognition rate. Conversely, if the distance between icons decreases but the distance between the frame and the icon increases due to a *uniform frame size*, either the proximity of the frame to the icons or the closeness between the icons themselves will amplify the crowding effect, resulting in a decline in recognition rate. Whether it is the frame surrounding the icons or the icons themselves, the crowding effect is anticipated to be equally significant. Moreover, the cumulative impact of crowding both between icons and between icons and frames is likely to contribute to a more pronounced decline in recognition rates.

2. Experiment

2.1 Respondents

The experiment included 25 participants aged between 18 and 36 years (M_{age} = 25.25 years, *SD* = 4.36 years, 14 women). Participants were recruited through a recruitment website (Forsoegsperson.dk), and all received a gift card of DKK 300 for their participation. The experiment took place at The Royal Danish Academy and adhered to the rules of the Declaration of Helsinki and The Danish Code of Conduct for Research Integrity.

2.2 Stimuli

The Auckland Optotypes consist of 10 icons specifically designed and validated for visual acuity tests, see Figure 3.

FIGURE 3.

The ten Auckland Optotypes (first line). Icons that are asymmetrical were flipped (second line). This was done to ensure equal balance when presented on both the left and the right, and to facilitate overlapping.

All icons were redrawn in Glyphs 3, a high-precision vector software for icon and type design, to ensure optimal resolution and precise size control. Each item – frame and icons – maintained a consistent stroke width of 26 pixels and a 1:1 aspect ratio.

Given our focus on testing the effect of spacing between icons and between icons and a frame, we deliberately included different icon spacings and frame sizes across conditions. The objective was for the locations and size of the target icons to be consistent, regardless of the size of the frame or the spacing between the icons. To achieve this, a systematic approach was developed to maintain consistent and equalized spacing, allowing for easy implementation whether the icons overlapped or were spaced apart.

All frames were constructed within a 1000-pixel square grid, divided into units of 40 pixels. Within this grid each icon measured 214x214 pixels. Three specific spacings were determined:

Spacing S: 120 pixels from center-to-center of the icons
Spacing M: 240 pixels from center-to-center of the icons
Spacing L: 320 pixels from center-to-center of the icons.

These spacings were incorporated into two types of frames: a uniform and a proportional. The uniform frame maintained a constant size of 560x560 pixels in each condition while the proportional frame adjusted its width based on the icon spacing to ensure a consistent distance between the icon center and frame edge. Frame P spacing S measured 440 pixels wide, Frame P spacing M measured 560 pixels wide, and Frame P spacing L measured 640 pixels wide. For example, in Spacing L Frame P, the icons touched the frame, whereas in Spacing S, the icons always overlapped.

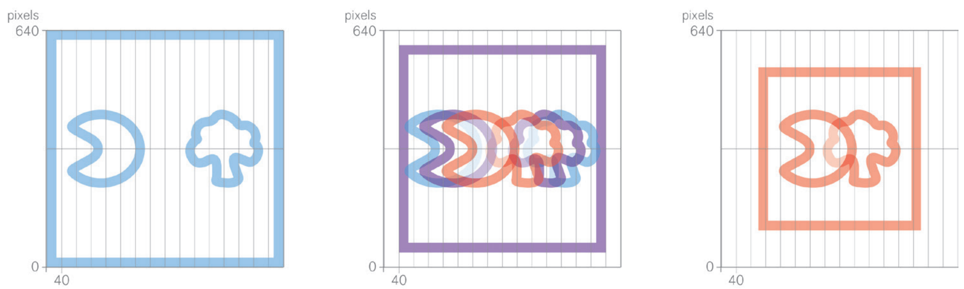


Figure 4.

The template was built based on units of 40 pixels.

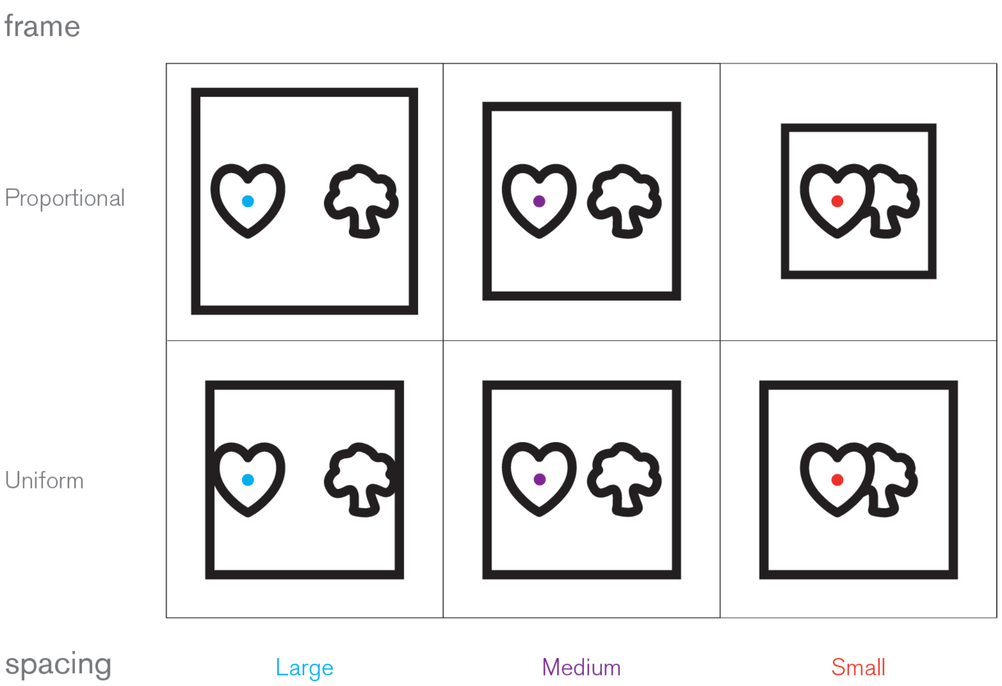


Figure 5.

The six different conditions. The colored dot in the target icon represents the center of the screen.

2.3 Apparatus

The experiment was conducted in a darkened room, with stimuli displayed in black (#000000) against a light background (#dadada) on a backlit 17-inch IBM/Sony CRT monitor (refresh rate = 85hz, resolution = 1024x768). The experiment was created using the software OpenSeame 3.2 (Mathôt et al., 2012).

2.4 Task and procedure

In the test procedure, participants were tasked with reporting the identity of the centrally presented target icon. This target-icon comprised part of the pictogram-stimulus, as it was flanked on the left or right by the distractor-icon, and both were surrounded by the frame (see 'Stimuli'). A trial was initiated by a black central fixation cross, size 0.63° by 0.63°—at 200 cm—presented for a variable duration of 1.300 ms with a uniformly distributed jitter of ±300 ms, followed by a 500 ms locational cue, and either the word 'LEFT' or 'RIGHT' that denoted which of the two icons was to be identified and reported. The pictogram-stimulus was then presented for 500 ms, followed by a 500 ms backward mask.

The size of the target-icon—and consequently the size of the pictogram-stimulus and backward mask—was determined separately for each participant at the start of the experimental session using an adaptive accelerated staircase procedure (Kesten, 1958; Treutwein, 1995). Specifically, the size of the pictogram-stimulus was set such that participants would correctly identify a target-icon, unflanked by a frame or distractor-icon, 75% of the time. During the staircase procedure, participants performed a similar task to the experimental test blocks, with the following differences: in each trial, participants were only presented with an isolated target-icon, unflanked by either a distractor-icon or a frame. Following a response, they received feedback in the form or a green fixation cross for a correct response and red for an incorrect response. Lastly, the size of the target-icon in the following trial was dependent on the response accuracy during the preceding trial. Please see Oderkerk & Beier, 2022 for details on the implementation of the adaptive accelerated staircase procedure.

The stimulus was immediately followed by a backward mask for 500 ms, consisting of a rectangular noise patch of variable height and width that was equal to the size of the pictogram-stimulus. Upon the offset of the backward mask, the participant was presented with the 10 possible icons included in the experiment, oriented left or right as the target icon. Participants responded using a mouse to identify the target-icon by clicking it, or by clicking elsewhere on the screen to continue to the next trial without reporting an icon. Following the participant's response, a coloured fixation cross provided feedback. Green denoted that the response was correct; red denoted that the response was incorrect or had not been given.

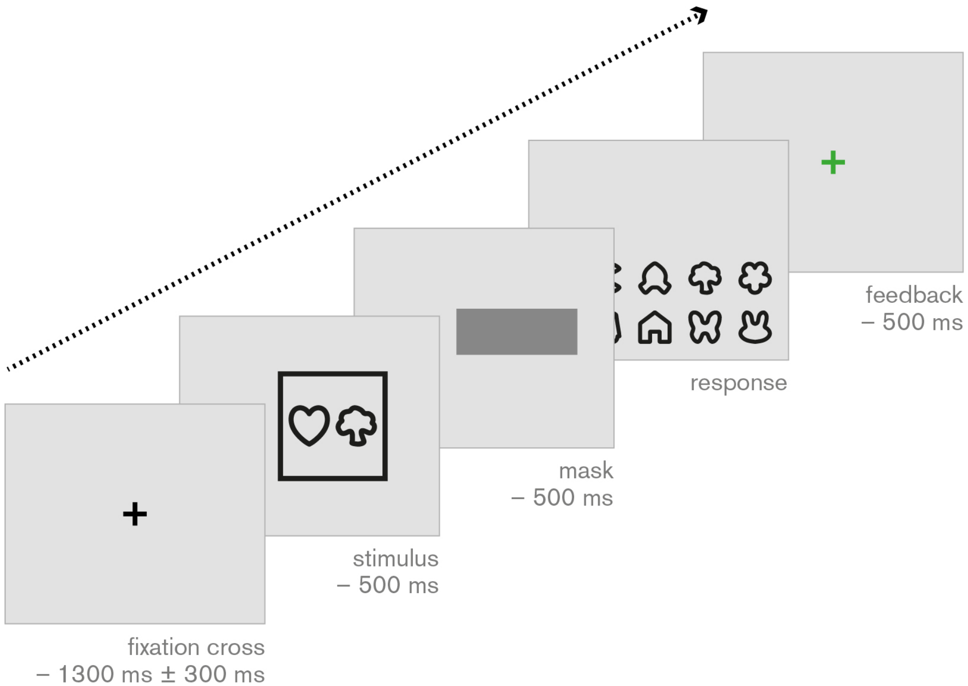


Figure 6.

Outline of the trial used in the staircase procedure and the regular experiment trials.

Each icon was presented as the target-icon in every block an equal number of times, in a randomised order. The identity of the distractor-icon was randomised and differed from the target-icon. The conditions of the frame type (i.e., Proportional or Uniform), spacing (Large, Medium, or Small), and icon target location (i.e., left or right) were varied across the test blocks. To counteract carryover effects, spacing conditions were counterbalanced using a balanced Latin-square design. Frame type was counterbalanced across participants, such that one would first see all the Proportional frame blocks, followed by all the Uniform frame blocks, or vice versa. Target location alternated after every block, with the order being counterbalanced across participants. This yielded 24 separate block orders. Participants took part in a staircase procedure for a variable number of trials, followed by a practice block of 24 trials, and 12 test blocks of 20 trials each.

3. Results

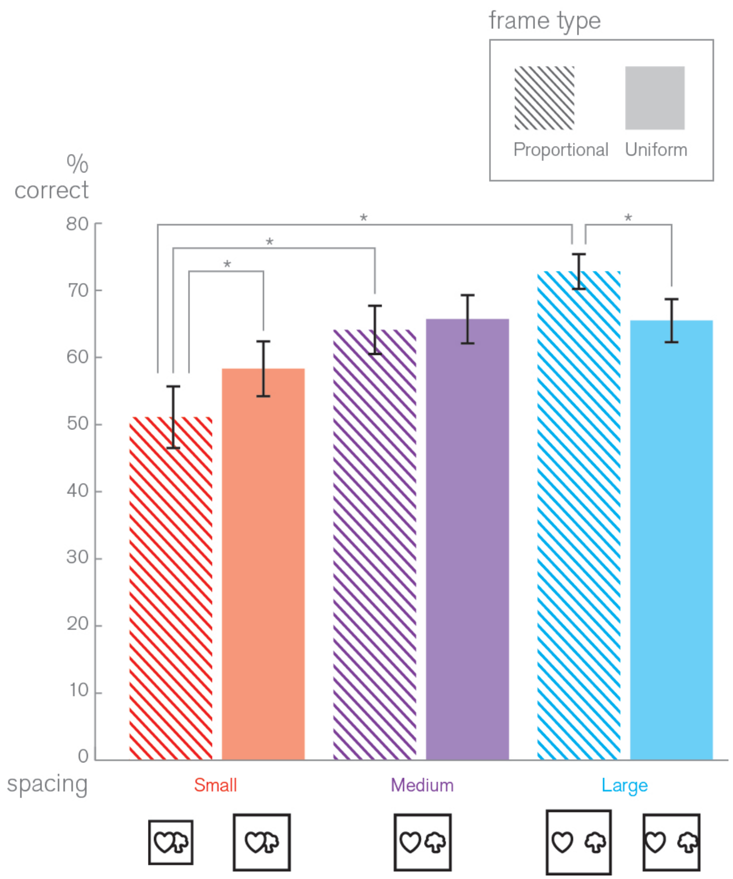
3.1 Data analysis

A 2 (Frame: Proportional vs Uniform) x 3 (Spacing: Large, Medium, Small) repeated measures ANOVA indicated a small significant Frame*Spacing interaction $F(1.60, 36.69) = 19.31$, $p < .001$, $\omega^2 = 0.029$, as well as a main effect of Spacing, $F(2, 46) = 27.43$, $p < .001$, $\omega^2 = 0.104$, but no main effect of Framing, $F(1, 23) = 0.15$, $p = .669$, $\omega^2 = 0.000$.

Planned comparisons, corrected for comparing a family of 15 using the Bonferroni method, showed that the effect Frame*Spacing interaction was the result of mean accuracy rates only decreasing monotonically with Spacing when the frame was Proportional. When the Frame was Uniform, however, the reduction in mean accuracy with Spacing was preceded by a plateau for the larger Spacings. Specifically, in the Uniform Frame condition, there was no significant difference between Large and Medium, $t(23) = 0.90$, $p = .999$, while mean recognition for Spacing Small was significantly lower than both Large, $t(23) = 3.10$, $p = .041$, and Medium, $t(23) = 3.19$, $p = .032$. In the Proportional Frame condition, mean recognition for Spacing Small was significantly lower than both Medium, $t(23) = 5.57$, $p < .001$, and Large, $t(23) = 9.34$, $p < .001$. In contrast to the Uniform Frame, however, recognition for Spacing Medium for the Proportional frame was significantly lower than Large, $t(23) = 3.77$, $p = .005$. Therefore, as a result of this interaction, recognition for Proportional-Frame Small-Spacing was significantly lower than Uniform-Frame Small-Spacing, $t(23) = 3.78$, $p = .005$, and conversely, recognition for Proportional-Frame Large-Spacing was significantly higher than Uniform-Frame Large-Spacing, $t(23) = 3.84$, $p = .004$.

Figure 7.

Data display of the results for the Proportional and Uniform frame. Comparisons denoted by * exhibited statistically significant differences.



4. Discussion

Our experiment focused on exploring the effect of crowding on recognition rates in three scenarios: 1) when icon–icon spacing remained constant but icon–frame spacing decreased; 2) when icon-frame remained constant but icon–icon spacing decreased; and 3) whether there would be an interaction between the effect of icon–icon spacing and the effect of icon–frame spacing. The experiment revealed that both the size of the frame and the overlap of icons significantly affects the recognition of individual icons. In the following sections we will elaborate on the different scenarios explored.

4.1 The effect of frame and icon–frame spacing

Previous research has demonstrated a significant crowding effect when a vernier is surrounded by a square compared to a vernier that is not (Herzog et al., 2015). Our study, however, did not indicate a significant main effect of framing. This does not dismiss the possibility of framing having a negative impact under different conditions. A comparison between the crowding effect of unframed icons and framed icons could potentially have revealed significant differences that were not explored in our specific experimental setup.

Although our study did not reveal a primary framing effect, significant recognition differences emerged between the Uniform and the Proportional frames for Spacing Small (red bars in Fig. 7) and Spacing Large (blue bars in Fig. 7). In the two Framing conditions of Spacing Small, the icons overlapped, while the spacing between frame and icon was increased from the Uniform frame to the Proportional frame. Similarly, from the Uniform to the Proportional frame Spacing Large, the spacing between icons was maintained, while the distance between frame and icon was increased. The significant difference between Proportional frame Spacing Small and Uniform frame Spacing Small suggests that something was influencing the recognition of Proportional frame Spacing Small more than it was influencing the recognition of Uniform frame Spacing Small, presumably crowding from the frame. In these conditions, we observed that the recognition rate increased with more spacing between the frame and icons.

4.2 The effect of icon–icon spacing

Our findings supported the hypothesis that diminished recognition occurs with tighter spacing of icons in a Proportional frame. The recognition rate for Spacing Large Frame Proportional was significantly higher than that of Spacing Medium Frame Proportional and Uniform. Although the Icon-Frame spacings were the same in these conditions, the Icon-Icon spacings differed.

Notably, the significant decrease in recognition from Spacing Medium to Small in the Proportional frame underscored the adverse effect of icon overlap on recognition. In both conditions with Spacing Small, the backmost icon was partly covered and less visible, which, as expected, impaired recognition of the target icon.

When two icons were in close proximity or overlapping, the effect of crowding increased, leading to a decline in recognition rate. This suggests the need for caution when adding elements within a pictogram as it may result in icon overlap and diminished recognition.

4.3 The interaction effect between icon spacing and icon-frame spacing

Our findings supported the hypothesis, showing reduced icon recognition with tighter spacing of icons and a smaller frame. Moreover, we found an interaction between icon-icon spacing and frame type. Specifically, recognition decreased with a Proportional frame, while a Uniform frame only reduced recognition when icon spacing decreased from Medium to Small.

When comparing the Proportional and Uniform frames for spacing Medium and Large, the findings indicated that the effect of the frame interacts with the effect of spacing. The individual features of the icons (first stage of feature detection) inside the Uniform and Proportional frame were identical in Spacing Large — the condition of wider spacing between the icons — and in Spacing Medium — the condition of equal spacing between icons and icon and frame. What changed from the Uniform to the Proportional frame Spacing L was the size of the frame and from Spacing Medium to Large was the location of the icons. Following the two-stage model of object recognition (Pelli et al., 2004), this implies that the individual icons would be equally identifiable, while feature integration would vary as spacing between features vary (the second stage of feature integration). This suggests that the significant difference identified in the recognition of these four stimuli conditions of no overlap is caused by differences in feature integration (here icon–icon or frame–icon spacing) and not by differences in feature detections (identifying icons).

Consequently, this implies that there is no notable advantage to having a larger surface area (which allows for greater distance between icons) if the icons come into contact with the frame. However, in scenarios where there are no constraints on surface area, optimal recognition is achieved through wide spacing of icons and a large frame.

Under a Uniform frame, one might expect increased crowding from Medium spacing (equal icon-icon and icon-frame spacing) to Large spacing (wider icon spacing merging with the frame). However, we found no significant differences between these two conditions (see Fig. 7). One possible explanation is that crowding primarily occurs between similar features (Herzog et al., 2015) , and when targets and

flankers differ in shape, the crowding effect is reduced (Levi et al., 1994). Although the frame and icons have the same stroke width, their difference in shape may diminish the crowding effect. However, another reason may be that the increased spacing between icons in spacing Large decreased the crowding and compensated for the increased crowding of the frame, resulting in the nonsignificant finding.

In the case of the Uniform frame, mean recognition significantly differed between Small and Medium spacing but not between Medium and Large spacing. Increasing the spacing between the frame and icons, without altering their relative spacing, resulted in improved recognition (e.g., recognition for Proportional L was superior to Uniform L). However, when transitioning from Medium to Large spacing and the icons ended up touching the Uniform frame, this adjustment had no discernible effect (no significant difference) on recognition.

5. Conclusion

This study examined how designers can improve the visibility of pictograms by strategically manipulating icon placement and spacing within a frame. Results indicated that overlapping icons are the most limiting factor to perception. Employing a proportional frame, synchronized with icon placement, progressively diminishes recognition as the space between icons narrows.

Furthermore, we observed no significant differences between conditions of a uniform frame with icons aligned with the frame (Uniform frame Spacing L) and a uniform frame with icons evenly spaced within the frame (Uniform frame Spacing M). This suggests that if the icons are not overlapping, there is room for varied spacing within the framed space. These findings offer valuable insights for designers, empowering them to mitigate the impact of crowding by strategically manipulating the spatial arrangement of icons within framed pictograms.

Acknowledgements

This work was supported by the Danish Council for Independent Research [grant number DFF – 7013-00039].

References

Bouma, H. (1970). Interaction effects in parafoveal letter recognition. *Nature*, *226*, 177–178. https://doi.org/10.1038/226177a0

Coates, D. R., Levi, D. M., Touch, P., & Sabesan, R. (2018). Foveal Crowding Resolved. *Scientific Reports*, *8*(1). https://doi.org/10.1038/s41598-018-27480-4

Cotter, S. A., Cyert, L. A., Miller, J. M., & Quinn, G. E. (2015). Vision Screening for Children 36 to G72 Months: Recommended Practices. *Optometry and Vision Science*, *92*(1), 11.

Hamm, L. M., Yeoman, J. P., Anstice, N., & Dakin, S. C. (2018). The Auckland Optotypes: An open-access pictogram set for measuring recognition acuity. *Journal of Vision*, *18*(3), 13. https://doi.org/10.1167/18.3.13

Herzog, M. H., Sayim, B., Chicherov, V., & Manassi, M. (2015). Crowding, grouping, and object recognition: A matter of appearance. *Journal of Vision*, *15*(6), 5. https://doi.org/10.1167/15.6.5

Hyvärinen, L., Näsänen, R., & Laurinen, P. (1980). New visual acuity test for pre-school children. *Acta Ophthalmologica*, *58*(4), 507–511.

Kay, H. (1983). New method of assessing visual acuity with pictures. *British Journal of Ophthalmology*, *67*(2), 131–133. https://doi.org/10.1136/bjo.67.2.131

Kepes, G. (1966). *Sign, image, symbol*. Studio Vista.

Kesten, H. (1958). Accelerated Stochastic Approximation. *The Annals of Mathematical Statistics*, *29*(1), 41–59. https://doi.org/10.1214/aoms/1177706705

Kline, D. W., & Fuchs, P. (1993). The Visibility of Symbolic Highway Signs Can Be Increased among Drivers of All Ages. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *35*(1), 25–34. https://doi.org/10.1177/001872089303500102

Lee, S., Dazkir, S. S., Paik, H. S., & Coskun, A. (2014). Comprehensibility of universal healthcare symbols for wayfinding in healthcare facilities. *Applied Ergonomics*, *45*(4), 878–885. https://doi.org/10.1016/j.apergo.2013.11.003

Lev, M., Yehezkel, O., & Polat, U. (2014). Uncovering foveal crowding? *Scientific Reports*, *4*(1). https://doi.org/10.1038/srep04067

Levi, D. M. (2008). Crowding—An essential bottleneck for object recognition: A mini-review. *Vision research*, *48*(5), 635–654. https://doi.org/10.1016/j.visres.2007.12.009

Levi, D. M., Toet, A., Tripathy, S. P., & Kooi, F. L. (1994). The effect of similarity and duration on spatial interaction in peripheral vision. *Spatial Vision*, *8*(2), 255–279. https://doi.org/10.1163/156856894X00350

Ma, Q., Bai, X., Pei, G., & Xu, Z. (2018). The Hazard Perception for the Surrounding Shape of Warning Signs: Evidence From an Event-Related Potentials Study. *Frontiers in Neuroscience*, *12*, 824. https://doi.org/10.3389/fnins.2018.00824

Merks, P., Świeczkowski, D., Balcerzak, M., Drelich, E., Białoszewska, K., Cwalina, N., Zdanowski, S., Krysiński, J., Gromadzka, G., & Jaguszewski, M. (2019). Patients' Perspective And Usefulness Of Pictograms In Short-Term Antibiotic Therapy – Multicenter, Randomized Trial. *Patient Preference and Adherence*, *13*, 1667–1676. https://doi.org/10.2147/PPA.S214419

Milling, A., Newsham, D., Tidbury, L., O'Connor, A. R., & Kay, H. (2015). The redevelopment of the Kay picture test of visual acuity. *British and Irish Orthoptic Journal*, *13*(0), 14. https://doi.org/10.22599/bioj.97

Murray, L. A., Magurno, A. B., Glover, B. L., & Wogalter, M. S. (1998). Prohibitive pictorials: Evaluations of different circle-slash negation symbols. *International Journal of Industrial Ergonomics, 22*(6), 473-482.

Ng, A. W. Y., Chan, A. H. S., & Ho, V. W. S. (2017). Comprehension by older people of medication information with or without supplementary pharmaceutical pictograms. *Applied Ergonomics*, *58*, 167–175. https://doi.org/10.1016/j.apergo.2016.06.005

Oderkerk, C. A. T., & Beier, S. (2022). Fonts of wider letter shapes improve letter recognition in parafovea and periphery. *Ergonomics*, *65*(5), 753–761. https://doi.org/10.1080/00140139.2021.1991001

Ota, Y. (1987). *Pictogram Design*. Kashiwashobo.

Pedersen, P. (2019). Legibility of Pharmaceutical Pictograms: Towards defining a paradigm. *Visible Language*, *53*(2), 72–99.

Pedersen, P., Oderkerk, C., & Beier, S. (2022). Simplification of pharmaceutical pictograms to improve visual acuity. *Information Design Journal, 26*(3), 175-192.

Pelli, D. G. (2008). Crowding: A cortical constraint on object recognition. *Current Opinion in Neurobiology*, *18*(4), 445–451. https://doi.org/10.1016/j.conb.2008.09.008

Pelli, D. G., Palomares, M., & Majaj, N. J. (2004). Crowding is unlike ordinary masking: Distinguishing feature integration from detection. *Journal of vision*, *4*(12), 1136–1169. https://doi.org/10.1167/4.12.12

Pelli, D. G., & Tillman, K. A. (2008). The uncrowded window of object recognition. *Nature neuroscience*, *11*(10), 1129.

Roca, J., Tejero, P., & Insa, B. (2018). Accident ahead? Difficulties of drivers with and without reading impairment recognising words and pictograms in variable message signs. *Applied Ergonomics*, *67*, 83–90. https://doi.org/10.1016/j.apergo.2017.09.013

Rousek, J. B., & Hallbeck, M. S. (2011). Improving and analyzing signage within a healthcare setting. *Applied Ergonomics*, *42*(6), 771–784. https://doi.org/10.1016/j.apergo.2010.12.004

Schieber, F. (1994). Using the "Blur Tolerance" Technique to Predict and Optimize the Legibility Distance of Symbol Highway Signs. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *38*(14), 912–915. https://doi.org/10.1177/154193129403801425

Shieh, K.-K., & Huang, S.-M. (2004). Effects of pictorial size and circle-slash thickness on glance legibility for prohibitive symbols. *International Journal of Industrial Ergonomics*, *33*, 73–83.

Strauss, A., & Zender, M. (2017). Design by Consensus: A New Method for Designing Effective Pictograms. *Visible Language*, *51*(2), 7–33.

Tijus, C., Barcenilla, J., Lavalette, B. C. de, & Meunier, J.-G. (2007). The design, understanding and usage of pictograms. I D. Alamargot, P. Terrier, & J. Cellier (Red.), *Written documents in the worksplace* (17–32). Elsevier. https://doi:10.1163/9789004253254_003

Treutwein, B. (1995). Adaptive Psychophysical Procedures. *Vision Research*, *35*(17). https://doi.org/10.1016/0042-6989(95)00016-X

Waterson, P., Pilcher, C., Evans, S., & Moore, J. (2012). Developing safety signs for children on board trains. *Applied Ergonomics*, *43*(1), 254–265. https://doi.org/10.1016/j.apergo.2011.05.012

Zender, M., & Mejía, G. M. (2013). Improving Icon Design: Through Focus on the Role of Individual Symbols in the Construction of Meaning. *Visible Language*, *48*(1), 69–95.

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Ruminations on Being a Journal Editor: Out with the old. In with the new!

Mike Zender

Abstract

This non-research article reflects upon the change from publishing *Visible Language* for 58 years under the direction of a single Editor to publishing *Visible Language* by a consortium of institutions and an editorial staff led by an Editor in Chief.

Keywords
research journal
scholars
editors

Out with the old, in with the new. It being January, reflections on the year gone by and anticipations of the new year still echo in our minds. The emotions evoked by that have particular relevance for *Visible Language* in 2025 as the journal changes from being published by a single institution with a single Editor to being the product of a consortium of three esteemed universities and ten editors, associate editors, and assistant editors. In *Visible Language* 58.2 we described the *Visible Language Consortium* and I won't repeat that complete story here. It's a new version of an old approach where multiple institutions support and staff the a scholarly journal.

My first thought is why didn't we do this before? The Consortium has been a success thus far with all the benefits I expected and several benefits that I never imagined. I expected that the new model would provide both diversity of perspective and unity of purpose maintained by stability due to multiple lines of support. And it's true, the energy to do the sometimes grinding work is nicely dispersed across multiple capable individuals. No one person gets worn out. That's nice. We've already broadened our network, which I anticipated, but we also have begun to grow multiple lines of succession, which surprised me. We're already cultivating the next editor who will take over the rotating position in a few years. That's a huge win as any editor knows. Being an editor of a non-profit academic journal is hard enough but being able to stop being an editor of a non-profit academic journal is even harder. Replacement editors don't grow on ivory towers. But now I can step away from major editing responsibilities knowing there is a whole cast of editors ready and getting more ready every day to take over. This is so different from how I became editor.

In 2012 I had written a manuscript "Improving Icon Design: Through focus on the role of individual symbols in the construction of meaning" and submitted it to *Visible Language* for publication consideration. Then Editor Sharon Poggenpohl wrote me back saying that perhaps I should look to another journal because she was not certain that *Visible Language* was going to continue publication. She was ready to retire and was having a hard time finding a replacement Editor. My response was that letting *Visible Language* die was a terrible idea, which led, as such observations have at many times in my life, to more work for me. Yes, Sharon said "You could be the editor." We met and Sharon transferred ownership of *Visible Language* to the University of Cincinnati and graciously mentored me into my editorship.

Knowledge from the knowledgeable

That leads to the first principle of this rumination: academic research journals should be owned and controlled by academic researchers, not by professional journal businesses. As Sharon and I initially met to discuss my personal qualifications and lack thereof, we agreed that *Visible Language* should be associated with a university and that the University of Cincinnati had the necessary reputational chops to continue to advance a design journal like *Visible Language*. Besides the pure logic of researchers and scholars driving an academic research journal, the energy, enthusiasm and commitment of professors (people who profess to both know and advance knowledge) motivate a journal properly. We want to advance knowledge. Money is secondary, as most academics and researchers can prove by their bank accounts. You want to make money, be a banker. You want to advance knowledge, be a professor. It's that simple. Our new Consortium builds upon that logic by grounding *Visible Language* in not one professor but many scholars from three universities.

Sitting at the hub

That leads to the second principle in this rumination: publishing a research journal from a research institution enriches the institution through enrichment of its people. Being a journal editor puts a scholar in the hub of current knowledge formation. Manuscripts advancing all kinds of ideas cross the editor's screen. Some good ideas, some half-baked ideas, but all purporting to be fresh thinking. There's often an important seed of an idea even in the worst manuscript. Being privileged to read all the studies that come in is like a being a post-doc. It's the continuing PhD Program for those with PhD's. And for a scholar engaged with knowledge creation, it's a lot of fun. New ideas are engaging and even the poorly developed or inadequately supported ones can provide at least reverse inspiration. That's the kind of inspiration that comes from thinking through a bad idea or poorly supported study and exposing not only why it fails to satisfy but being inspired by what it attempted or saddened by its fatal flaw or imagining how it might have worked or what parts could be made to work. Out of the ashes often arises a firebird of what a good replacement idea might be.

Nobody seems to talk about this, and I'm not suggesting that an editor or editorial staff pirate other people's ideas, but just being exposed to so many different thoughts can't help but enrich an idea-monger. Every idea no matter how bad, and sometimes the bad ones stick out the most, goes in there somewhere and eventually makes connections which stir up fertile soil. A university owning, and its scholars managing, a journal is a huge source of intellectual energy, and one that I am very surprised not many universities tap into. Publishing a journal is almost free these days. Ten thousand dollars will get you there since your staff are already paid to do scholarly work.

Not from trivial or trendy

Sitting at the hub of disciplinary conversation exposes a third principle: hearing a wide range of diverse voices sharpens scholarly discernment. One soon sees patterns among those research studies that get weeded out. In the past ten years I've observed that weak manuscripts have tended to lean one of two directions: research focused on minutiae or research following trends.

Every important idea has multiple dimensions with various nuances which can trap those that are unaware of the big picture. A poorly informed scholar can easily focus on a detail without regard for the relevance of that detail to higher issues or ideas. And even important design issues are often studied in isolation, as if there is no knowledge from other disciplines that might inform or ground the design issue.

The other frequent failing comes from following the latest intellectual trend or theory. Theories abound. Ungrounded speculations, some of which fly in the face of experience or "common sense," take on a life of their own in narrow echo chambers and capture the imagination of those who lack historic perspective.

Listening to many often unanticipated and surprising proposals forces one to notice what's working and what's not, what's building something useful and what's not, what's enriching others and what's falling flat. The resulting discernment can lead to the identification of sustainable lines of inquiry that have the potential for lasting high impact, and can compete with the best researchers for potential funding.

Connecting with the best

This leads to the fourth principle: being a hub for new knowledge connects scholars with the best scholars from all over the world. By far the most cherished benefit of being the editor of *Visible Language* over the last dozen or so years is the new colleagues I've connected with. Reviewers, board members, contributing authors all make unique contributions. Finding reviewers means making contact with the top people in various fields. Manuscripts leaning into different domains cause the editor to seek and find experts who possess unfamiliar knowledge. For example, I recently had a manuscript on graphemics and grapholinguistics. It's a fairly new area of study related to reading and typography. Who knew. Well, I emailed the world-renowned type designer and scholar Chuck Bigelow, and asked him if he knew anyone in this area. True to form, Chuck immediately got back to me with list of members of the editorial board of a proposed journal on the topic. One eminent scholar, Chuck, connected me to 15 others, most of whose names I did not recognize and could not pronounce.

Bonding with new friends

Mentioning Chuck Bigelow evokes a fifth principle: being a journal editor is a wonderful way for an introvert to make new friends from among some of the most wonderful people. Chuck Bigelow and Kevin Larson are just two examples worth elaborating. In 2016 *Visible Language* celebrated its 50th anniversary with a series of special issues, the most extensive of which reflected on 50 years of typographic research. Chuck and Kevin guest edited that special issue. They leveraged their extensive knowledge and rich networks to produce 224 pages of wonderful information from some of the best designers and scholars in the world. I have come to trust them and rely upon them many times over the years when I was in a pinch. In short, they became not only colleagues but friends, yet I've never met either of them in person. What a wonderful world where a shy and socially inept guy like me can forge such wonderful lasting friendships with smart people like Chuck and Kevin. Various jobs have benefit packages. Friendships with quality people throughout the disciplinary community is part of the benefit package of an editor.

Knowledge in community

The sixth principle in this meditation is this: knowledge is communal. One individual alone can certainly observe and connect and analyze and infer and conclude. We are individual beings and can operate no other way. But if we want to develop a principle or rule of thumb to guide future actions, we need to know that our personal observations apply in other places with other people. Fortunately, we are also social beings and can share our observations, connections, analysis, inference and conclusions with others to see if they have observed analyzed and concluded the same things we have. We compare notes. When a lot of individual observations align we have some confidence that our knowledge is not just individual and personal but also general and universal. Universal knowledge is not only more certain but more useful because it applies in many (nearly all) places and situations.

And a discipline is a self-disciplining community. This is the essence of peer review. Community members with knowledge generously and kindly evaluate each other. Imagine a world where non-experts evaluated the work of experts. It's hard isn't it. Peer-review is one of the ways a knowledge community endorses new knowledge.

Quality from character

The seventh and last principle in this reflection is this: character matters most. This may seem to contradict the importance given to scholarship and research in the previous principles, but knowledge is communal and communities function, or not, on relationships and relationships thrive among people of good character. Honesty and trustworthiness are the bedrock foundations without which nothing can be accomplished. Love, joy, peace, patience, kindness, goodness, faithfulness, gentleness and self-control are the food that feeds productive collaboration. The opposites of these destroy community as surely as any bull in any china shop. Deceit kills collaboration. Unfaithfulness demolishes trust.

A healthy community thrives on quality character of the individuals in it. Few people would say this off the top of their heads, but I think one of the most important articles *Visible Language* published in the last 15 years was an article in the 50th anniversary issue memorializing scholars who had contributed to *Visible Language* in the previous 50 years. It's been said that we stand on the shoulders of giants, and that article acknowledged that reality. It's healthy for good people to recognize and be in a bit of awe of those who have gone before. It parks the ego and bursts the illusion of novelty. None of us create out of nothing. We all build on what's gone before. Pondering this breeds humility. And humility greases the wheels of relationship.

I learned at Yale that the greatest scholars are often the nicest people: curious like children, excited by new good ideas wherever they come from, humble because they love ideas more than just about anything else, generous since their joy is enhanced as they share ideas with others who love ideas too, supportive because it's advancing and making new cool ideas that's fun and more cool ideas from more sources are more fun that fewer ideas from fewer people. I could go on. Getting to know such top scholars is a real joy. Now by *know* I do not mean in-person face-to-face knowing. So many great people I've never met in person. More than once who I thought was a woman turns out to be an older man, and vice versa. It doesn't matter. The internet has a way of anonymizing tangible details like gender and skin color and focusing us on intangibles like knowledge and character.

Our Consortium is a community

Of course, this takes me back to where we started. *Visible Language* will no longer be published by one editor at one university. Instead it will grow out of a community of design colleagues who I testify are not only great scholars but exhibit admirable character. What a joy it is and has been working with them. Ideas emerge, spark new ideas, are fanned into flame and explode into new initiatives that were the product of no one and everyone. The new ideas are better than before. The new *Visible Language* will be better than before, and will continue to grow because it's a knowledge building community focused on humbly sharing and joyfully celebrating new knowledge.

Out with the old. In with the new!!

Author

Mike Zender

Mike has served as Editor of *Visible Language* since 2013. He will remain one of the editors of *Visible Language* until his replacements are established.