

KILLING PRINT MEDIA: TUPLES AND MATH IN DEFINING viewability, THE Viewability METRICS, THEIR ISOMORPHISMS, AND OBJECT PRIORITY USER CONTROL

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Abstract

The problem treated in this paper is to develop metrics for flat, rectangular, display **Viewability**, (**V**), metrics, including digital ads. Because Visual Display is such a large part of human communication, being able to numerically measure its effectiveness, by studying visual display sub-genres, is important. Isomorphism is important in systems science, and surprisingly, it turns out that all six of the main sub-genres studied are not only isomorphic--but some at the next lower level--are hierarchically isomorphic—further evidence of a good fit to be studied using systems science. The methodology used in exploring the problem is to operationalize the objects in the, (**v**), tuple--defined as two areas [viewable area, (**A**), **clutter** area (**c**), and time (**t**->**T**), read as **t** becomes **T**]--and to let **c** take on different values relative to **A**. By induction, the results are taken to apply to all flat, rectangular and generally shaped visual displays. A combination of mathematical symbols, afforded by an equation editor APP, is used to notate expressions and equations. Distinction between numerous variable names and their recognition are enhanced by the first-time use of color in mathematics. Results in this paper include that **v** is defined as objects in a tuple being two areas and a time. An equation is developed for a **V**. The value of defining **v**'s using tuples suggests that a tuple-based database might be a future step toward a GST. Using *GoMedia* to format this paper suggests that it is time to forego print for presentation scripts, and move closer to the digital age using more of its benefits.

Keywords

Viewability Metrics, Culture-Media Interactions, Isomorphisms, Color in Mathematics, Human Input to Media Format, General Systems Theory Prototype.

1 | Introduction.

The different disciplines represented in the title are indicative of the ISSS interdisciplinary interests.

Human language and other forms of communication, superior to any used by animals, are our species' most unique attribute (Google, 2023).

Media Ages and Cultural Interactions. 10 |

About two million years ago the hominid brain greatly increased in size. That resulted, about 1.6 million years ago, in the development of language and visual display of hands and arms upon cave walls (Mithen, Steven, 2024).

This was the beginning of the first great communications media age—the Age of Language. For communication to take place, there must be a sender, a receiver, and some means of transmission. *Medium* in this paper is the means of transmission.

Other great ages are shown in the timeline in Exhibit 1 below. It shows in Years Ago or CE for the development of some of some culture changing media:

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

Exhibit 1. Media/Culture Age Timeline (not to scale).

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gnals			ation
than	0 ⁶	00	00's &
6 yrs.	s	rs	900's

These media are used to communicate information and meaning--that is encoded and that therefore may be imprecise and contain errors perhaps requiring *handshaking* or error correction coding--especially using digital media. See (Buckner, 1991).

See **Supplement 1** for information about **Marshal McLuhan and Media Theory**. 11 |, **Examples of Cultural-Media Interactions**. 12 |, **Some Digital Media**. 13 |, **Digital Media**. 14 | and Exhibits 2, 3, and 4.

The Tuple. 15 |

To conclude the Introduction, a rigorous definition of a tuple follows.

A tuple is a mathematical construct consisting of a list of objects enclosed in parentheses. The objects are symbolized by small square boxes needing no commas to separate them. Unlike sets, they may be prioritized and duplicates. The objects may be tuples that may be nested.

See **Supplement 2** for **Notation 16** | and **Conventions 17** |.

2 | Mathematical Renderings.

To be precise, the body of this paper uses mathematics in the development of definitions and equations.

Basic Definitions. 18 |

Let:

Viewability, (v), = definition in mathematical notation of the 3-tuple **viewability** construct.

Let:

Viewability Metric, (V), = expression or equation for a measure of v in general, V 's = plural of V .

Notes: The plurals of other variables are of the same format by induction. **A's**, **c's** and addends in **c** expressions of the following subgenre take on the subscripts of the subgenre designations. Other variables may be defined later, but are included below.

Color combinations and subscripts are used to differentiate v 's, V 's, and c 's of the seven subgenres and other variables in this paper.

As noted before, other variables associated with a particular subgenre are to be understood to take on the subscripts of that subgenre--except for **c** explicitly subscripted for particular subgenres, and for the modifying parameter example. Expression (5) uses a p subscript. Prime superscripts are used in expressions (24) and (25).

The v construct (Buckner, 1992) to be proposed in mathematical notation, more precisely, and concisely herein, is defined by the 3-tuple:

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

*[All information necessary to complete a task using display is present,
No other information (**clutter**) is present (viewable),
The necessary information is present for the time needed to complete a task].*

For more information on the above construct, see (Buckner, 2017. 2018). And v is, in general, a function of major variables area, clutter and time as in (0):

$$\text{viewability} = f(A, c, T) \quad (0)$$

that reads: The construct **viewability** is a function of variables A , c and T .

Usually, the dominant variable in this paper is A , the area, in square inches, available for display of information including **clutter** (c), in square inches.

A cannot be 0 because is a divisor.

Definition and use of area a is treated later.

As shall be shown later, c is to be subsumed into a ratio of two areas ($A - c$) and A , multiplied by a time ratio. **Clutter** has several addends that vary between different v 's.

Clutter for *GoMedia* is minimum if there are no margins, interlinear space is 6 points, font size is 12 points, and there is no blank space at the bottom of the last page. White space, such as is around equations in this paper, is considered an aid to **viewability** as is interlinear 6-point space. In *GoMedia*, there will be no blank end lines.

Per page, screen or in A :

Let:

b = combined areas of any borders

m = areas of any margins, and

ω = area of any other **clutter**.

The sum of these three addends may range in value from 0 to just less than A square inches, and therefore they are zero or positive, and their sum $\geq 0 = c$ may be subtracted (from A). Then (1) is:

$$c = \{b + m + \omega\} \quad (1)$$

Printing on paper, using many commercial home and office computers, includes margins a few millimeters wide enforced to prevent printing off of the edge of the paper. These margins could be considered as part of ω in **clutter**, but for the purposes of this paper, will be ignored.

Clutter will be treated in depth later to explore possible determinations of isomorphism.

Any expression defining v and leading to its metric must be constrained by an expression involving time expended in completing the task at hand, t , and time needed to complete it, T .

Let:

t = time in seconds expended up to completion in seconds > 0 and ≤ 1 . When t/T reaches 1 the task being

worked on is complete.

T = time > 0 in seconds needed to complete a real-life task with supporting information .

To convert an expression for V to an equation requires multiplier parameters as will be seen later.

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

For V , the units of t and T in the ratio t/T cancel out so V is dimensionless. This time ratio can be taken to mean approximately how far along one is in completing a task.

That t must start out > 0 but eventually must $= T$ means that v is a binary or go/no go construct. There is no reason why t , if $t < T$, may not be increased by coming back later to finish the task until T is reached. T cannot $= 0$ because it is a divisor of t .

The $(A - c)/A$ ratio of areas is to be multiplied by this ratio putting all tuples of the construct in one term for V . See (3). Because both $(A - c)$ and A are areas in inches² the units cancel as for the time term, and V is dimensionless.

Perfect viewability Definition. 16 |

Now a must be defined:

Let:

$$a = A - c \text{ (area available to display information to complete a task minus clutter).}$$

With the basic variables now defined, it is possible to propose a definition of perfect v in (2):

$$(2) \quad \exists v \Leftrightarrow a = A \wedge c = 0 \wedge t = T$$

That reads: "There exists v if and only if (iff) $a = A$ && $c = 0$ && $t = T$. Note that in (2) $a = A$ is equivalent to $a/A = 1$, and $t = T$ is equivalent to $t/T = 1$.

As will be seen in the definition of **V(dad)** for digital ads, by the method of the other five subgenres highlighted in this paper, (contiguous) area in square inches is replaced by (contiguous) pixels (assuming that pixels are displayed in a rectangular area).

A Perfect V Proposed. 18 |

Because the equation editor produces an image for an equation and the equation number is included in that image, from this point on, the equation number will be to the left of the equation. It is intuitive that area A be included in **viewability** definitions because visual display is upon some medium such as paper, or a screen, and occupies area. Development of a mathematical expression for V below requires a ratio of $(A - c)$ substituted for a --that includes c in the expression for V . That ratio combines with a part of T, t , in another ratio term. The expression for a perfect V follows and is evaluated to 1:

$$(3) \quad c = 0, \quad t = T, \quad V = \frac{(A - c)}{A} \cdot \left(\frac{t}{T}\right) = 1$$

Because the numerator and denominator variables have similar units on both sides of the dot, their units cancel out. V is dimensionless and ranges from nearly 0 up to 1.

The equations and expression (1) through (3) form the kernel of this paper.

Visual Display. 19 |

For people to see visual information, information must be displayed; some media are listed below that visually display information: art, books, scientific papers.

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

Now consider V for A displayed using Windows and Word where margins (and thus areas) are measured in square inches. Headers and footers display some information--such as page numbers for paged display. Word documents are displayed in one or more Windows.

In the days before 1992, multiple Windows were touted by MS as increasing productivity, and products sold by various companies used Windows as a base and repeated that claim. They depended upon or promised increased productivity. It was shown (Buckner, 1992) that this was not possible because the opening of only one additional Window, from the state that only one was in use, increased complexity such that any productivity increases due to using more than one Window was swamped. But multiple Windows do increase area for display--increasing, up to a point, V . The validity of v in a social sciences experiment was orders of magnitude $>$ the nominal $p = 0.05$.

W is a differentiator between subgenres of visual display in name only, not in format, in this paper.

When using MS Windows and Word to display Word documents, that medium is denoted by W :

$$(4) \quad W = \textit{Word in Windows}$$

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

Resources for Visual Display—Especially for *GoMedia*. 20 |

In order to achieve communication visually, a human must format and encode it. The encoding and formatting maybe done by programming a computer--and programming is a human occupation. Each new medium must have developed for it a new format and the new format leads to the development of new content for it (McLuhan, 1964).

A new medium is *GoMedia*. Using it as display medium for print is usually on paper. (A digital display genre displays pixels mostly on a rectangular digital screen.) A print age, culturally influenced, overall format is a rectangle for print or digital display. The human may format the information ingeniously, and is therefore a potent resource. The **W** format allows a plethora of resources including color, embedded sound and other MS Office products (content). **W**, in the pageless mode, is a key resource for *GoMedia*.

General viewability. 21 |

The definition of **v** proceeds from a 3-tuple construct (see **Basic Variables Used** above) for six sample visual display subgenre **v**'s, and there is an additional exception for digital ads.

Rectangular Ads and Regular Resources. 22 |

Most digital display screens, and about all paper print pages or print pages simulated on digital or projection screens, are rectangular. This is due to print age culture influence. The area, **A**, can be of a screen or of a Window. There is no reason that a screen has to be rectangular. Radar and sonar screens may be circular. The projection on the hanging (not cyclorama) irregular (wood and burlap?) area in the stage production of War Horse is irregular (War Horse, 2012).

Web pages are rectangular as is the MathCast equations list, Youtube, Netflix and many other application screens. **A** for **V_(dad)**, according to the derivation schemes below, are displayed, more or less the same as for the other six subgenres, but it would be more or less the same as for any other displays emphasized. The only control that the user has over digital ads, other than skipping them when one can, is to wait them out or X them out. In some cases, like with Youtube, one may use sliders to browse a virtual **A**; some websites use active arrows (>, <) on their displays, and some use tabs to navigate to view a complete virtual **A**.

Making the area for display rectangular, the position in the screen **A_s** and the size and shape for digital ads, are not under control of the user. With **W**, the rectangular shape of **A** is also dictated by MS. The position(s) and sizes of one or more Windows upon the screen display area, and how many Windows are open, is under the control of the user. In these latter ways, Windows make significant contributions, and **v**'s and **V**'s are most useful in planning, writing, editing, testing and controlling scripts--especially using *GoMedia*.

It would be possible to put a Boolean marker in definitions of **v**'s--requiring more or less such assumptions and/or resources as digital ads--but the color coding developed below plus the redundant subscript mnemonic abbreviations are adequate.

One important note regarding the digital ad **v**'s and **V**'s is: that they are terribly undemocratic. They are only for ad marketers to sell their ads; the ad industry cares nothing about the viewer. However, except for the time constraints, they approach more perfect **v** (the definition in this paper) than any other display genre treated--even notating in terms of pixels instead of areas, and they do have a time component. They usually have no borders or margins and very little **ω**'s, so **clutter** could often be nearly 0.

Development of **V**'s in this Paper. 23 |

A general form of a **viewability** definition in this paper requires the following considerations.

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

Clutter, as will be seen later, requires further discussion.

Placer, Placement and Coordinates Where A Is Placed (Position). 24 |

Two markers for height and width in v definitions are not needed to differentiate coordinates of digital ads that are placed externally (as opposed to by the user or script writer). In other cases, the user places **A** manually--determining its coordinates and its height and width. The color and name abbreviations suffice to reference such an ad. Considering a full screen ad:

Let:

A_s = area of screen

w_s = width of screen

h_s = height of screen

In this paper, digital views that are not externally placed ,are manually placed by the user APP, and V is highest with **A** placed at the upper left of a display area and the width of $A_s = w_s \times h_s$ and A_s is maximized.

Regardless of who the placer is, the coordinates of the rectangle of contiguous pixels must be communicated to the digital display device. Influenced by our print custom of reading from the top down and left to right on a printed page, it is proposed that the coordinates for the top left corner of the rectangular image (disregarding margins, but not borders) be a standard for full screen for larger files. The simplest instance of coordinate specification is top left of the screen with the image taking up the whole screen, as with a movie and many digital ads.

In *GoMedia* ,with W centering **A** on the screen with maximum height, is recommended to be standard with standard width of the information to be displayed = 6.5" (another deference to print culture). Actually, "too much" width might constitute **clutter**. A display needing maximum screen width might be helpful in viewing a large spread sheet. Again, the needs and ingenuity of the user play a large part in application of V 's.

Using W in v and V Definitions and Expressions. 25 |

A virtual **A** is larger than an **A** in a full screen Window. Although using multiple Windows will be shown to reduce individual Window V values, it is advantageous to use multiple Windows with partly virtual A 's so large that A_s s cannot accommodate them.

For Multiple Windows:

Let:

N = maximum number of Window **A**'s needed to show all of a virtual file

n = number of nth Window in the range 1 to N

h_s = height of screen available to display information needed to complete a task

w_s = width of screen available to display information needed to complete a task

The area, A_n , of a Window, $W_1, W_2 \dots W_N$, may be sized by the user to full screen ($h_s \times w_s$), $h_s \times$ user chosen width, or the latter width \times user chosen height. Or, the user may choose both.

The parts of b when using W , b (in that context) and some **A**'s are defined below. These calculations may not be carried out because V is theory, but if they were, one would have to consider the variables shown.

Let:

b_l = left border of Window (in Word 2019, b_l is eliminated for paperless files)

b_t = top border of Window

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

\mathbf{b}_r = right border of Window
 \mathbf{b}_b = bottom border of Window
 \mathbf{A}_w width of a area in a virtual file
 \mathbf{A}_n = area of nth Window of a virtual file
 \mathbf{A}^* = total displayable area of a virtual file
 \mathbf{W}_{nw} = width of Window n .

$$\mathbf{b} = \mathbf{b}_l + \mathbf{b}_t + \mathbf{b}_r + \mathbf{b}_b = \text{border of a Window.}$$

Print Mode. 26 |

Each of multiple Windows has a border (area of which is \mathbf{b}). MS has made improvements in Word to maximize \mathbf{V} in the print mode—especially for a single page. The dimensions of Window borders are dependent on the layout of a paper, whether or not there is more than one page (in the print mode), and the manipulation of the Window edges by human inputs. If there is more than one page, a vertical slider appears inside the right edge of \mathbf{A} . If $\mathbf{A}_w > \mathbf{W}_{nw}$, then a horizontal slider appears (when the cursor is in \mathbf{a}) above the bottom Window edge, maximizing \mathbf{V} . If the Window vertical edges are set wider than the width of the right and left margins, a pastel border is created by Windows that may be considered a part of ω . See Exhibit 8 for a near representation of this state in art.

The left part, (\mathbf{b}_l), is of no width Using Word 2019. If the vertical ruler is shown (if checked in the View tab), it is to the left of the left margin except when the layout is narrow enough in width to make the ruler encroach upon the left margin of the paper. That is, human input moving the edges of the Window may override the Layout tab settings--making less of the paper margin show. There is some off white space either side of the ruler if it is making that encroachment. By drawing the left side of the Window towards the right (if there is no ruler) the left border may be eliminated and even much or all of the margin may also be eliminated. As the left side of the Window is drawn to the right, Windows maintains about $\frac{1}{4}$ “ of the left margin and the right margin ,and even the text is eliminated but the slider is maintained; that is, if there is more than one page.

In the pageless mode, a fixed, larger width margin is maintained, there is no left border or horizontal slider, and there are no page boundaries except the right edge of the screen. The vertical slider is always available when the cursor is in \mathbf{A} , the width of which depends upon the human input to the right Window edge position.

The right, (\mathbf{b}_r), is small. The top \mathbf{b}_t , consists of an optional ribbon and/or ruler, etc. and the bottom (\mathbf{b}_b) contains a control bar and a horizontal slider if the width of \mathbf{A}_w exceeds the width of the Window. So,

$$\mathbf{A}_n = \mathbf{b}_n + \mathbf{m} + \mathbf{w} \text{ and } \mathbf{b}_n = \mathbf{b}_l + \mathbf{b}_t + \mathbf{b}_r + \mathbf{b}_b,$$

and virtual \mathbf{A}^* may be $>$ than the sum of all \mathbf{A}_n with $n = 1$ to \mathbf{N} with \mathbf{A}_n accessed with the sliders. With \mathbf{W} ,

users may choose placement positions, but \mathbf{b}_r and \mathbf{b}_b will be fixed in width and height by MS respectively. The heights of \mathbf{b}_l and \mathbf{b}_r and widths of \mathbf{b}_t and \mathbf{b}_b will be chosen by the user respectively.

The width of \mathbf{b}_t is the same

as for \mathbf{b}_b and its height depends upon which of various of the ruler, ribbon, quick access bar etc., options are

visible, the height of which are determined by MS. The height of \mathbf{b}_r is determined by the user and its width by

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

MS. The **b** of two Windows of equal sizes is double the **b** of one and the same holds true for **A**. If the **c**'s are the same, then **V**'s are the same and two Windows double **V**, except that **T** is larger to account for switching user attention between them. If multiple Windows are of different shapes, then individual calculation of areas must

be done for each. Productivity using multiple Windows drops proportionately with **N**.

An advantage of *GoMedia* is that **b_l** and **b_r** disappear.

Color Codes and Subscripted Abbreviations for c's, v's and V's. 27 |

Clutter for print almost always includes margins (as in a book or a scientific paper), but almost never borders. There can be borders (the frame of a picture).

For digital media considered in this paper without **W**, there is usually no **b** or **m** in **c** for maximum **V**. The user has no control over the digital ad subgenres **V_(MKTGdad)** and **V_(MKTGdad)'S** and they are for evaluative purposes only.

For digital media using **W**, **b** is mandatory in **c**, but **m** is optional; however, because of print age culture, it may appear. Of course, **V** is greater if it does not.

For a simulated print page using **W**, **b** is mandatory in **c** for the same reason as above.

For *GoMedia* that uses **W**, **b** is mandatory and **m**'s are avoided in **c**.

Below is a grouping of this paper's featured six **c**'s by prevalent **c** commonality. For a particular **c**, another **c** with usually the same variables is listed after the common **c**'s list of variables. If **c**'s are present in **V**'s and their differing values are not considered for isomorphism between **v**'s and **V**'s; isomorphism should not be constrained by **c** variable addend values. From the standpoint of this paper, differing units should be constraints on isomorphism being considered to exist. Microsoft got it wrong, their units should be pixels, and they measure **A**'s in square inches; but MS took a step away from reality and declared the units in terms of the display areas that the displayed pixels take up, as for print. MS was page oriented--a print culture influence.

Isomorphisms--Naming of c's. 28 |

Exhibit 8 below shows **c**'s and their subscripts for various visual display subgenres, their usual **c** values and similar **c**'s. The mnemonic abbreviations in parentheses are subscripts. Parentheses enclose the mnemonics to be consistent with the way that the equation editor must have them.

Exhibit 8. Addends for c's.

Addends	Similar
(m + ω)	
(ω)	C(dig)
(ω)	C(dad)
(b + ω)	C(GW)
(b + ω)	
l + ω)	

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

Now let us pair **c**'s with similar sets of addends(s) shown in Exhibit 9.

Exhibit 9. Pairing **c**'s With Similar Addends.

Addend(s)

(ω)

(ω)

(**b** + ω)

(**b** + ω)

These **c**'s usually have no similar addends:

c _(pnt)	(m + ω)
c _(pntW)	(b + m + ω)

It might be likely that **V** would decrease as the number of addends in **c** increases in the above list. But **c**_(GW), touted in this paper, is in the middle ground, so why all of the bother about *GoMedia*? **W** supplies sliders that extend the facility and usefulness of media metrics. It might be intuitive that the **V** for **c**_(dad) be isomorphic with that for **c**_(dig) and the same for **c**_(digW) and **c**_(pntW), but is the first pair isomorphic with the second pair? Are all of the six **V**'s isomorphic with each other? If one is a stickler that the kinds and numbers of variables in the **c** expression in **V**'s differentiate them from others in considering their isomorphism, then maybe not. Any variable in **c** could be zero by human input, so the values of the **c** variables are not taken as constraints against isomorphism. Therefore, **c** does not differentiate between expressions if sources for values of addends (**b**, **m** and ω) regarding **V** isomorphism.

Definitions of **c**'s. 29 |

To augment the above conclusion, consider the following logic:

Paul, **Mary** and **Lee** all like fruit, and for the purposes of this argument, this portion of their culinary tastes are isomorphic. But **Paul** will not eat any fruit but bananas; **Mary** particularly likes apples but will eat almost any other fruit. **Lee** eats only mangos and lychee nuts. Clearly their detailed culinary fruit tastes are not isomorphic, but that most like (some) fruit is. **Shan** does not eat fruit. "Likes" means "eats." Now **Shan** will not eat any fruit at all. Therefore:

- \exists **Paul** \leftarrow likes fruit \Leftrightarrow fruit = bananas
- \exists **Mary** \leftarrow likes fruit
- \exists **Lee** \leftarrow likes fruit \Leftrightarrow fruit = mangos \vee fruit = lychee nuts
- \exists **Shan** \leftarrow (does) \neg like fruit

So let:

- P** = **Shan**'s culinary (lack of) inclusion of fruit or simply **P** = **Shan**
- Q** = **Paul**'s culinary inclusion of fruit (or simply **Q** = **Paul**)

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

$$P \neg \cong Q \tag{8}$$

The same result is obtained for **Mary** and **Lee** by induction.

But if :

P = **Paul** and

Q = **Mary** then:

$$(9) \quad P \cong Q$$

and that (some) fruit is liked is isomorphic between **Paul** and **Mary** and between combinations with them and **Lee** by induction, but not for **Shan**. The same is true by induction for all combinations of **Paul**, **Mary** and **Lee**.

Therefore, any definition of **c** as in Exhibit 8, and designation of its common (usual) addends, is merely for clarity and convenience. With this caveat in mind, the **c**'s (except for digital ads) in this paper may usually be defined as shown in expressions (10)-(15).

$$(10) \quad \exists c_{(dad)} \leftarrow (\omega)$$

Quasi definition: There exists **c** sub digital ad--usually characterized by having the value **omega**. Note: the following five definitions follow by induction.

$$(11) \quad \exists c_{(dig)} \leftarrow (\omega)$$

$$(12) \quad \exists c_{(digW)} \leftarrow (b + \omega)$$

$$(13) \quad \exists c_{(GW)} \leftarrow (b + \omega)$$

$$(14) \quad \exists c_{(pnt)} \leftarrow (m + \omega)$$

$$(15) \quad \exists c_{(pntW)} \leftarrow (m + b + \omega)$$

Definitions of Six Each **v**'s and **V**'s and their Isomorphisms. 30 |

Given the above, one is now in a position to write definitions of six **V**'s. It is implied that the variables **A**, **t** and **T** belong to all of the **(dad)**, **(dig)**, **(digW)**, **(GW)**, **(pnt)**, and **(pntW)** variables. **V** expressions follow **v** definitions and are approximations; see **Modifying Parameters** below as an example as to how to convert them into **V** equations. A real-world general expression of **V** where \approx means "nearly equal to" is (16) with **c** having non-zero addends:

$$(16) \quad c = (b + m + \omega), \quad V \approx \left[\frac{(A - c)}{A} \right] \cdot \left(\frac{t}{T} \right)$$

In the following, expressions of **V**'s for Different Subgenres are treated. **V_(GW)** is selected for treatment, and the remaining five **V**'s follow by induction. **GoMedia's** expressions and variables cannot be

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

italicized by MathCast. One might propose that the addends proposed for \mathbf{c} 's above be substituted for \mathbf{c} 's in \mathbf{V} 's. From (17) one could define $V_{(GW)}$ by specifying that $c_{(GW)}$ is characterized (generally) by $(\mathbf{b} + \omega)$:

$$(17) \quad V_{(GW)} \leftarrow \mathbf{c} = (\mathbf{b} + \omega)$$

Consider \mathbf{c} in $V_{(GW)} = (\mathbf{b} + \omega)$ when it's $(\mathbf{b} + \omega)$ is substituted for \mathbf{c} in the right side of a single \mathbf{V} expression without a separate equation for \mathbf{c} :

$$(18) \quad \mathbf{A} = \mathbf{A}_{(GW)}, \quad V_{(GW)} \approx \left\{ \left[\mathbf{A} - (\mathbf{b} + \omega) \right] / \mathbf{A} \right\} \cdot \left(\frac{\mathbf{t}}{\mathbf{T}} \right)$$

The rest of such \mathbf{c} variable substitutions may be made by induction.

But suppose that **Shan's** doctor tells her to add fruit to her diet and **Paul's** doctor notices that he eats too much potassium and orders him to substitute some citrus for some bananas in his diet. The user or author of a digital visual subgenre may in general change the number, kinds (of those proposed in this paper) and values of addends. The more complicated (18) with the set of square brackets loses the (duplicate) explicit variable designation $c_{(GW)}$ from (17).

So, upon second thought, the above substitutions may not be such a good idea. How can the variable values for \mathbf{c} best be shown? A proposed answer is the inclusion of another expression, an equation for \mathbf{c} as in (16):

$$(19) \quad \mathbf{c} = \mathbf{c}_{(GW)} = (\mathbf{b} + \omega), \quad \mathbf{A} = \mathbf{A}_{(GW)}, \quad V_{(GW)} \approx \left[\frac{(\mathbf{A} - \mathbf{c})}{\mathbf{A}} \right] \cdot \left(\frac{\mathbf{t}}{\mathbf{T}} \right)$$

An improvement adds a placeholder for \mathbf{m} --just in case it is needed:

$$(20) \quad \mathbf{c} = \mathbf{c}_{(GW)} = (\mathbf{b} + \mathbf{0} + \omega), \quad \mathbf{A} = \mathbf{A}_{(GW)}, \quad V_{(GW)} \approx \left[\frac{(\mathbf{A} - \mathbf{c})}{\mathbf{A}} \right] \cdot \left(\frac{\mathbf{t}}{\mathbf{T}} \right)$$

that reads " \mathbf{V} for *GoMedia* is about equal to $\mathbf{A}_{(GW)} \times \frac{\mathbf{t}_{(GW)}}{\mathbf{T}_{(GW)}}$ with $c_{(GW)} = (\mathbf{b} + \mathbf{0} + \omega)$."

Again, the other five \mathbf{V} 's follow by induction.

To discover isomorphisms, let, \mathbf{P} , successively = all six \mathbf{V} 's, one by one, and the subset of six \mathbf{V} 's, excluding the one just set to \mathbf{P} , = \mathbf{Q} , one by one. Then, by inspection:

$$(21) \quad \mathbf{P} \approx \mathbf{Q}$$

for all comparisons of \mathbf{P} and \mathbf{Q} . Therefore, all \mathbf{P} 's are isomorphic to all \mathbf{Q} 's treated herein except for the definitions and metrics as defined by the digital ad industry.

So, the above results seem non intuitive and rather remarkable, especially for print vs. digital visual display--given the magnitude, power and flexibility of digital processing in MS products. Clearly, much digital display is print, even text, oriented (Word is a Word is a Word)--hearkening back to

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

the print age. Surely computer and information scientists, along with media and culture theorists, could think of more, different and better ways to convey information digitally. Maybe someday the greater part of information could be digitally communicated visually instead of by text, words, and even speech. Enter the artist and remember smoke signals and dance. Isomorphism may exist between print and digital metrics, but not between digital and digital ad metrics. This is remarkable because one would expect that two digital media metrics would have more metric isomorphism than one of them with print. This may be a consequence of the digital ad industry failing to be competent in defining metrics, or lack of print culture upon a digital medium. More of this is evident in treating MS Windows and Word.

See Supplement 3- for Establishing Equality in v Expressions. 31 |

Virtual A Definitions and Equations. 32 |

If the area normally referred to as A is larger than one Window could show, then multiple Windows or virtual areas could be involved.

Multiple Windows for A 's Larger than the Screen Area. Suppose that the area of information needed to complete a task is greater than a in a Window and (old) A is greater than a screen; then two Windows open would help and would up to double V (doubling would result only if both Windows were full and have the same areas and shapes with maximum h heights) producing a new V^* . In this case multiple Windows comes into its own. If Windows are standard sizes, two might be arranged side by side, and new T^* would be adjusted to take into account the time to look back and forth between the Windows. Then old V could be doubled to calculate new V^* and increasing T^* would lower productivity = time rate of task completion.

But suppose that a newly designated $A^*(VIRTGW)$ is very large--larger than the screen and multiple Windows that could fit on it. Using sliders, one could move the new $A^*(VIRTGW)$ area around under the Window border in a rectangular cookie cutter fashion until all new $A^*(VIRTGW)$ have been viewed. But it would make no sense to consider the v 's of each Window's "worth" of in the new $A^*(VIRTGW)$ because one could not calculate $V^*(VIRTGW)$, for the new large $A^*(VIRTGW)$ until the entire new $A^*(VIRTGW)$ is examined. $T^*(VIRTGW)$ would be large and productivity lowered, but the task could be completed). Again, this is another instance of Windows coming into its own. The sliders of MS products allow viewing the entire new $A^*(VIRTGW)$. An example of the new, large $A^*(VIRTGW)$ might be a spread sheet.

What is V^{**} for viewing a movie or video (including a video ad)? A **viewability** definition could be the average for all frame V 's projected x the magnification used in projection or modified by the eye chart physics. Perhaps some frames at the beginning and end (title, credits) could be omitted. A similar approach could be taken for T with T^{**} being the (modified) run time of the program. This is given by Netflix and Youtube, and their t^{**} 's would be times elapsed assuming that the frame rates of display are the same.

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

Reverse Use of V. 33 |

Sometimes, for special effect, the human creator of visual display may reverse the recommendations of the Viewability Metric. See the picture Exhibit 16 of the small, supported tree. The rendition of the tree does not extend to the super wide margin—creating in effect—two margins and the dark frame contrasts with the pastel or white margins. Was the artist out of his mind or did he/she want to use up an existing frame?

Exhibit 10. Drawing of Tree with Very Wide Margins.



Or does the sense of “something’s wrong” attract the attention of the viewer” Is the clever artist subliminally aware of large margins being clutter? Sneaky artist, maybe was trying to evoke emotions of loneliness, isolation, dormancy or even death. This example emphasizes the human input side of visual display—all the more available to use in digital visual display. Because tuple objects may be prioritized:

$$(27) \mathbf{c} = (\mathbf{b} + \mathbf{m}), \mathbf{a} = \mathbf{A} - \mathbf{c}, \mathbf{V} \approx [\mathbf{c} - \mathbf{a}]/\mathbf{A}] \cdot \mathbf{t}/\mathbf{T}$$

And

$$\mathbf{V} = \mathbf{f}(\mathbf{c}, \mathbf{a}, \mathbf{A}, \mathbf{t}, \mathbf{T})$$

3 | Summary and Conclusions.

Mathematical notation describes \mathbf{v} 's and \mathbf{V} 's in a universal way of communicating.

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

The v and V 's for digital ads are not under the control of the user and their V 's are not isomorphic with the rest of the subgenres treated herein.

Digital ad metrics' units of pixels and lack of margins and borders are more in line with the digital age than other subgenres treated in this paper. Their V 's may be higher than any other subgenre of visual display considered in this paper.

V is a binary construct.

The v 's and V 's may be useful in appraising some forms of print and digital visual display (a kind of transmission of information), particularly for presentation scripts.

Color and other MS resources enhance **viewability**.

Word in multiple Windows may allow a task to get done for large files that do not fit upon a screen.

The forms/formats of many subgenres of digital display are heavily influenced by the print culture including digital APPs for presentations.

MS products are heavily influenced by the print culture to their detriment, but sliders and multiple Windows allow access to display areas larger than a screen or a few Windows, allowing tasks requiring large virtual displays to get done.

Isomorphism depends upon what level in a hierarchical content structure that the human casts it.

Print and digital ad V '(s) are isomorphic from the standpoint of this paper, ignoring that of the digital ad industry.

Digital ads are very undemocratic.

Use of *GoMedia* with pageless display takes advantage of new digital age resources while still compromising on some print age customs.

Digital media, especially *GoMedia*, affects culture by putting more power in the hands of the user as opposed to corporations.

GoMedia is especially useful with one vertical file.

GoMedia provides a new format for presentation scripts and other digital files.

Gomedia pageless files are **green** and are advantageous over digitally simulated print files.

Colored variables and expressions for variables of different display subgenres are sufficient to differentiate them but may be resisted due to the familiarity of print culture textual identifiers such as subscripts and superscripts.

Non-text visual display such as art may supplant print, writing and speech.

The 3-tuple may be generalizable in analogues to many parts of Systems Science.

Future communication might be more visually oriented in the future than by text or speech.

V and v are human, Living Systems constructs.

Analogies and re-orderings of 3-tuple objects offer extensions to General Systems Theory.

4 | Looking Ahead to a General Theory of Tuple Analogues.

When I was a boy, I was asked by my mother how I wanted my birthday cake decorated. I thought of the flat top and vertical side of the cake, which is not usually decorated (it is clutter in the baking industry, but I did not "know" that). I asked for white icing with red tulips around the vertical side. I got a cake with nothing on the side and gobs of red around the edge of the top that looked like roses. I was so disappointed. But I ate the cake.

Killing Print Media: Tuples and Math in Defining viewability, the Viewability Metrics, their Isomorphisms, and Object Priority User Control

When I was in school, I was taught to try to apply something new that I had worked on beyond the context of the immediacy of the work, the so called “bottom of the hourglass” part of experimental design. I think of the 3-tuple of the **viewability** construct and architecture. The primary end of building is to provide utilizable space—a in this paper. **Clutter** is vacant ground around the building, a central open space, and perhaps even halls, sidewalks and balconies, but especially the rooftops. As to halls, I think of my missing tulips and the shops along the airconditioned tunnel sides underground connecting the buildings in downtown Houston. The tunnels not only provide relief from the hot and sticky summer air but a chance to stop and shop on your way to your next destination. The worst waste of space besides the roofs is the sidewalks; at least they could add a different color to each slab.

Upon reflection, it seems that many human endeavors are met with natural resistance: human racers by wind, a muddy track, or water and crowd noise in the pool; custom by the cake decorator; the prosecution vs. the court calendar; and usually there is a time factor. So maybe in human Living Systems the 3-tuple applies as an addition to Systems Theory. And maybe the objects are not in the same order as for display v. A more general 3-tuple might be:

(Human endeavor or task

Obstacle or resistance

Time factor).

Supplement 4. Closing Thoughts, 34 |

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