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Learning . Life . Work

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INTRODUCTION

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Today, education is often defined as hybrid. Hybrid delivery in-class and online. Mixed theories of teaching and practice. Cross-disciplinary courses and programs. Alternative modes of enquiry. Community and student engagement. Concepts of explorative learning. Multicultural perspectives on subjects. The combined arts and sciences of STEAM – to name but a few. The same hybridity is true of life and work. We value a work-life balance. We seek self-fulfillment in professional contexts. We see education as continual through professional development and life-long learning.

In this context, education plays many roles, and serves many people and purposes. It takes on many forms. In embracing this hybridity, the Learning. Life. Work proceedings publication seeks to explore the numerous ways education morphs and blurs – through varied methodologies across a multitude of disciplines, geographies, and mindsets. As such it welcomes perspectives from the arts and humanities, design and media studies, science and technology, education and training, health and the social sciences.

In this diversity, these proceedings reflect the place and institution in which the conference was set: the California Institute of Integral Studies in San Francisco. A city famous for its counterculture, history of gay rights, its Hispanic heritage, Asian diaspora and its cutting-edge arts scene. It is a place renowned for alternative models of thought. Home to the first free public school in California, San Francisco has also spearheaded various education initiatives in United States. It implemented the Indian Education Program in the 1970s, supporting Native American communities. It led in the adaption of the Beacon Initiative to use schools for community needs, and it is home to one of the largest publicly funded university systems in the United States.

Incorporating authors from locations across the world who consider the future hybridities of teaching and learning, this publication aims to share perspectives, initiatives, programs, and projects, and disseminate best practices across the education sector.

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WRITING IT UP AND WRITING IT DOWN: NOTATION FOR INTERDISCIPLINARY RESEARCH

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THE PROJECT

The "Speaking, Writing and Picturing" (SWaP) project investigates originality and innovation, and how creativity, novelty, and "the new" can be facilitated. More specifically, it investigates the intersection of two theories that appear to limit our ability to conceive or express radically novel content, i.e. linguistic relativity and writing systems. As a result, the project problematizes how originality and innovation are possible given these conceptual and expressive constraints, and what to do about it.

The theory of linguistic relativity impacts on our ability to think outside the box. This theoretical problem, sometimes inaccurately referred to as the Sapir-Whorf hypothesis,[1] does not "determine" what we can think based on our native language, but it does imply that the structures of our language influence the way we think about the world and how they mediate our lived experience. In terms of our project's intellectual relationship to this theory, we assume the weak relativity thesis of the Edinburgh School[2] and the structure-centered approach to empirical investigations,[3] in which we find connections with the philosopher Wittgenstein's observations about aspect-seeing.[4]

The theory of writing systems – both conventional writing and other discipline-specific notations such as maths and music – impacts on our ability to communicate novel ideas and to make connections between what we already know, and the radically new. Maths and music are discipline-specific notations that have been developed to encode a narrow subset of human experience and as a result they are often poor at operating beyond their disciplinary boundaries. For example, although we can describe birdsong in words and text, linguistic description falls far short of capturing the phenomenological experience of hearing it. Even notating birdsong in Western staff notation only approximates to the content, despite its aural rather than linguistic mode, because staff notation has developed around the needs of instrumental performance. It does not have the capacity to record the non-instrumental, atonal sound qualities of birdsong, even in the creative hands of composers such as Messiaen.

In terms of our project's intellectual relationship to the theory of writing systems, on one hand, we note the advantage that increasing disciplinary focus brings increasing explicitness. For example, mathematical and logical notations have been developed to make explicit what is often only implicit in verbal renderings of mathematical problems. Mathematicians and logicians work by operating with these signs, to render perspicuous what is hidden by ordinary language. On the other hand, mathematical and logical notations are completely symbolic, and their coding must be learned, i.e. one cannot infer the meaning of the signs from their form. This brings the disadvantage that any extension of the sign system within the domain must be undertaken formally, comparable to the

formal admission of new words into the lexicon by the language academy, e.g. Real Academia Española.

THE NOTATIONAL DIMENSION

The research presented is a pilot study of the notational dimension of the problem of how originality and innovation is possible, and how to mitigate the effects of linguistic relativity and our mono-disciplinary habits of language and thought. When we are embedded in a discipline or a social context, we become enculturated and therefore blind to alternative conceptual paradigms. For example, in the UK in the 1970s, it was normal practice for female production-line workers to be paid an hourly rate that was less than for their male counterparts for the same job. What, you might wonder, was the context that normalized the connection between the compensation for labor and the category of gender? Even in 2023, despite the issue of equal pay being first raised in 1888, the UK gender pay gap was estimated by Pay Justice to be 18%.[5] Surprisingly, inequality is still enshrined in law, where in the UK the statutory minimum wage for under-18s is half that for over 23s.[6] Given our overall research aim of facilitating both awareness and change through originality and innovation; can notational systems be analyzed in ways that render perspicuous our cultural habits and identify the potential of innovative writing systems to express the radically novel content and outcomes of interdisciplinary research?

Wittgenstein thought that these kinds of enculturated assumptions about how things "must" be, underpinned many misconceptions about how we operate with words, and how we understand the world.

What we are supplying are really remarks on the natural history of man: not curiosities however, but rather observations on facts which no one has doubted, and which have only gone unremarked because they are always before our eyes.[7]

His strategy for overcoming the problem of linguistic relativity included the use of images that reveal how we have blind-spots to alternative ways of seeing "the facts".

A rectangle can be made of two parallelograms and two triangles. Proof:

A child would find it difficult to hit on the composition of a rectangle with these parts, and would be surprised by the fact that two sides of the parallelograms make a straight line, when the parallelograms are, after all, askew. It might strike him as if the rectangle came out of these figures by something like magic. True, he has to admit that they do form a rectangle, but it is by a trick, by a distorted arrangement, in an unnatural way.

I can imagine the child, after having put the two parallelograms together in this way, not believing his eyes when he sees that they fit like that. 'They don't look as if they fitted together like that.' And I could imagine its being said: It's only through some hocus-pocus that it looks to us as if they yielded the rectangle – in reality they have changed their nature, they aren't the parallelograms any more.[8]

These blind spots become more apparent when we operate across or between disciplines. Interdisciplinarity introduces new, previously unexpressed world views, not simply new elements requiring supplementary vocabulary. In response, we are not advocating a strong linguistic relativity thesis – that these new interdisciplinary domains are therefore inconceivable, but a weak relativity thesis – that we need to overcome our current habits of thought and language, and expand our conceptual space to accommodate these new concepts. The problem is therefore how to facilitate this conceptual expansion, and for this paper we focus on the notational dimension: on how we write down, write up, draw, or otherwise annotate our ideas.

THE METHOD

We approached the problem through an analysis of two dimensions of notation: semiotics and pragmatics. From the semiotic perspective, we noted above that sign systems which are heavily symbolic benefit from depth of communication but suffer from lack of breadth of application. This is a consequence of them being closed systems of discrete signs with formal or conventional uses. This may be contrasted with the flexibility, but shallowness, of an iconic system such as Isotype,[9] in which the meaning of new signs can be inferred by the user. As a result, iconic systems can be applied in novel situations and with new referents, whilst maintaining their semiotic implication. We labelled this semiotic axis "symbolic-iconic". From the pragmatic perspective, we noted there was a range of transferability of sign systems, from broadly applicable systems such as true writing, i.e. writing of the spoken word and its ability to describe the content of many domains; to the very narrowly constrained system of symbolic logic, i.e. the glyphs of symbolic logic do not have uses beyond logic (and mathematics according to Frege). We labelled this pragmatic axis "intrinsic-extrinsic".

Writing it down

We took 18 varieties of notation and scored them on a relative scale (±5) on the independent variables of symbolic-iconic and intrinsic-extrinsic, shown in the table below (sorted on symbolic-iconic).

name	*label*	*(-5) symbolic-iconic (5)*	*(-5) intrinsic-extrinsic (5)*
symbolic logic	Log	-5	-5
maths	Mth	-5	-4
true writing (e.g. English)	TrW	-5	5
proto writing (e.g. Cuneiform)	Pro	-4	-3
shorthand	Srt	-4	3
staff notation (music)	Mus	-3	-4
Feuillet dance notation	Feu	-3	-3
Sutton movement notation	Sut	-2	-2
graphic scores (music)	Gra	-1	0
Mayan script	May	-1	3
Egyptian hieroglyphs	EgH	0	-1
Laban dance notation	Lab	2	-2
semasiography	Sem	2	3
orthographic projection	Ort	3	1
diagramming	Dia	3	2
Mixtec picture-writing	Mix	4	-3
airport signage (Isotype)	Air	4	2
representational drawing	Drw	5	4

Table 1.

"Iconic" signifies that the elements in a notational system have some level of visual similarity with what they represent, which means that when new signs are introduced, users can infer their use from precedents within the system, e.g. road signs, airport signs, etc. Representational drawing is a paradigmatic case in which each production is unique and yet it can be decoded owing to its iconicity or indexicality, and the user's accumulated experience of interpreting two-dimensional images. Hence representational drawing scores +5 on the symbolic-iconic axis, i.e. high iconicity.

"Symbolic" signifies that the elements in a notational system have low iconicity. True writing,[10] which is the normal practice of writing a language such as English using the Latin script (Unicode 0000-007F), is a familiar and paradigmatic example of a symbolic notation. This is revealed by observing that the forms of the script do not indicate their phonetic or syllabic equivalents, and that the system must be explicitly learned and cannot be inferred from its appearance: "a code can be either learnable or comprehensive, but it cannot be both."[11] Hence true writing scores -5 on the symbolic-iconic axis, i.e. very low iconicity.

"Extrinsic" signifies that a notational system is applicable beyond discipline-specific boundaries and tends towards broad completeness (also called comprehensive: the ability to document all kinds of data). True writing/language is widely regarded as complete, although it has limitations in documenting phenomenological content such as colour and sound. Extrinsic systems tend to be broadly applicable but lack nuance and disciplinary specificity/granularity. They have breadth but lack depth. The ability of true writing to document a diverse range of multi-disciplinary content results in a score of +5, i.e. very high extrinsicality.

"Intrinsic" signifies that a notational system is discipline-specific and not readily deployed beyond its disciplinary boundaries. A notation may even restrict the range of possible content that can be recorded, e.g. in music, staff notation cannot document all types of sound, or even some types of non-Western music. Intrinsic systems tend to be very specialized and hence narrowly complete, i.e. complete only within its discipline. They have depth but lack breadth. Intrinsic notational systems risk becoming deterministic of content rather than facilitating the documentation of novel types of data and will tend to operate normatively. Hence logical notation scores -5 on the intrinsic-extrinsic axis, i.e. very low extrinsicality.

Writing it up

To establish the relative positions of the data points on the axes, we fixed Egyptian hieroglyphics [EgH] as a datum point near the center of the chart. It scores 0 (neutral) on the symbolic-iconic axis because, despite being pictorial in appearance, the operation of the sign system depends on the phonics of the initial consonant of the name of what is depicted in Egyptian, i.e. an abjad-like rebus.[12] We took this to indicate an equal operation of symbolic and iconic modalities. On the intrinsic-extrinsic axis, Egyptian hieroglyphics score -1, i.e. slightly intrinsic, owing to the focus of the notational system on religious and ceremonial documentation on monuments, in contrast to the subsequent development of hieratic and demotic as a tool for description that could be applied more widely to record information.[13]

It should be noted that it is the relative position of each writing system rather than the exact numeric score that informs the present research. Thus we were simply seeking a distribution of notational systems according to their position on the semiotic and pragmatic scales that we had identified.

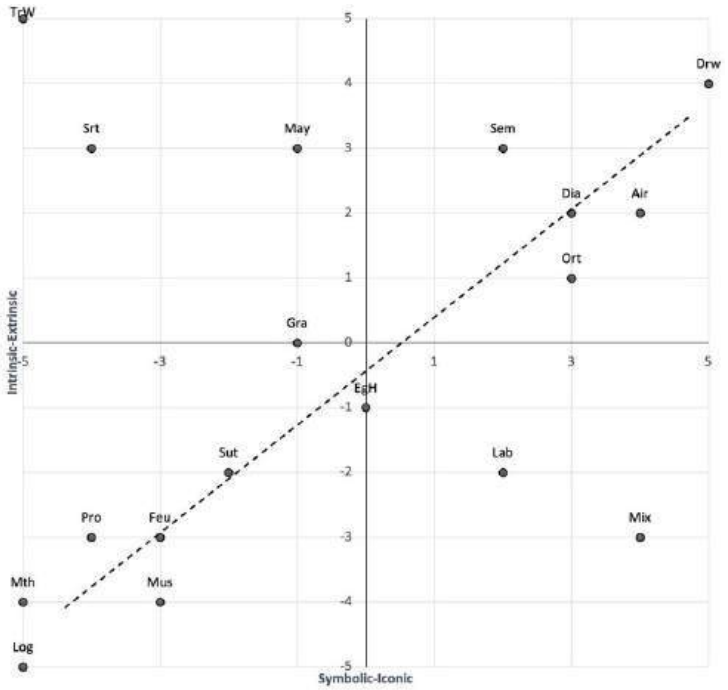

Figure 29. Scatter graph of writing systems

We notice from the resulting scatter chart that, although the sample is admittedly limited, there are more symbolic systems than iconic systems in the intrinsic quadrant. Symbolic systems tend to be intrinsic, sometimes referred to as "motivated", because they develop around in-depth documentation for a specific discipline, e.g. staff notation of Western music [Mus]. They tend not to be applicable beyond their disciplinary boundary, which is revealed by the trend (plotted diagonal line) from lower left quadrant (symbolic-intrinsic) to upper right quadrant (iconic-extrinsic). The clustering in the lower left quadrant implies that communication beyond disciplinary borders is frequently, but not universally, sacrificed in favor of notational granularity and depth, i.e. most but not all the examples lie on the plot line. The polar case in the lower left quadrant (symbolic-intrinsic) is symbolic logic [Log].

Conversely, iconic systems have the extrinsic advantage of being able to be interpreted in novel situations but may suffer from a lack of specificity owing to the limited capacity of iconic communication to express modality. This is also to be expected since iconic systems are highly transferable across domains but suffer from a lack of specificity/granularity, as implied by weak modality. The polar case in the upper right quadrant (iconic-extrinsic) is representational drawing [Drw].

We also notice that some forms of writing are more extrinsic than others. These occupy the upper left and upper right quadrants of the chart. Atypically, true writing [TrW], which is our ability to discuss and write our thoughts in words, is both symbolic and extrinsic. Although true writing is sometimes strained, it is sufficiently complete, for example, for Einstein to describe curved space and for Whorf to describe Hopi concepts of time.[14] In the upper quadrants one also finds representational drawing [Drw]. Drawing is iconic and moderately complete but lacks the modality and therefore the degree of extrinsicality of true writing [TrW].

There are also interesting, outlying points on the chart that represent exceptions to the expected trend, i.e. these less expected combinations lie in the opposite quadrants to those indicated by the plot line. The lower-right quadrant (iconic-intrinsic) contains Mixtec picture-writing [Mix]. Despite the Mixtec

writing system being very pictorial, the "lexicon" consists of a limited set of icons that only superficially depict what is occurring, and in practice most of the content is symbolized as "the essential documentary evidence for history", i.e. propositionally.[15] Perhaps in this sense, Mixtec picture-writing may be compared to neumes in music notation which are *aides-memoires* for music that has already been learned aurally.[16] As a consequence, surprisingly, the Mixtec writing system largely functions symbolically despite its iconic appearance.

The chart also reveals a difference between the Mixtec [Mix] and Maya [May] writing systems. According to Sampson, Maya script is complete within the bounds of Mayan spoken language owing to its supplementation of logographic elements with phonetic notation.[17] On the other hand, Mixtec picture-writing is a primarily logographic system, with additional limited phonetic and mathematical elements that serve to spell out the names and dates that identify individuals and places. Thus, there is little descriptive content in the Mixtec system itself. As a result of our observations, we speculate that logographic systems tend towards propositional content.

CONCLUSION

We are taking three key ideas forward that seem to warrant further research. The first is that logographic systems tend towards propositional content. They are therefore limited to applications in which they make assertions about the real world which are either true or false. For example, if an airport sign indicates that passport control is straight ahead, it either is or it isn't. The iconic sign does not describe anything modal. The second is that intrinsic notational systems operate normatively. The more complete and mature the symbolic sign system, the more it determines what is annotated. In other words, if we cannot write our discipline-specific content in, for example, symbolic logic, or mathematical notation, or staff notation, then it is not what our culture calls logic, or mathematics, or music, respectively.

Let's remember that in mathematics, the signs themselves do mathematics, they don't describe it.[18]

The distribution shows that true writing (ordinary written language) is a sufficiently abstract system that it can describe almost anything, so why not use it for everything? Wittgenstein cautions us that we are frequently misled by language into wrongly believing that the logic of our language is the logic of the world. So, although we can say almost everything in words, those words may be infelicitous, i.e. unfaithful representations of reality. The advantage of mathematical and logical notations is that they can only annotate what is possible in mathematics and logic; indeed, according to Wittgenstein the sign system determines what constitutes mathematics, i.e., the sign system is normative. Unfortunately, although mathematical and logical notation is therefore felicitous, we cannot say everything with it.

In interdisciplinary research, we are trying to extend and annotate our knowledge beyond its disciplinary boundaries without constrained by our notation, i.e. thinking that the "limits of our notation are the limits of our world".[19] Although a disadvantage of iconic notation is its lack of specificity, an advantage is its denotative iconic or indexical connection to its reference. Therefore, a third outcome of this project is the conclusion that the optimum expressive and communicative space on the chart for "the new" is somewhere in the middle of the upper right quadrant. It is above zero on the intrinsic-extrinsic axis, which implies broad applicability for writing down innovative content, and it is above zero on the symbolic-iconic axis, which implies liberation from the normativity of symbolic notation for writing up innovative content.

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NOTES

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[2] David Bloor, *Knowledge and Social Imagery* (Chicago: University of Chicago Press, 1991).
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[13] Ignace Gelb, *A Study of Writing* (Chicago: University of Chicago Press, 1963), 74f.
[14] Michael Biggs, "Speaking, Writing, and Thinking: Linguistic Relativity and Research," in *Teaching and Learning Projects in Arts and Humanities*, edited by Santiago Pérez-Aldeguer (Madrid: Adaya Press, 2023).
[15] Elizabeth Boone, *Stories in Red and Black* (Austin: University of Texas Press, 2000), 20.
[16] Richard Rastall, *The Notation of Western Music* (London: Travis & Emery, 2010), 27ff.
[17] Geoffrey Sampson, *Writing Systems* (Sheffield, UK: Equinox Publishing, 2015), 58.
[18] Ludwig Wittgenstein, *Philosophical Remarks*, ed. Rush Rhees, trans. Raymond Hargreaves and Roger White (Oxford: Basil Blackwell, 1975), 186.
[19] To misquote Wittgenstein's *Tractatus Logico-Philosophicus* §5.6: "The limits of my language mean the limits of my world."

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