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RULES: A TOY BOX

abstract

"Induction provides a path to first principles" (Aristotle): so we approach our topic by sampling three distinct sorts of data—rules in actions as exemplified in games; rules as directives for manufacture; as laws not only for maintaining order among people but also relations between citizens and governments— finding in each case the parts that nonverbal expressions of rules play. While words are essential to formulating constitutive rules defining sporting games, they seem less important than emulation for recreational uses. They drop out in children's games of make-believe, which developmental psychology shows to be crucial to early development, since ours is a naturally rule making and following species. Industrial artifacts, thereby the modern world, depend on graphic systems, here exemplified by origami notation, which feature isolation and sequence in simultaneity, lacked by words. Such notations also exhibit a five-order pattern of intentionality, whose importance is demonstrated by communication breakdowns in road signage, undermining civic life.

When we think about rules, we tend to formulate examples in terms of their contents, for which language provides unequalled resources—more so when we do this in terms of laws, even more, inscribed ones. The Laws of Moses, Hammurabi's Code, state constitutions, edicts and so forth easily come to mind, and colloquialisms such as 'not carved in stone' and 'unwritten law' suggest what could be. Yet, as with most human affairs, when it comes to concrete cases, especially those dealing with implementations of rules, even laws, matters are not so tidy and therefore more interesting. This comes forward when we consider rules in connection with the focus of our issue, the places that graphic signs play in our use of them. So rich is this subject that the present essay consists in examination of three rather disjoint, familiar cases in which situations beyond words are crucial to rule-guided behavior. The first stresses behavioral aspects of human nature that precede sign-formulations, while the latter two deal with purely graphic and then more complex, mixed graphic and linguistic situations.

1. Let's Play: Rules in Two Kinds of Games

Before laws, we should consider the more general category of rules. A relaxed example of them might be rules for *games*—which we begin with a charming source: Figure 1. Here the artist, Edward Ardizonne, sets before us three interlinked examples of human behavior, which might reward close attention as a first inductive array, displaying the breadth of rule-governed behavior. From top to bottom, let us take them briefly in turn, for what insights about rules they provide, before going on to the more 'serious' legal matters of Section 3.

Sporting-play games. At the top we see a formalized game, hence one that follows expressed rules. Badminton is half a millennium old, played throughout the world, even as an Olympic event (although indoors). In formal practice, its *constitutive* rules are indeed verbal, even written down for group consultation—including appeals—and are quite specific. However, as an informal, popular—even as here outdoor—sport, badminton's rules are relaxed so as not to include umpires, courts 6.1m wide by 13.4m long, net heights of 1.55m, or even some rules of play, such as serves being struck below server's belt-line. Indeed many players may never have referred to written or basically verbalized rules, but only picked the game up from others, by watching it, or by instruction that is a mix of speech, gesture, expression and displayed action. Considered in terms of artifacts, few have 'read the manual' for it. This reminds us that many of our rules are learned, 'picked up', by, as Aristotle wrote, our tendency to *direct imitation* of our fellows, which developmental psychology now holds to be not only species-specific but
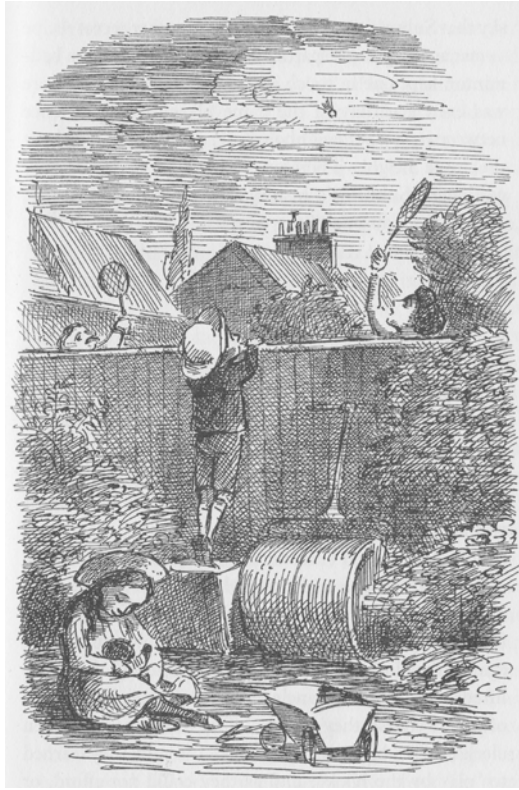
Figure 1. © The Ardizonne Trust. Used with permission

important for much else.[1]
This is extended beyond games. Such *emulative* behavior brings out how, in a very loose sense, children's understanding and use of any artifact, beginning with their toys, is in terms of what Michael Tomasello (see note 2) terms 'intentional affordances'—that is, what the artifacts are *for*, for *us*, where 'us' denotes a community (from family to larger groupings) to which the child belongs, as the sense of a collective, consensual 'we' develops. Let us consider rules and affordances.

Going down the picture, we see that the boy is different from those above and below him in his use of artifacts. In terms of 'intentional affordances', the other three people have "socially learn[ed] the conventional use" of each artifact in terms of the prescribed outside end it is *for*. As well, since, apart from Suburbia's "so particularly blue sky" (Kenward, p. 28, before the Beatles), Ardizonne places them in a veritable (suburban) world of artifacts that people, unlike other tool-using animals, not only use to achieve outside ends but internal ones, for example

Affordances: Physical and Intentional

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1 See Tomasello (1999) on 'emulative learning' in humans as opposed to other great apes, and Hobson (2002), Ch. Eight, specifically regarding child development.
It needs adding that, for instance, basketball provides a sharp contrast in the prominence of constitutive rules by words. The game was invented by one person, Canadian James Naismith, for a specific purpose, and set forth in thirteen constitutive entirely verbal rules in 1892 (*Rules for Basket Ball*), although in context of explanatory text and one illustration, regarding the spirit of the game. Still, its *popular* practice would seem to be like that of badminton.

in playing games. Our topic, games, are themselves a kind of artifact whose very existence is defined by appropriate use of artifacts—badminton not being volley-ball.[2]

This Ardizonne contrasts with the boy's uses of artifacts—a box and a fence-rail—for their *physical affordances*, as he might natural objects, without regard for their rule-governed intentional ones. (Ardizonne makes that clearer by placing beside the box a lawn-roller, which would not only be harder to stand on but make him more visible.) As the girl might say, were she to turn around, 'you're not supposed to do that!'[3] In the boy's action no rule is followed, since neither artifact is used as what it is '*for*, for us'. His artifact uses are ad hoc *improvisations* (possibly not good for the box, either)—very important uses that we cannot investigate here.

Before approaching the topic of the boy's creative neglect of norms, let us further consider the very existence and observance of any such norms, as related to rules. For that let us look back up to the badminton game. Just considering it carries us well into how the *Homo* species differs from great apes, thus presumably from its distant forebears.[4] For what we notice in that kind of game is '*joint intentionality*'—that is, of a kind of what Tomasello terms 'we-', or socially-collaborative, intentionality. This introduces roles.

In illustration, we may note that of the four people here depicted only the adult couple exemplify joint intentionality, since, beyond being involved in the "shuttlecocks rising and falling against the sky" (Kenward, pp. 27f), they share a joint *goal*, which gives them *roles.* Going beyond what is with small children called 'parallel play', we see them doing—indeed making—something together, called 'playing a game of badminton', likely by prior agreement and even plan. Thereby, besides noting the importance of *rules*, we may note that such formalized games have *roles*, roles which people who play them assume. For a child, such roles provide an important step towards a socializing 'agent neutrality'—a sense of what anyone in one's particular role would be 'supposed to do' or not do. Thus in such games we can 'spell' another, assume another's role. Roles go beyond rules. To stand there without trying—or only half-heartedly—to hit the shuttlecock back, is not to *play*, not to fulfill one's role, and thereby to let down the joint project of the game—even if this violates no rules of the game.[5]

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2 That introduces an important issue of normativity into our discussion, notably through Michael Tomasello's remarks on a normative aspect of cultures, where everyone has "come to understand the intentional significance of the tool's use...—what it is 'for,' what 'we' ... do with it", a feature certainly underscored by suburban culture. What are racquets—what are they *for*? They are for hitting shuttlecocks while staying on opposite sides of a net—there are rules for this game. Tall fences are *for* privacy. While not following any such formal rules in her game, the little girl, too, knows what a doll is *for*, what 'we' (boys not included) are 'supposed to' do with them. See Tomasello, 1999, p. 6 etc.

3 Besides misusing artifacts, Ardizonne's boy would likely be corrected for violating what would have been, in that suburbia, unspoken rules of not peering over fences (as noted by the man), which one is supposed largely to 'pick up' by emulations, such as looking away.

4 Tomasello (2014, p. ix).

5 Accepting such roles are, in turn, cases of an even broader characteristic of human sociality. See Peter Hobson's eloquent citation (e.g. "the dance of human gestures and sounds") of Jerome Bruner on roles in early games like 'peekaboo': Hobson (2002 pp. 42f.)

As Tomasello reports, older, preschool children between ages one to three already "seem to have a species-unique motivation for collaboration" itself, beyond games. Young children will "engage with others in collaborative activities" and "coordinate a joint goal, commit themselves to" it until its reward is achieved, expecting "others to be similarly committed", while grasping—even helping with—the others' roles, then share the rewards—or else "take leave when breaking a commitment" (Tomasello 2014, p. 41).

We find these features in the badminton game, where 'taking leave' is a notable feature. Should a player wish to stop, briefly or permanently, we would strongly expect the player to 'take leave'—not, as we say, 'just walk away' ('wander off'). Unlike two year-old children, three year-olds tend to take leave when they break off, not only from informal games but from wider collaborative activities, joint projects, with at least acknowledgement, sometimes even explanation, apology. This is no small point: it may indeed be a species-specifying characteristic, first arising in our post-*Homo erectus* ancestors.

Down the picture from Ardizonne's transitional boy we find depicted another familiar and developmentally crucial kind of play using artifacts, but of a very different kind: in a game of 'make-believe'. A game, yes, but what could be its relevance to our topic of *rules*? Only one plays, and surely quite freely. In reply, without argument, there is only space to cite two impressive sources on the topic, the philosopher Kendall Walton, in his masterly study of make-believe, and the great Soviet developmental psychologist Lev Vygotsky, sixty difficult years earlier.[6] As Walton's account is worked out as part of a developed theory in a well-known and easily accessible book, I will quote briefly from short lectures by Vygotsky, some of which have been rescued for us by translators and editors, in order to make them better known.

Beginning with Walton's theory, make-believe appears as an important category within not only games but also imagining projects, indeed at an important intersection of the two classes, games and imagining. Let us start with *imagining*, which, as Walton points out—already in its vivid forms as dreams and daydreams—is much the broader class of activities. What is make-believe? The make-believe subclass of imaginings is picked out in terms of its enhancers and guides of imagining, '*props*', as Walton terms them ('pivots' for Vygotsky), such as the child's doll and attendant toys, and, Walton emphasises, including the imaginer herself and her interactions with the other props. Props provide the imagining with perceptually present and therefore vivid mobilizers (which, moreover, can be shared with others in group games), whose relevant *prop*erties determine (thereby provide guidance for) the course of the imagining.[7] What, after all, are the girl's toys *for*, given that she could simply imagine holding a baby? By use of artifacts, however, she provides what Vygotsky terms 'mediators', which work back on her through her perception of them. Thereby her wide panoply of sight, touch and kinesthetic visual and motor systems, with their many interconnections, evolved for dealing with her physical environment, is intentfully recruited, focused and turned back on her, to assist her game of imagining. As Vygotsky stressed, by use of the mediators, she thereby uses nature—nature as it exists in her body—for her own purposes, thereby achieving a kind of freedom from nature, which, paradoxically, comes with rules.[8]

One of Walton's important insights is that make-believe thereby also provides *guidance* to imaginative games. However selected, the relevant attributes of 'props' provide, interactively, *rules* for the ongoing game. Although this allows, as we know, great scope for makeshift props (e.g. broom hobbyhorses), it does restrict what in fact may function as an effective prop. To the extent that, in interaction with the imaginer, a prop's actual properties do not sufficiently prompt and direct the course of imagining, it fails as an artifact, since, as Walton puts it, generating rules is part of what it is *for*. Thus, as Vygotsky observes, "Goethe's contention that in play any thing can be anything for a child is incorrect" (Vygotsky 1978, p. 98), since there must be a basis in the prop for the crucial mental 'pivot' (Vygotsky 1978, pp. 97-102) of

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6 See Walton (1990), Vygotsky (1978, pp. 92-104).

7 Use of Walton's term in this short discussion is for two reasons. First, Vygotsky's 'pivot' (1978, pp. 98-101) has much broader use in his account, having to do with the child's developing ability to 'detach' meanings from one context and 'transfer' them to another, as we shall see below. (See further Tomasello (1999, p.85), on 'decoupling' of affordances, citing Peter Hobson.) Second, the more restricted term 'prop' has the connotations of 'property' and 'a*prop*riate', suggesting that attributes of it indicate what we are to imagine from it.

Here is a point to add that Walton does not use the term 'rules' in this context, but rather 'principles of generation' for what a prop's attributes 'mandate' or 'prescribe' imagining. See Walton (1990), e.g. pp. 38f.

8 Not to appear naive, we need to note how even that freedom is challenged by mass artifact prop technologies. Well beyond dolls and childhood, props as enhancers and guides to imagining constitute an immense class of artifacts, such as songs, novels, plays, moving pictures and other 'media' technologies, with vast economies and enormous psychological, social and political effects.

pretense. Like the racquet and shuttlecock in the other kind of game, these artifacts, too, must be 'fit for purpose', in physical affordances sufficient to what they are for.

Anticipating parts of Walton's make-believe theory—while missing Walton's crucial specification of make-believe within the broader range of imagining activities—Vygotsky, with his term 'play', focuses on rules. Although the girl plays freely, it is still in the context of rules.

> Whenever there is an imaginary situation in play, there are rules—not rules that are formulated in advance and change during the course of the game, but ones that stem from an imaginary situation. Therefore, the notion that a child can behave in an imaginary situation without rules is simply inaccurate. If the child is playing the role of a mother, then she has rules of maternal behavior. The role the child fulfills, and her relation to the object ... , will always stem from the rules.... [S]he does what she most feels like doing because play is connected with pleasure—and at the same time she learns to follow the line of greatest resistance by subordinating herself to rules ... since subjection to rules and renunciation of impulsive action constitute the path to maximum pleasure in play... [which] continually creates demands on the child to act against immediate impulse... . Thus, the essential attribute of play is a rule ...become a desire (Vygotsky 1978, pp. 95, 99).

As Tomasello in effect later argued, it seems in our nature to escape nature's constraints by inventing our own: rules.

Let us close this brief review of two sorts of cases for the prevalence of rules that are not only 'without words' but without any kind of articulation, showing what rule-guided creatures we naturally are. Regarding rules of make-believe, Vygotsky also noted what Walton would later argue in detail, that while fictions are often quite distinct from facts, this is by no means necessary. After all, what is imagined may be real or true: "it is very easy to have a child play at being a child while the mother is playing the role of mother, that is, playing what is actually true" (Vygotsky 1978, p. 94). Regarding charming examples, Vygotsky cites the English psychologist James Sully's observation (in his 1896 *Studies of Childhood*) that two sisters may say, "Let's play sisters", upon which:

> The child in playing tries to be what she thinks a sister should be. In life the child behaves without thinking she is her sister's sister. In the game of sisters playing 'sisters', however, they are both concerned with displaying their sisterhood; the fact that two sisters decided to play sisters induces both to acquire rules of behavior. Only actions that fit these rules are acceptable to the play situation.

More commonly, however, rules of make-believe correlate quite different things, although with sufficient affordances, such as a doll and a baby, which is a crucial part of the freeing that Vygotsky saw in children's early play, as 'a leading factor in development' (Vygotsky 1978, pp. 101). As for other great apes, so with the very young child, '*things* dictate to the child what he must do: a door demands to be opened and closed ... , [b]ut in play, things lose their determining force. *The child sees one thing but acts...independently of what he sees*' (Vygotsky 1978, pp. 97f). This detachment of meaning, he adds, is a significant freedom:

> The child at [make-believe] play operates with meanings detached from their usual objects and actions; however, a highly interesting contradiction arises in which he uses real actions and real objects. This characteristic is the transitional nature of play; it is a

stage between the purely situational constraints of early childhood and adult thought, which can be totally free of real situations.[9]

For Vygotsky, such kinds of detachment and transfer form a crucial part of what he called '*mediation*', whereby we free ourselves from the space and time stimulus-proximities of the classical Empiricist, associationist psychology Hume founded. 'Unlike the ape,' Vygotsky remarked, 'which [Wolfgang] Köhler tells us is "the slave of its own visual field," children acquire an independence with respect to their concrete surroundings; they cease to act in the immediately given and evident space' (28), by imposing their own rules in play.

The 'prop' in the girl's make-believe game was an artifact, a doll, whose *prop*erties guide the rules for the game, the playing of which requires correlations of them with certain features of a baby. As an artifact, with attributes adequate to that function, it had to be produced—made *on* purpose *for* the specific purpose of inciting, but also of determining, states of affairs in the child's make-believe game, which, Walton stresses, includes herself as a central object of imagining. Although, as is well known, without dolls, children can be quite resourceful in pressing objects of many sorts into ad hoc, makeshift use in such games, where rules of consistency apply to the selected features, once chosen. Otherwise there may be imagining, but there is no make-believe game, and certainly not any in which others may join—as is normal even in the sort of game that Ardizonne depicts, where children past the age of three not only assemble with their toys to play side by side but to play together (which clearly does not interest Ardizonne's boy). Developmental psychologists find in such *shared* games the basis of the kind of rule observance that distinguishes human social groups.[10]

Next, directions for making artifacts, including toys, can themselves be taken as rules. This seems especially pertinent in the case of small children, where normativity is a frequent feature of the directive, since children like following simple rules with a sense of right and wrong, and getting things 'right', the right way, before they are sufficiently confident to extemporize on their own. Psychologists also observe that such successful productive processes, guided by a carer, achieve a strong sense of joint attention, in joint action, for joint goals: an essential basis for socialization and thereby—to repeat—a sense of an objective world, of what things are *for* (albeit, as Tomasello states, for *us* or for *them*). In this imitation is again a principal factor, in which verbalizations, besides gestures, hand-guidance, demonstration, play only a part in learning to do things the right way. Peter Hobson observes that it is important that normal human imitation, emulation, tends to take in not only a method for getting to a goal but the manner or 'style' of the action.[11]

Of course a crucial feature of humans is that this guidance can occur through disembodied ('extra-somatic') representations of productive rules. Tomasello has pointed out our species' crucial 'ratchet effect', whereby skills once achieved are passed on and gradually improved.[12] There could be no modern world without an enormous advance in our ability with these capacities for what Tomasello calls "cultural transmission", without direct imitation, by widely dispersing 'representations', which can be understood, stored, annotated, circulated

2. Sequence and Simultaneity: The Case of Origami Notation

9 Vygotsky (1978 p. 98), from his last (1933) lecture, 'The Role of Play in Development'. The next quotation is from p.104. Vygotsky's thinking is in the Hegel-Marx tradition of dialectic, which he cites, so thus opposed to the Empiricist stimulus-response thinking of his time.

10 See, for example, Michael Tomasello (2014), Ch. 3, "Joint Intentionality".

11 See Peter Hobson's (2002) experiments, Ch. Eight, "Self and Others".

12 Tomasello, (2014, p. 5).

at multiple remote sites with little effort.[13] Such representations (e.g. wiring diagrams) are of course themselves artifacts, of a higher order, which needed invention, then formalization into international trade rules. In them we find dramatic examples of the limits of words and the advantages of standardized graphics. With them comes another level of rules, rules for making the very notations that guide the prescribed processes: rules for expressing rules to guide action.

Rather than considering this meta-level through complex engineering drawing systems, let us keep to our light-hearted basis in children's games, and consider modern paper folding ('origami') notation, where basic principles are exemplified sufficient to our purposes.[14] Modern notation provides a case study of the emergence of increasingly nonlinguistic rules as we seek precision, through what J.S. Mill called "the method of isolation", whereby not only the ambiguity and vagueness of language, but also its great powers of suggestion are avoided. Beyond that, linguistic barriers between languages—and, considering children, within vocabulary and syntax—can be minimized. To an extent, this may be considered a case of the adage, "show, don't say!". Yet, as just noted, this is 'showing' that crosses the great divide between emulation and that definitively human extra-somatic form of representation generally (and vaguely!) termed 'sign-use'—notably in surface markings.

Yoshizawa's Notation System   It is fitting to exhibit this method through a simple, effective design of a make-believe figure (a nun) by the Japanese origami master Akira Yoshizawa, an engineer, with whom the standard notation is closely identified.[15] I suggest that the reader, with a square of paper, follow its nine folds through our discussion.

As shown in the present instructions, such origami diagrams feature mainly three kinds of lines: solid for edges (partial for crease 'scars', with long dashes for median folds); then for fold directions, short dashed lines denoting 'valley' creases and dash-dot-dot lines 'mountain' folds. (Auxiliary dotted lines may be used for measurement.) In addition, there are three kinds of curved action arrows. Two used here are slightly curved: solid-headed for folding forward, open for folding backward.[16] Added proportional numbers and arrows as shown here, like the sequential numbering of the stages, are not usually necessary. Removing such auxiliary numbers would leave us with a purely graphic set of directional signs, which, with context, may be taken as rules. This is because (although short written instructions are common) people can be counted on to figure things out for themselves, perhaps after some trial and error—which leads us to the next major point about 'pure' graphical rules.

That Japanese signs, including pagination, move from right to left is easily seen. However, getting from step 4 to step 5 might not seem clear, as it excludes a diagram for an intermediate instruction, which in words might be: 'preserving fig. 4's top mountain fold, open model out again as in step 3, make a vertical valley crease through its center, then lie it flat to produce step 5.' However the fact that beginners work such things out by themselves, even without

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13 Following Arnold Pacey, I discuss this in Maynard (2010), Ch. 1.

14 Should we desire a philosophical transition from rules of games of make-believe to productive notation, here are a few lines from a pivotal figure in the history of paper folding, Miguel de Unamuno. Recalling childhood games with the traditional Spanish folded pajarita (little bird), he wrote: "When I see myself in my children and, especially, when I start to make for them paper pajaritas of the many kinds whose production I have mastered, I recall my best years. That is because those same pajaritas became the favorite, almost the only, toys for over two years of my early childhood. We made them in legions, invented a country, wrote its history, made dangerous expeditions—in a small holding my family owned in a village near Bilbao. As that did so much to form my mind ..." Unamuno (1902).

15 Along with Samuel and Jean Randlett, and Robert Harbin, although features of it precede them by decades. For a recent effort to trace its history, see Rosenberg (2019).

16 In addition, hollow arrows denote pressing in (sinking) or pulling out, looped denote turning the model over.

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Figure 2

the Japanese, is due to a striking feature of this method of 'signs', which distinguishes it from language: that users can look ahead easily, for example to step 6.

Indeed looking ahead—sometimes several steps, and always to the conclusion—is usual, past the first few steps. Thereby directions as to what to do are supplemented by their reasons, since we see where we are going, and it becomes easier to spot mistakes and to backtrack. Therefore all our figures except the last combine action (directive) and result (descriptive) functions, with action leading the way. For example, step 4 shows us that the valley-fold notation atop step 3 must be taken as applying only to the back layers. Step 5, in turn, shows the importance of the mountain fold in step 4, for what will be the peak of the nun's veil. This is possible because such graphic directives, unlike verbal, have the power of presenting sequences without losing simultaneity, compresence. Indeed as we become practiced, we cluster sequences, skipping groups of figures, towards a familiar result, which may have a familiar name, such as "bird-base".[17] This is striking when we note the inferiority of photographic instructions, more so with contemporary on-line movie origami instructions that show the process of folding. Besides loss of valuable 'isolation' in our notation—in other words, addition of distracting noise—where these reach the least complexity users find themselves having to stop the movie and go back, repeatedly. That is due to the graphic sequence having lost simultaneity. 'Not so fast!' Thus some weaknesses of the direct emulation method: losses of isolation and of simultaneity.

Having stressed 'isolation', what are the properties isolated by Yoshizawa's rule system? Obviously spatial, as geometrical. But they may be characterized, too, in terms of dimensionality. To fold a 3D figure, we fold a 2D object along straight 1D lines, paying close

Diagrams and Dimensionalities: Against 'Iconic'

17 Here is a place to note that origami has developed a non-ordinal notation called 'crease pattern', in which all that is diagrammed is the sheet of paper with the mountain and valley creases on it. Furthermore, as we all know from closing cardboard boxes, 'collapse folding' is used, whereby several folds must be accomplished simultaneously.

attention to 0D points and crossings.[18] In engineers' language, we thereby achieve true proportions, thereby true angles—but not true sizes of lengths or areas. Yet this simple theoretical description needs qualification.

From the first fold, none of the diagrams can be fully 2D; all appeal to 3D perceptions, and in two ways. First, steps 3 and 4 must indicate hidden layers by means of occlusion. For example, lines for the veil's edging-band (under-veil) in fig. 4 imply six of these. Next, steps 1, 2, 5 and 6 also provide important 'oblique' views of under-layers, by means of small 'v', arrow, and 't' junctions of edges. This becomes more complex in step 5, where the diagram slips further toward three-dimensionality, with a slight indication of foreshortening at the open base. Next, two short 'scar' lines on the veil (on study of which we determine that the higher is not on the close side but a 'transparent' view of the corresponding back layer) suggest an oblique image, now not only in layers but already in the dimensional 3D space of step 6's completed models, which feature convergence indications for linear perspective. Thus our little example develops gently through the standard devices of occlusion, foreshortening, diminution.

Now comes the most radical statement in this essay, that, working through even a short, simple set of diagrams like these shows the bootlessness of the common phrase "iconic sign" for characterizing how 'rules without words' function, since blanket terms such as "resemble" and even "stand for" are not only ambiguous but misleading. Objective resemblances there are, notably in the isolated property of true proportions: thus one can transfer angles by tracing them from physical models, also measure proportions for transfer. This is standard engineering drawing.

But what guides us in 'isolating', selectively choosing, features such as line junctions is no isolated objective resemblance or correspondence between figure and physical model but rather a very few, highly selected cues important to mammalian vision. Furthermore, as mentioned, moving picture directions, even when assisted by words, usually fall short of diagrams, despite providing far more 'resemblance'. Thus, besides ambiguity, is revealed the most misleading connotation of 'iconic' and contrasting 'sign' systems, in its underlying 'correspondence' assumption, that the topic is basically of relations between a 'sign' and what it allegedly 'refers to' (which in most engineering also fictional drawing does not exist!). We need better analytic tools for thinking about such matters.

I suggest that such are to be found in another of Lev Vygotsky's conceptions, termed "mediating artifacts", which turns attention to pragmatics, to users of signs, rather than to fancied semantics via 'correspondences'. For Vygotsky, while most artifacts are "externally oriented" to make changes in the environment, signs are "internally oriented" to work on ourselves.[19] Thus, with the origami notation, the printed signs exploit selected (isolated) aspects of our visual systems, notably regarding our extreme sensitivity to edges, along with our species' fine hand-eye coordination, to achieve motor goals.[20] The diagrams therefore mediate the actions of two parts of our brains or neural systems, as visual guides and displays offload short-term memory work as we perform daily tasks. 'Resemblance' and 'iconic' (similarly 'convention') fail to locate the main distinction between rules and directives (mainly) by diagram from those (mainly) by words. Worse, their wide use lulls us into thinking that we understand what we do not. They are blanket terms that smother inquiry.

Rules and Orders of Intentionality   In a final use of our humble example of graphic rules, there is a last large issue to bring out, to prepare for its use in the final section. The result of the folding sequence above is, as we

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18 Following Willats (1997), esp. Ch. Three. Since we are dealing with physical objects the latter three dimensionalities are approximate.
19 Vygotsky, "Internalization of Higher Psychological Functions" (1978, p. 55).
20 Vision theorists still dispute the biological basis of edge lines in drawing, and there is a long tradition in art of stating that they do not exist 'in nature': see Maynard (2010, p. 99).

noted, itself an artifact. And although it may be made simply for the sake of making it, it may have the function of a prop for imaging a nun moving forward, which has its own loose rules. Indeed, once completed, we will likely adjust the folds (Yoshizawa suggests softening them) to get the right openness of the imagined figure, which we may then even connect with a specific imaginary game ("And afraid of a disaster Miss Clavel ran fast and faster …") from Ludwig Bemelmans' children's classic series, *Madeline*. But this is optional.

By contrast, the second level directive rules in the example exemplify something else, a sort of communication between the maker, Yoshizawa, and us. As such it presupposes what I term the five orders of intentionality necessary to *communication*, which is shared by linguistic, graphic and other methods. At the first order, we have our own conscious perception of the markings on the page. At the second, we attribute them to a maker (rather than to accident) who has put them there for a purpose—that of guiding us (order three) to fold a figure. Yet three orders are not enough to capture this communication. Two more are required, which reflect the second and third orders: that we *understand* that the marks were put down to guide us, by our (order four) understanding that they were put there with just this purpose (five).

That is what allows us to follow a given instruction and also to figure some things out ourselves, trusting that the diagram-maker would not skip essential, difficult steps. Thereby we can note when this does happen, and perhaps add our own notations. It also allows us to note and to correct mistakes or ambiguities, such as the tiny one in step 5 where Yoshizawa has not, as elsewhere, left a gap between the figure and the horizontal line marking the top of the '1/2' measure, and also in step 3, where the two dotted lines showing transparency through the veil are not consistent. Generally speaking, this ability, easily to take in such five-order patterns of intentionality, is essential to human communication and thereby to human society. Child development requires attaining some degree of such elaborate 'mentalizing' well before the so-called 'Theory of Mind' of the fourth or fifth years.

In case this last point about communication seems anodyne, let us now consider a very different, more complex case of rules and communication. The great importance of such communication, often without words, may be indicated by leaving the child's world and games for civic road markings, where failure of imaginative powers to put oneself in what Tomasello calls "the mental shoes of some other person", notably to figure things out, not only undermines social cohesion but can be dangerous.

3. Rules of a Road: Signage and Civility

Beginning with our childhood imaginative games, we learn to follow joint rules, which hold for all of 'us', rather than be compelled by force, and to enjoy doing so. That prepares us for later ages when it all becomes more complex. Societies exist only when, and to the degree that, following common rules prevails. I have suggested that such rules involve a five-pattern of intentionality orders, based on the pattern of communication, whereby we are motivated at least partly by recognizing that rules obtain. Of course, societies differ markedly according to the balance of motives: thus the presence of police and other restraints.

Setting out in the first two sections with games of different sorts, as well as crafts, we were able to deal with isolated situations, with a few, friendly participants, done for their own sakes. We noted that such isolation is crucial to what makes them enjoyable and shareable, removed from the challenging complexities of life. As Vygotsky argues, the self-imposed rules make them so. Still, we cannot tell how useful are the analytic tools we developed with such games, in helping us understand the place of signs with rules, without testing them in that complexity. Let us begin such a test with the familiar example of city driving situations, which present well-known complexities.

An everyday example of the places of words or other other 'signs' with rules appears on

Rules and Agency: A Case Study

communal roads. There, shared knowledge of 'the rules of the road', and where they apply, is necessary for safe and efficient passage, especially in congested areas, where, say, mere eye-contact will not suffice.[21] This makes posted signage necessary, a case study of which may show in what forms themes of our previous discussion emerge again. The city of Chelmsford, Essex, although not very large, stands at a junction of a number of busy highways, carrying much truck traffic. It also features a much-travelled railway line, whose embankment crosses above a city street (Duke), next to its passenger station. All this is approached by road from the south side out of a traffic double-roundabout (see Fig. 3) at the crossings of two roads (Duke and the larger Victoria Road). Duke narrows to pierce the rail embankment through a railroad 'gate', masonry arch (Fig. 5) emerging on the north side at the city's bus station. It is there that our signage challenge begins.

Since a ruling eight years before, automobile traffic that had gone through the gate is no longer permitted. EU and other readers will likely realize that private motorists' knowledge of rules about even entering bus lanes and stops (also exceptions to these laws) is uncertain—so, as before, adherence to the law likely much depends upon our principle of emulating others' actions. More so with less familiar bus gates, where failure to follow the law at that gate in Chelmsford is evidenced by 58,977 penalty charge notices and £1.5 million collected in the first eighteen months after cameras were installed there.[22]

In our terms, this suggests, regarding rules and signs, a breakdown of the five-pattern intentionality of communication, which requires 1) that signs be seen to have been 2) made and located by authorities, for the purpose of getting drivers 3) to follow certain driving rules—based on their understanding that the signs 4) were posted by authorities, in order 5) to get them to comply with those rules at those places. However, according to the civic authorities, many drivers have been flouting rules 4) and 5), thus showing disrespect for law. Many drivers reply that the main failure occurs at orders 2) and 3), involving poor sign design—and for some even at 5), where they believe that—given a fine of £60, 'reduced' to £30 (ca €33, $38) if paid in two weeks—one purpose of the 2), 3) failure is as "a money-spinner" or "cash cow" for the Council.

For the present our topic is limited to orders 2) and 3): sign design and placement, as involving words and graphics. By luck, informed testimony regarding this case comes from one of only a few drivers to win on arbitrated appeal, Dr Bernadine King, a psychology Ph.D. and well-published university researcher in dyslexia. Her argument, notably regarding word signage, provides a concrete test of our analytic tools. I trust it is worth illustrating and citing it at length from news coverage (in five sections), in order to make that test. Looking at Fig. 3, it is important to know that her first destination was the railroad station, through the bus gate. Here are her five arguments, in two groups.

Upstream signage: i) 'Dr King explained that the first sign mentioning the bus gate was along Victoria Road,[23] which is not easy for drivers to understand; drivers don't have enough time to take in all the information on the sign, as a person's eyes would only be able to take in about six or seven words from the sign when driving past: "In addition to two mini roundabouts and roads there's a title in capitals that says 'Duke Street bus gate' on two lines. The number

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21 Note how our five-pattern intentionality obtains there: 'I see you and that you see me, and that you see that too, and so we agree.' The Dutch road engineer Hans Mondgren argued influentially against much road signage, citing the sufficiency of such exchanges.

22 See Brown (2019).

23 The Fig. 3 sign is 80 yards from the roundabout at its junction with Duke, .2 miles from the bus depot, illegally through the gate. The shortest legal approach for private vehicles from there would be a loop in the opposite direction, and .9 miles to the depot.

Figure 3   Figure 4

of lines is important, because if it gets beyond two, motorists have a problem taking it all in. Then you have three lines there saying, 'Through traffic avoiding bus gate and low bridge', and what you're drawn to isn't the reading of it. In a busy situation your brain is looking out for important messages, for commands, so you're drawn to the red triangle, which is the height restriction and so to my mind it was, 'oh, there's a height restriction here [but] I'm all right; I'm in a car', and I really didn't take in the rest of it. [Drivers] haven't sufficient room here, where the sign is visible, to take in all the information." She [also] argued that the placement of a road marking and the words "110 yards" below it could easily be interpreted as there being 110 yards between the bridge and the bus gate.[24]

ii) She added that the blue sign identifying the bus gate will "fade into the background as the brain will focus on the red triangle." Another version of the same sign [Fig. 4] is situated on the first mini roundabout, however she said that "it is in a position where drivers not only won't look, and that if a high-sided vehicle were to come past they wouldn't see the sign at all.'"

Downstream signage: iii) 'Exiting the second mini roundabout, unaware of the bus gate, it was only then, when she was confronted by the signs at the bridge did [she] realise she was in a restricted area, but found there was no safe way for her to turn around [See Fig. 5]. "I looked up and saw all these signs and then saw the blue sign with the yellow background right on the bridge, saying that I wasn't allowed through there. There are so many signs by the bus gate but a little contradiction in the brain means we cannot absorb all the information. To consciously process all the information, it may take a few seconds and by that point, you've already travelled 20ft or 30ft down the road." Thereby, frustration of the 'figuring it out' principle.

iv) "[Essex County Council] make a big thing about this message that is painted that says bus gate, but you can't read it from here [the junction at the mini roundabout] when you're supposed to be making your decisions [about] what you're doing. It's directly underneath the bridge" [on a downslope, as shown in Fig. 5].

v) "At that point if it's busy, you can't turn around without knocking somebody over and that's why I appealed it, because I felt really strongly that it's an accident waiting to happen. Drivers are being trapped in the area and panicking. The worst thing about this experience—also what everyone has said to me who has been stuck in this situation—is the panic. You just start

24 See Brown (2019). In editing, I have omitted lacuna dots, and substituted 'Dr' for 'Mrs' in references to King.

Figure 5

panicking, 'how do I get out of here', and if you're not an experienced driver you'd be tempted to a quick maneuver to get out of there, which could be a dangerous one and it could end up with an accident."

A first observation is that Vygotsky's principle of 'mediation' seems thwarted by the signage design, since drivers are not able to use their sight and reading capacities adequately to guide their motor (sic) actions, via a quick planning (frontal lobe) task. As Dr King in effect states in i), the bus gate signage, in two upstream locations, is presented as a printed headline, 'bus gate/110 yards' (applying to Duke St, but with no directional arrow at top), divided by a printed clause of seven words (with three qualifications on "traffic") and a directional arrow pointing to Victoria Avenue. The lower portion of this headline is further separated by two colored traffic emblems: blue containing a mix of pictures and text—regarding vehicles permitted, not those banned—red's measurements in metric and English: a mix of words and different kinds of graphics. The linear structure of syntax with words is weak at presenting 'sequence in simultaneity'; however the first sign, on Victoria, 75 m from the two roundabouts, does feature a useful map graphic for that purpose.

In this sort of case, the problem applies as well to the spatial *placement* of the signage, as noted in ii), iii) iv), and here rule application goes wrong in more than one way. Re ii), as Fig. 4 shows, the vertical sign at the junction, placed on the opposite side of the road, is easily occluded, by other signage as well as traffic. More generally, there are real dimensions of time and space. Our rules in previous examples sometimes (notably in the case of origami) were temporal only in the weak sense of *ordinality*, but there was nothing about *interval* (proportional) or *metric* (which includes 'now' and 'then') scales (except in the case of instructional movies). However, as noted in all five objections, intervals of space and time are crucial to such road directions, regarding comfortable perception and reaction times. Although the rules, laws, may not mention them, these are central to the means by which one *applies* the rules.

This will likely become even more evident as driverless vehicles proliferate. We note that, as a perceptual psychologist, Dr King emphasizes the rates at which humans can process and react to visual information—partly because we carry out many simultaneous tasks. Such may not be the parameters of narrowly focused automatic systems, which may be guided by different

systems, with faster response times and more accurate spatial interval and temporal metric sensors. Related to that is another spatial dimensional issue, crucial to road signage: *vertical* versus horizontal presentations. A Council spokesperson replied to the complaint as follows:

> We increased signage at all junctions leading to the bus gate, sent more than 3,000 warning notices and painted the words 'BUS GATE' in five-foot high letters on the road at both entrances to help make drivers aware of the restrictions…. There is no review of signage planned at the bus gate. The signage was reviewed and increased before the enforcement cameras were switched on in 2017.[25]

Yet, as stressed in objection iv), since these physical word inscriptions are horizontal and under the prohibited bridge (see Fig. 5), by the time drivers can read them it is too late to react safely without breaking the law.

A last comment on meanings of this set of arguments for our inquiry into rules in practice, is the psychologist's emphasis on motorists' affective, besides cognitive and conative states: v). Signage itself, whether in words or not, makes *affective* use of designs and their locations, as is clear from even the pointed shapes of caution signs, the use of colors (as mentioned at i)), the size and boldness of markings, along with depictive imagery, exclamation marks and so forth, to carry more than information for human subjects. Besides, there are physical, nonverbal guides and constraints, including road narrowing, bumps, lights, sounds and other devices, termed by designer Donald Norman, 'forcing functions'.[26] The advantage of many of these are Vygotskian: they are artificial environmental states that temporarily call on other parts of ourselves—notably, other perceptual systems—to assist our minds in specific awarenesses. For some of these, working in real (metric) action time, their variations may guide us in modulating our actions, even by feedback structures (consider even speed bumps, which in current terms are 'user interactive'). If, as Norman generally argues, such mistakes are common, users have discovered a *design fault*, which engineers, including information designers, should be eager to know.

Let us conclude these three studies with a case for the importance of our overall topic. If, from the perspective of public-sign design, with or without words, we review the concrete cases with which we began, socially meaningful dimensions may come forward. First are communicative 2), 3) design questions of how good and clear, for users, design and location are. Second are the 4), 5) questions present in all our examples: the maker's expressed attitude toward the user, and the reciprocal. That these issues can form a pair shows up with frustratingly unclear—even confusing—improperly located, badly maintained roadsigns, which may further seem to express authority's lack of concern for users.

Perhaps in stressful—including hazardous—situations, this stands out as a common second-order of intentionality failure of the designers and posting authorities—a third-order intentionality failure, through absence of what is termed 'user-based' policies. Added to that are content deficiencies in graphic design generally, including even for consumers on products. There, where users 1) look for guidance in makers' 2) design and presentation of signs in order to guide 3) their actions, the term 'content' may denote more than information or deontic modulation, and have wider meanings regarding *civility*. For at this point of

Signs, Intentionality, Civility

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25 Brown (2019), also: "[Dr] King successfully appealed the fine after the adjudicator decided the signs leading up to the bus gate were unclear to drivers and that the amount of signs around the bridge itself could be distracting."
26 Norman (2013, pp. 144f).

communication, as in any exchange, the 'mentalising' aspect of intentionality includes affective attitudes—not just the cognitive ones so far stressed—with important social and political implications. An essay on the relative 'autism' of many manufacturers with regard to consumers and users would be long indeed. Fortunately, much of it has already been written, with telling examples, by Norman (2013).

Our single example of a council authority's *response* to detailed arguments about public signage, well illustrates more general problems of attitude. As Plato had Socrates remark, makers need to take instructions from users, since products are judged by how they perform in use, and it is the users who know that (*Republic* X, 601d). Yet, Norman argues empirically, at least in our society, with complex artifacts, users tend to blame themselves, not knowing that in many instances their poor performances are shared with many others—who are similarly too embarrassed to reveal them. Not quite so, when they are subject to fines, however. In an earlier work Norman (2013 p 67) argued,

> Eliminate the term *human error*. Instead, talk about communication and interaction: what we call an error is usually bad communication and interaction. When people collaborate with one another, the word error is never used to characterize another... . That's because each person is trying to understand and respond to the other, and when something is not understood or seems inappropriate, it is questioned, clarified, and the collaboration continues.

Whatever the merits of Dr King's arguments, from this point of view it is disappointing to find the Council's all too familiar response of stating what the sign users' position should be, rather than what they are likely to be, and interpreting this narrowly. Having sent out "warning notices" years earlier is not relevant to the case, painting 'bus gate' in "five-foot letters on the road at both entrances to help make drivers aware of the restrictions" does not addresses either why many likely do not become aware or what they are to do if they see them. That most people have poor success folding your simple origami design suggests finding what is lacking in it, not in them.[27] Besides, as Dr King points out, sentience exceeds visual recognition: "Drivers are being trapped in the area and they're panicking". Under stress, more emphatic deontic signage can be counter-effective.

The terms of such civic breakdown might be understood in terms of Tomasello's (non-autistic) child development principle, putting self in "the mental shoes of some other person". What appears lacking in the underpass example is the authority's understanding of motorists' likely points of view, literally, and beyond that. Thus a lack of empathy: imagining how an object might appear, to some, from changing perspectives, optical and otherwise. (There is clear evidence of breakdown of such when the authority refers to the underpass as a "rat run".) The empirical evidence for design failure, including posted graphics and words, seems overwhelming: an average of 110 failures a day in the first year and half of what should be considered a trial of the signage, even when each failure costs a motorist £30. Perhaps red signs showing what single vehicles may *not* pass would be more effective than blue ones (mixing graphics and words) that show those that may.

For such signs, several engineering principles seem clear. First, that whatever the content of the law, sign applications of its rules are inevitably particular, for the senses, and concrete.

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27 While writing this piece, there occurred the tragic crash of a Boeing 737, and the response of a U.S. Congressman— "facts in the preliminary report reveal pilot error as a factor...; pilots trained in the US would have successfully been able to control this situation"—proved false

Whether in words or graphics, such signs are artifacts, physical displays, usually visual markings on surfaces, vertical or horizontal, located within wider environments of more or less relevant and irrelevant states and events (which is the meaning of 'concrete': grow together). Next, for such signs, are factors of change, time and motion. Finally, that the agents that these artifacts are *for* are people, with some range of mental abilities and, importantly, intentions and attitudes. Of course, the implication of all this is that makers, authorities, and users should cooperate to improve *communication* via such signs, rather than assume adversarial positions.

Finally, we may remark on how design failures—especially at authority levels—of the sorts noted become failures for us all. Perceived disregard, even disrespect, for oneself is understood as the same for all, "us". With this comes a *collective* sense, regarding the maker's or the authority's attitude to us, not just to self. To put the point in a positive manner, when, as often, government sign-design seems user-based (for 'us'), respectful, clear, intelligent, even pleasant to use—and well integrated with its environment—our sense of *collectivity* is strengthened, and government, perceived as concerned with that, seems present in a good way.

As the social scientist Tony Judt often stressed in just such contexts, we are thereby encouraged to be diversities that, with government's help, cooperate to form collectivities, with what he termed "institutions and relations of ... cohesion, trust, custom, restraint, obligation, morality, authority" in their best senses.[28]

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28 Judt (2016, p. 313).

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