TOWARDS A BIOLOGY OF LANGUAGE

a mathematical approach by way of the rule of four

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2020

April 2020 edition

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PRELUDE

is it possbile that language, mathematics, and biology are all built on the same design?

this report continues from two previous in lingbuzz, the grid of language in mar 2010 and the amazing rule of four in feb 2016. latecomers and strangers to the tagalog grid should visit the latter at least to gain best from this following work. i take it up from where i left off there, from these conclusions in particular:

> the quadrisections, we find, are telling our mental world apart! the grid is like a coordinate system for our organism's information sources. and this final foursome obviously represents four separate but communicating circuitries of an organism that are together responsible for its continued survival. [fig. 0]

senses	mind
memory	brain

> to perfect descartes, it would be {i see, i know, i will, i think} therefore i am. the seeing i is our senses tracking things, the knowing i is our memory retrieving things, the willing i is our mind driving things, and the thinking i is our brain computing things.
>
> and should you wonder what kind of actions each of the foursome contributes to our language making, then that is precisely what the tagalog grid is spelling out for us, affix set by affix set, quadrisection by quadrisection. what senses are at work? what memories are required? what actions are available? what conclusions are desirable? (46-47)

in which light i now revisit the two um affix sets, the volitional UM and non-volitional *UM* and their grids, that appear also in amazing (pp.31-32). the intention was to possibly perfect both grids according to the lines suggested by the surfaced ruling quadrisection above and to see what other eurekas might be in store in that direction. the results are frankly astonishing.

the um verbs are really the natural starting point for any differential study of tagalog verbs. non-um verbs all seem somehow to be derivatives or sundry complications of

them. they appear to me to be the simplest verbs in tagalog, from which all the other verbs might be said to evolve.

this simplicity of um verbs is semantic in nature: um verbs are simple in that they describe the most simple actions—easy, natural, spontaneous, sure—whether as observed event or performed action. trivially, we might say that actions are 'simple' that are um verbs in tagalog.

what actually sets um verbs apart from the other affix sets, a keen appreciation of the range of verbal actions embraced by their english keywords (pp. 7-8) might provide an inkling. but it would not be enough, a contrasting reading of at least the mag verbs is essential. later with the perfected um grids in hand i try to pin down anew with fresh keywords the semantic contrasts that set the different verbal affixes apart from each other.

by the grid, there are sixteen distinct and well-defined affixes in the language. they are our access to the grid. without them it was impossible to start breaking down the infinities of language into manageable sizes. (fig.1)

	Q2Q3			
	involuntary		voluntary	
doer focus	*MAG*	*MANG*	MAG	MANG
	UM	*MA*	UM	MA
object focus	*IN*	*AN*	IN	AN
	I	*MÅ*	I	MÅ

according to q2q3, um verbs are doer-focused, and can be either volitional or non-volitional. in tagalog, a doer-focus(ed) verb points to a *doer in action*, as opposed to object-focus(ed) which points to an *object acted upon*. verbal actions are *non-volitional* that are autonomic or involuntary, what are listed in *UM* (italicized); as opposed to *volitional* which are deliberate or voluntary actions, what are listed in UM.

you may want to see the the two perfected um grids as they stand on pages 7-8.

1 EVIDENCE OF A GRID

it all started with um, of course. of the sixteen affix sets of the tagalog grid, the two of um were the first to intimate a quadrisection to me. and of the eight quadrisections of the grid q1-q8, the first to surface was q5, again in a deeper study of um verbs. i date these beginnings to 1992. afterwards, testing the same q5 on the non-um verbs the foursome looked as if it could be of general application to all tagalog verbs across the board. i wrote then:

> The four categories of events into which all tagalog verbs appear to divide are best expressed by the keywords *Projection, Acquisition, Motion,* and *Transformation* [or] the simpler *Give, Get, Do,* and *Become.* (*The Grid*, a discovery in the human brain by way of Tagalog verbs, desktop edition,1994, 93-94)

q5 is essentially unchanged today except re-arranged into {move, become, go. get} in the key verbs {happen, happen-to, do, do-to}. the um database is vastly larger now and the four kinds of verbs then are each broken down now into 64 semantic sets by virtue of three further successive quadrisections q6-q8 of the database.

q1 was the second foursome to emerge. here it was that the first obvious evidence of a 2x2 permutation at work in the language appeared, strongly suggesting an underlying mathematic behind the widespread foursomes emerging in the language. in fact, the permutation offered up two more strong candidates for semantic foursomes: in the doer focus affixes {um, mag, mang, ma} and object-focus affixes {i, in, an, må} of our verbs—what later would shape up to be q3 and q4.

q2 was the last quadrisection to make an appearance. and what a dramatic finish. for here would soon unravel, another undeniable 2x2 permutation to be found at the heart of the language, this time in the morphology of the tenses of tagalog's verbs (figs.2a-b)

	Q1	
doer-focus	IT HAPPENS	I DO
object focus	HAPPEN TO IT	DO TO IT
	non volition	volition

	Q2	
repeat syllable	PRESENT	FUTURE
basic root	PAST	POSSIBLE
	inflected affix	basic affix

in mathematics these sorts of successive 2x2 permutations at the bottom of things mark the underpinnings of a combinatorial system at work. not only was it astounding to encounter them in a study of language, but also compelling that these mathematical objects were only a step away from the machine language and boolean logic of modern computers.

it was a shocking coincidence of maths and language. indeed, if language was reducible to a finite series of 2x2 quadrisections, i thought, perhaps computers could be taught to speak after all.

it was obvious that q5's four groups of um could still be deconstructed into smaller and finer semantics sets. and given the patterns emergent in q1-q4, it seemed reasonable to imagine that the verbs of an affix set, in all their semantic variety, were subject also to four quadrisections, and reducible to exactly 256 (=4x4x4x4) semantic sets.

this is really what the gridding has been all about. the aim forever has been to surface from the deep somehow the perfection of these four quadrisections q5-q8, not only for the um verbs but theoretically as to apply to all the affix sets across the grid.

there was little to go on with. where in q1-q4 there were the affixes at play to mark the way, here were no surface markers to go by. from q5 on, it was sheer speculation, a leap into the deep. for the most part what it relied on was the *sprachgefuehl* of it—this speech-feeling. tagalog's affixes had a way of making our verbs *feel* alike or different, for some reason. list up verbs of the same affix, and some verbs naturally *felt* as if they belonged together, they not only meant alike in some way but also turned into similar kinds of sentences in our heads, forming what i called 'grammatical sets'.

surfacing all the 4,096 (=256x16) grammatical sets of the grid in all its glory is the work i call gridding. the work is twofold. firstly, to sort out the verbs of an affix set into distinct, well-defined grammatical sets, with the aim of arriving at 256 of them per affix. secondly, to find a logical arrangement of these 256 grammatical sets in a 4x4x4x4 grid reflecting the effects of four successive quadrisections at work.

it was easy enough, as it turned out, to break down a thousand-verb sample of any affix set into 256 more-or-less semantic sets. that an affix set was so reducible was soon a given with me. but coming up with four neat quadrisections of the 256 according to some dependable algorithm was easier said than done.

it was a blind search for semantic patterns in a jungle of syntax. what drove the hours was the intrigue of it, why these foursomes and quadrisections and 2x2 permutations? one wanted to see what it was all about, and what further and greater truths might be coaxed out of the databases by them.

for years, neither um nor mag—or their interactions with the object-focus i, in, and an—would yield any convincing lines of subdivision. although semantic foursomes were cropping up everywhere, always there was some fuzziness preventing the four quadrisections from clearly and unequivocally forming.

around 2004 it was that, finally, in the volitional IN affix set, there arose the first tentative configuration of four successive quadrisections and the semantic lines that the tagalog grid was drawing. in 2006 i wrote the -in grid: a mathematical order in language by way of tagalog verbs for the 10th international conference of austronesian languages; followed by the peer-reviewed the tagalog grid (2011) and its ebook version the secret grid of language: a deep structure surfaces in tagalog. all were about IN and the evolving lines of q5-q8.

i had hoped by these reports to attract tagalog speakers everywhere to the work of the grid, to help explore the language, for gridding it entire was clearly not a job for one. but it was not to be. i took it that the work was too eccentric, or, that in the end it was meant to be solitary work; that perhaps only solo work could integrally unravel the grid in a single lifetime. it would all have to be based on a single, my own, personal deep structure. so alone i bore the excitement and wonder of it all, ever in waiting for the next

eureka, revelling in every next new find in the jungle, in quiet anticipation of some unbelievable finale.

using the IN grid as template, i went on to grid the non-volitional *IN*, then the UM and *UM* affix sets, so giving me a fully-gridded affix set for each of the quadrants of q2. the result of this effort i reported out in lingbuzz in 2016, in amazing.

it was there in amazing, towards the end, in the very writing of it, that the rule of four took flesh at last, what i now call qθ (q-zero), what appeared to be the ruling foursome responsible for all the others, the key to the logic of the quadrisections that had been unravelling everywhere. with qθ came the promise of things deeper than imagined hitherto.

finally the accumulated evidence speculated from the raw data of tagalog verbs was pointing to a possible basis in the natural order of things for the grid and its digital-friendly manifestations of mathematical order in the language. qθ was telling us that language was logically traceable to an interplay of four blocks of data relating to organic processes centering in the human brain. (fig. 3:)

qθ	
senses	will
memory	thought

the arrangement of the foursome in the quadrisection was dictated by the tenses of the affixes in q2. what 2x2 permutation was responsible for the foursome is undefined; i will essay a solution to at the very end. note here that the keywords ‘will’ and ‘thought’ now take the place of ‘mind’ and ‘brain’ in fig. 0.

until this qθ result, the grid had been a stupendous piece of guesswork, the fruit only of a deep conviction that these mathematically significant linguistic markers in tagalog were there for some good reason, and that it brought language clearly into the realm of logical and scientific curiosity and inquiry.

with a qθ, for the first time a rational basis was manifested against which the alignments of verbs so far arrived at in amazing could be tested.

2 THE PERFECTION OF UM

if qθ was the underlying logic behind the eight quadrisection of the grid and the natural source of its mathematical order, one wondered how well did the already gridded data match up to it? and would it make the work of gridding the rest of the grid any easier and surer?

hoping to quickly add to the four affix sets already in evidence in amazing (*UM*, UM, *IN*,

and *IN*), i began on the mag verbs, only to give it up after a year or so. mag is a very busy affix in tagalog in both volitions. there are many complex forms with secondary prefixes like magpá- or magká- or magkangdá- plus the special bilateral sense of it (both-do-together), plus its ever-readiness to turn untranslatable foreign words into tagalog verbs (mag-kudeta, mag-online, mag-immigrate, mag-evaporate). i had been there before. despite qθ, the semantic range still proved too vast and layered to submit easily to a satisfactory, definitive gridding.

what was needed to guide the work was a hard and fast result from a smaller and simpler sample, but that nevertheless filled up all the 256 slots of an affix's grid of grammatical possibilities. i determined it was better to return to um.

the um database was much shorter and had the advantage of already being gridded in amazing into 512 grammatical sets to start with. moreover, because um verbs told the simplest actions, they bore the added promise of yielding something elementary and fundamental about the nature of language—the role of qθ, the logic of the grid, and the ultimate value of the information being generated. in a perfection of um by way of qθ, i was confident, some very basic things in language and communication would come to light. as they have.

fast forward to three years hence and see now how it has turned out with the two um grids in the following pages (tables 1-2).

at last word count, there were 2,185 root verbs in the um database, 1001 root actions for *UM* and 1184 for UM. i began these lists by culling from a tagalog dictionary of some 8,700 entries all the rootwords that i thought turned into good um verbs. i have added to them along the way, sometimes subtracted. it represents pretty throughly my entire um vocabulary as a native speaker.

no um affixed root useful as a verb in a sentence has been ignored. as is the rule for everywhere in the grid, every semantic distinction of a verb is significant. no odd verb may be cast out, its mere thinkableness as a verb in a sentence requires that it have a true place in the grid.

the difference between *UM* and UM is established in q1 as the difference between involuntary and voluntary actions. the semantic bisection is easily accomplished on the um database, with um verbs that have both volitional and nonvolitional values going into both affix sets.

the *UM* and UM grids above are the two verb samples each gridded down by four quadrisections (q5-q8) into 256 grammatical sets of distinct semantic values logically arranged in a 4x4x4x4 (=16x16) matrix. english keywords are used to unravel the results at every stage.

altogether 512 grammatical sets are identified by the english keywords (the white bars). there being sixteen affix sets altogether in the tagalog grid, the combined results represent an eighth picture of the whole and now offers us a template for the rest of it.

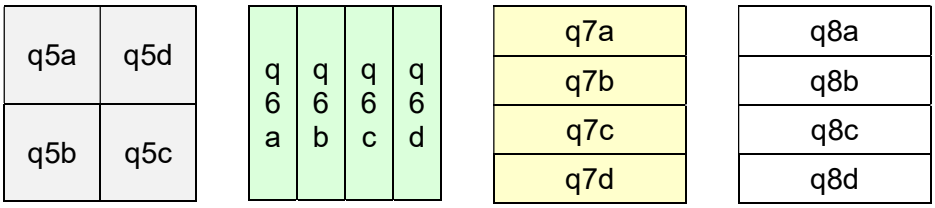
Q5Q6Q7Q8 of *UM*							
IT HAPPENS				*IT DOES*			
arise	**pass**	**move**	**quit**	**tjoin**	**part**	**go**	**come**
OCCUR	ELAPSE	QUICKEN	SUCCUMB	AGREE	VARY	PROPEL	STAY
commence	expire	sway	crash	resemble	differ	flow	remain
originate	fleet	rock	tumble	conform	reverse	advance	halt
advent	transpire	liven	conk	mix	diverge	fly	rest
resume	lapse	trigger	flop	synchronize	avoid	fall	suspend
APPEAR	DISAPPEAR	OBVERT	REVERT	ATTACH	DETACH	RELEASE	HOLD
shine	vanish	stretch	sag	align	isolate	scatter	cling
flash	evanesce	open	close	adjoin	withdraw	dangle	catch
dawn	set	stand	tilt	connect	disconnect	overflow	bottom
glimmer	perish	orient	upend	stick	unstick	drain	clog
SOUND	REPERCUSS	UNLEASH	CEASE	CONFER	DISPLACE	TRACK	LAND
resound	snore	rain	discontinue	protect	shift	trail	enter
report	squeal	pelt	stop	support	lift	meander	impact
reverberate	belch	blow	expend	boost	budge	pass	dock
resonate	gasp	fume	exhaust	prop	slip	bypass	destine
ENERGIZE	RUPTURE	INFLAME	SUBSIDE	INDUCE	REPEL	EJECT	PENETRATE
glow	crumble	swell	abate	tug	retract	spring	infiltrate
blaze	split	erupt	stanch	suck	bounce	spill	pierce
smoke	pop	secrete	recede	incite	recoil	protrude	embed
boil	curdle	flare	heal	attract	resist	surface	sink
IT HAPPENS TO				*IT DOES TO*			
become	**alter**	**gain**	**lose**	**absorb**	**reject**	**deliver**	**obtain**
DEFINE	DIM	THRIVE	DECLINE	RECEIVE	BLOCK	PROVIDE	CONSUME
brighten	darken	endure	wither	experience	shield	cause	devour
color	pale	strengthen	weaken	witness	bar	fulfill	deplete
cleanse	dirty	prosper	wane	hear	hinder	supply	weardown
clarify	blur	peak	slack	breathe	arrest	furnish	waste
FORM	DEFORM	INCREASE	DECREASE	ACCEPT	REJECT	REPRESENT	TOTAL
shape	distort	multiply	diminish	abide	violate	reflect	measure
straighten	contort	enlarge	reduce	regard	defy	refer	count
refine	roughen	grow	shrink	like	dislike	denote	contain
upgrade	downgrade	rise	drop	trust	doubt	signify	sustain
MATURE	DEGRADE	OVERLOAD	EASE	DESIRE	WHELM	IMPART	REACH
toughen	soften	oppress	comfort	crave	ravage	cast	reach
thicken	dilute	unsettle	becalm	require	raze	taint	tie
ripen	spoil	complicate	lighten	lust	disable	imprint	catchup
scent-en	stink	ache	resolve	dream	exterminate	influence	overtake
DEVELOP	REGRESS	MATCH	MISMATCH	THINK	FORGET	GENERATE	BENEFIT
enliven	deject	exceed	need	remember	scrap	reproduce	reap
behave	debase	suffice	lack	recognize	delete	breed	earn
motivate	retreat	meet	miss	understand	skip	sprout	profit
learn	retard	qualify	flunk	imagine	lose	payout	win

Table 2. The *UM* grid

Q5Q6Q7Q8 of UM							
I HAPPEN				I DO			
express	**oppose**	**exert**	**relieve**	**interact**	**counteract**	**dispatch**	**situate**
VOICE	CRY	MOVE	REST	ASSOCIATE	DISSOCIATE	TRAVEL	SETTLE
recite	bawl	frisk	rest	attune	desert	wander	stay
utter	yowl	rouse	bestill	ally	defect	startout	halt
sing	weep	act	sleep	participate	withdraw	launch	shelter
talk	whine	feign	relax	coordinate	dodge	dive	immerse
DECLARE	REFUSE	POSE	REPOSE	LINKUP	UNLINK	VACATE	LODGE
confess	deny	extend	bend	accompany	disengage	drop	hang
consent	decline	stand	sit	join	backoff	unhand	hold
answer	object	arise	recline	mate	escape	descend	climb
decide	complain	lift	kneel	meet	evade	alight	ride
CONVEY	CRITICIZE	PROJECT	VOID	ASSIST	SUBJUGATE	TRANSIT	LOCATE
relay	fault	thrust	discharge	care	abuse	wend	approach
mention	unmask	slam	expel	contribute	deceive	transfer	enter
cheer	discredit	throw	excrete	help	obstruct	traverse	touchdown
praise	reproach	impel	exhale	rescue	prevent	detour	head
SIGNAL	WARN	APPLY	DISPEL	ADDRESS	AGGRESS	DEPART	ARRIVE
address	growl	play	scratch	invite	fight	evacuate	gather
greet	rebuke	wield	swipe	prompt	hurt	exit	appear
call	admonish	press	soothe	ask	attack	disperse	visit
notify	caution	pull	remedy	woo	shoot	embark	return
I HAPPEN TO				I DO TO			
confront	**retreat**	**reinforce**	**regulate**	**undertake**	**eliminate**	**commit**	**source**
EXPOSE	HIDE	ENHANCE	LIMIT	IMBIBE	DISMISS	ATTEND	PARTAKE
peek	screen	prolong	shorten	view	rebuff	serve	chew
disclose	cover	harden	lighten	observe	shutoff	observe	feed
emerge	conceal.	maximize	minimize	study	disregard	tend	taste
surface	submerge	enhance	underplay	learn	discount	further	inhale
OPEN	SHUT	GREATEN	LESSEN	FAVOR	DISFAVOR	ASSUME	GRAB
gape	clamp	frequent	restrict	obey	disobey	use	claim
openeye	shuteye	add	subtract	honor	sneer	keep	snatch
spread	twist	accelerate	decelerate	prefer	refuse	carry	seize
smile	frown	raise	lower	endear	challenge	underwrite	steal
ORIENT	TURN	ARRANGE	REARRANGE	SEEK	DESTROY	WORK	FETCH
face	aboutface	leadoff	fallback	wish	ruin	farm	get
turnup	facedown	position	interpose	search	remove	plant	deduct
look	turnabout	cue-up	sidestep	chase	kill	make	draw
point	overturn	align	deviate	aim	eradicate	invent	catch
PREPARE	BEWARE	ASSIGN	RESIGN	PONDER	NULLIFY	INVEST	ACQUIRE
ready	cower	head	relinquish	recall	discard	stake	harvest
brace	prostrate	sit	abscond	identify	erase	spend	procure
await	ward	stand	surrender	discover	omit	venture	collect
lookout	fend	oversee	quit	solve	suppress	sneak	select

Table 2. The UM grid

here is how the two grids are both laid out—follow the colours: (fig. 4:)

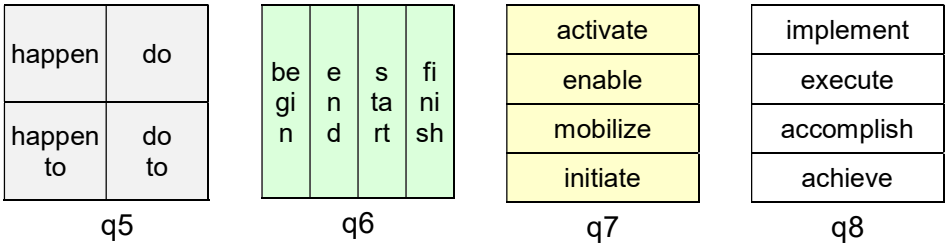


i have labelled the quadrants of every quadrisection {a, b, c, d}. note that the location of every grammatical set in its grid, may be pinpointed by which quadrant it belongs to at every quadrisection. the key verb at location aaaa, e.g., is ‘commence’ in *UM* and ‘recite’ in UM, and at dddd ‘win’ and ‘select’ respectively.

every grammatical set is thus expressible as the combination of four semantic values, one from each quadrisection, with every possible combination resulting in a different, distinctive keyword.

in perfecting um, the job was to finalize the 512 grammatical sets with an eye to the demands of a qθ, re-arrange UM and *UM* both into some comparable semantic order, and to derive therefrom the best expression of the semantic values that distinguished clearly the separate parts played by the four quadrisections.

in the end, the string of semantic foursomes that seemed to work best, for both *UM* and UM, at setting the four quadrisections apart were the following foursomes of english keywords: (fig. 5)



q5. here is the {do, become, give, get} of the big bang of the grid 1992, essentially unchanged. q5b is where it all starts, where are gathered all the ‘descriptive’ roots in *UM*, the most easily recognized *UM* roots semantically for their usefulness also as adjectives—often but not always with the help of an adjectival ma- prefix: t*um*amís (turn-sweet) into *ma*tamís (sweet), b*um*ilís (go-faster) into *ma*bilís (fast), or p*um*angit (turn-ugly) into simply pangit (ugly). with the descriptives in q5b as a pivot, the other quadrants divide up the rest of the roots into ‘actives’ in q5a, ‘interactives’ in q5c, and ‘decisives’ in q5d.

q6. the business of this quadrisection is the semantic contrasts in our verbs between positive and negative, plus and minus, forward and back, for and against, in and out, on and off, yes and no, etc. the keywords {begin, end, start, finish}i are deeply accurate but rather subtle on the surface so that q6 of all the quadrisections was the last to submit to

a clear arrangement of its columns. it was the perfection of this quadrisection in fact that signalled the perfection of um itself (with the aid finally of fig. 12).

q7. this quadrisection appears to distinguish four modes-of-doing or doer-actions, with varying shades of involvement and attention, according as it is a kind of {activation, enactment, agency, or instigation} of something. it all seems to do with four different ways that we perceive an action progressing in our consciousness.

q8. this final quadrisection of the same 256 grammatical sets distinguishes in turn four different modes-of-doing-to or object-actions, which are the actions left behind by q7's doings. it seem to do with four different ways that we perceive an action coming to a resolutiion in our consciousness.

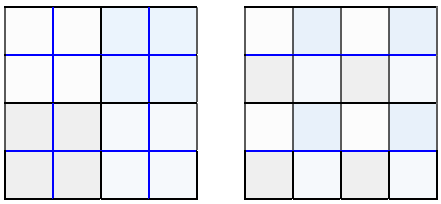
the perfecting of um went quadrant by quadrant, affix set by affix set, first *UM* then UM then back and forth between the two to reconcile them maximally, always with an eye to evidencing the rule and role of a qθ. compared to how they presented in amazing, both um grids are much revamped. although much also has kept constant, there are many realignments, many difficult and uncertain assignments in the past that have now found their true places in the two grids.

once in a while i still return to these tables and change a keyword or two, or flip their positions. very rarely an odd um verb or usage shows up in conversation that i cannot locate properly in the grids and i must rethink my reading of some grammatical sets, and sometimes have needed to combine two to make way for something new.

the database is ever fixing the grid in this way. so that it is easy to imagine that there is, theoretically, a perfect um grid to be reached when the entire universe of um verbs is captured and 100% represented in the two grids, every conceivable um verb unerringly at home in its proper and correct grammatical set. we are very close to it now i think.

what fuzzy edges remain have mostly to do with either too small a grammatical set of only one or two verbs, too short to really tell its real scope, or with the ones too large as to arouse suspicion of unlawful mergers. what these await are results from the other affix sets to help pin things down better. often in the work on UM and *UM*, a difficulty in one would later be solved by results in the other.

perhaps the most significant change wrought by qθ since amazing is a reversal in the order of q1 and q2, i.e., what was q2 in amazing is now q1 and vice-versa—it is focus first before tense, we are told. the flip was practically dictated by the need to keep the two grids' columns-and-rows intact when the old q1q2 sequence was threatening to throw things into a checkerboard effect during the work on q5 and q6. (fig. 6)



there has been a major shift also in q3 and q4 with the ma affix sets of both moving from quadrant d to b. the switches again obviated any realignments in tables 1 and 2, affecting only the lay of some keywords in fig. 7 below, in conceivably another case of the grid self-correcting.

q1-q8

here is how the eight quadrisection q1-q8 of the tagalog grid presently add up: (fig. 7)

q1	q2	q3	q4	q5	q6	q7	q8
FOCUS	TENSE	DOER	OBJECT				
nv-d	present	um	i	happen	begin	activate	implement
nv-o	past	ma	ma	happen to	end	enable	execute
v-d	future	mag	an	do	start	mobilize	accomplish
v-o	possible	mang	in	do to	finish	initiate	achieve

in q1: n=non-, v=volitional, d=doer, o=object

the first four q1-q4 are clearly marked in the language, deriving directly from the variety and habits of affixes in the verbs of our sentences, and appearing to evidence an elementary mathematical order underlying the surface structure of the language. it is as it were the syntax part of the grid—each quadrisection giving rise to a separate feature of the basic tagalog sentence

the second four q5-q8 have no surface markers in the language (except perhaps for q5b above), and entirely the result of a long and determined search for the four semantic quadrisections of an affix set that might logically mirror the syntactic quadrisections of. q1-q4. it is the semantic part of the grid—each quadrisection giving rise to a separate component of the verb's meaning—revealing the same mathematical order underlying the deep semantic structure of the language.

thus, we are told by the grid, that every sentence that we comprehend or produce may be seen to be the intersection of four elementary syntactic elements {q1-q4} and four elementary semantic elements (q5-q8) in a single unit of meaningful information. one may declare, trivially perhaps, that eight separate things in consciousness turn into a unit of information by turning into a sentence.

in the um grids, we are looking at two examples of the 256 different ways per affix that q5-q8 can combine (permute) to bring us the distinctive verbal actions that turn into a grid's grammatical sets. whatever affix set it is, the same q5-q8 applies, and in each case a different set of 256 distinct grammatical sets is generated. it can happen in sixteen different affixes (see fig. 1) so that all together 4,096 grammatical sets make up the language.

it is in q3 that the difference between um and mag arises. where as i put it um verbs 'activate' while mag verbs 'mobilize'. and to the different pairings of doer and object that q3q4 generate we can trace the semantic difference between such as "t*um*ayô sa tayu*án*' (stand in place) and '*mag*tayô sa tayu*án*' (erect in place), 't*um*urò ng *i*turò' (point

toward it) and '*mag*turò ng *i*turò' (teach it to), or 'bumuhay ng buhayin' (bring it to life) and 'magbuhay ng binuhay' (turn it on).

so what is the difference between um and mag? to decide it once and for all, we will need to grid mag down to its own 512 grammatical sets and compare them thoroughly with um's; we are only halfway there with the um results. there is some new light thrown, however, on what all these affixes may be up to, as we home in on the 2x2 permutation behind qθ which i recount next.

3 THE NATURE OF LANGUAGE

one might ask. where is qθ in it all? and the answer it seems is, all over the place. it is as if all of qθ is in congress with each of qθ.

turning q1-q4's foursomes above (fig. 7) into nounal keywords, qθ looks a perfect fit, first, for q2 itself. and then again right across the four quadrisections. (fig. 8)

	q1	q2	q3	q4
	senses	memory	will	thought
	FOCUS	TENSE	DOER	OBJECT
a	event	senses	engine	input
b	outcome	memory	mechanism	output
c	intention	will	driver	effect
d	objective	thought	processor	result

each of q1-q4 appears to reflect in its own fashion some different aspect of qθ:

> in its sensitivities, qθ is q1, each of the four {senses, memory, will, thought} only perceiving and transmitting its own kind of information.
>
> in its physical functions qθ is q2, each responding to the information and triggering its own memories of similar events and the reactions indicated,
>
> in its machinery qθ is q3, each having its own powers of movement and direction for the advancement of desirable intentions.
>
> in its capabilities qθ is q4, each exercising its own manner of intervention towards the attainment of objectives (fig. 8:)

the identification of the tenses with qθ was already raised in amazing (when 'will' and 'thought' were still 'mind' and 'brain'):

> it would now appear that what we think of as separate locations in time are merely four separate activities of our organism communicating together in a single language, creating by their different and separate informations the illusion of time. . . .the past are the files in memory. the present is the information of the senses. the future are the actions of the mind. and the possible are the calculations of the brain. four different givens, one reality. (47-48)

in q3, i intentionally defer to computer-friendly keywords to reflect the connects that i am seeing with the technology, which will prove useful later below. um and mag doers are at q3a and q3c.

the serious gridder is encouraged to study fig.8 above very closely before moving on. one must grasp how these nouns are logically derivable from the sixteen syntactic markers of q1-q4 in fig.7. only when you are satisfied that you have got it, only then turn your attention to q5-q8 below.

in q5-q8, the keywords are already all elementary *verbs* instead. consider now how each of these verbs may be seen to apply semantically to its corresponding noun in q1-q4 above: (fig. 9)

	q5	q6	q7	q8
	senses	memory	will	thought
	MONITOR	TRIGGER	RUN	APPLY
a	happen	begin	activate	implement
b	happen-to	end	enable	execute
c	do	start	mobilize	accomplish
d	do-to	finish	initiate	achieve

the suggestion is that each of these key verbs is defining the sort of verbal actions that each of qθ, across the table, is {sensitive to, prompted by, equipped for, and capable of}. and that it is the coincident interaction of the four in every unit of information that generates the singular mental image that turns into each sentence that we speak.

by these key nouns and verbs of fig. 8 and 9, we are told, all the basic elements and possibilities of a sentence are represented. thus, one might read any eight-string code of abcd's (or digital bytes) as a distinctive generic sentence. what 'brands' the sentence, what makes every sentence different, are the particular nouns and verbs that are identified to singularize the information.

take the random string aabddcab, e.g. aabd (q1-q4) tells us that this is an ongoing nonvolitional *UM*x*IN* event. looking then in the *UM* grid, we see that dcab (q5-q8) is the key verb 'fulfill'. the generic sentence is therefore is "it fulfills (or is-fulfilling) it". a particular usage might be "the apology fulfills his promise".

be mindful that while all the sixteen elementary verbs of fig. 9 are meant to apply to all the affix sets, the keywords appearing in the *UM* and UM grids are specific to um verbs and their grammatical sets. indeed, the same english keys may serve also in other affix sets but it would always be in some different semantic sense. as a rule, i avoid repeating keywords whenever possible, in hope of maximally contrasting the differences in the grammatical sets within and between affix sets.

also keep well in mind that all these key nouns and verbs for q1-q8 are meant to have both volitional and non-volitional semantic values as per q1. although we may normally think of 'will' and 'thought' as exclusively volitional affairs or 'happen' and 'happen-to' as

non-volitional, this is principally a difficulty in finding better keywords that will work across the volitional divide.

what does it mean to ‘will’ and ‘think’ nonvolitionally or to ‘happen’ and ‘happen-to’ volitionally? this is important, and one may need to pore over tables 1 and 2 and take one’s own measure of what grammatical sets and verbs are meant to be encompassed by each keyword. be guided by fig. 4 in tracking the correct quadrant(s) and grammatical sets indicated by a keyword in fig. 9.

pay special attention in *UM* to what is being told of the non-volitional face of qθ. the important takeaway is that although we naturally associate the elements of qθ with our own mental functions, yet the grid is telling us that phenomenal nature also has its own brand of qθ{senses, memory, will, and thought} and that the 256 grammatical sets of *UM* are their combined work, at the most elementary.

as one grows more familiar with the semantic layout of the two grids one is surprised at the semantic contrasts displayed by corresponding locations in *UM* and UM. in about half of the grammatical sets there are almost perfect matches as it were, volitional and non-volitional keys often similar enough to be synonyms in english.

everyhwere else however are many striking semantic leaps that take some deep thinking and imagination to recognize as the result of the same affix on the same intersection of four elementary verbs. what did ‘it commence’ at aaaa in *UM* have in common with ‘i recite’ in UM, *e.g.*, or ‘it expires’ with ‘i bawl’ at abaa?

this was a remaining perplexity and i was determined, if indeed i had everything right with the um grids, that there must be extractable from the gridded data some more elemental notions and keywords that might explain the empirical congruence of such as ‘commence’ and ‘recite’ in the natural scheme of things.

the ultimate hope, of course, was to discover with these elemental notions and keywords just what 2x2 permutation was actually responsible for qθ in the real, scientific terms that i felt the work demanded, for it was only this that would finally lock the grid and everything with it into place.

so it went: a still closer look at the two um grids, back and forth, in a hunt for the better keywords, always in the foursomes of a possible 2x2 permutation. slowly but dependably over time a useful line of thinking took form, following which on a forward course, eureka after eureka, a logical trail would finally clear that would take us all the way to the deepest sources of the grid and our human language. below is the quickest way there that i have found.

behind qθ

if we linkup the nouns of q1-q4 with the verbs of q5-q8 above into minimal sentences, we arrive at the sixteen logical statements in the white boxes below: (fig. 10)

q1q5	q2q6	q3q7	q4q8
senses	memory	will	thought
MONITOR	TRIGGER	RUN	APPLY
event happens	senses begin	engine activates	input implements
outcome happens-to	memory ends	mechanism enables	output executes
intention does	will starts	driver mobilizes	effect accomplishs
objective does-to	thought finishes	processor initiates	result achieves

like we did in amazing to arrive at qθ, we might also turn the above table, first by columns, into these four logical sentences:

> the senses monitor {events that happen, outcomes that happen-to, intentions that do, and objectives that do-to}
>
> memory triggers {senses that begin, memories that end, wills that start, and thoughts that finish}.
>
> will runs {engines that activate, mechanisms that enable, drivers that mobilize, and processors that initiate}.
>
> thought applies {inputs that implement, outputs that execute, effects that accomplish, results that achieve}.

put this way, the four sentences appear to be actually defining the functions of each of qθ in the very life system of an organism. taken in order, they may be seen to follow the actual progress of a moment of organic activity—the senses monitor a change, memory triggers a response, will puts it into motion, and thought brings it to a conclusion.

read the same table by rows instead, and we come up instead with the four statements below, this time appearing to describe the actual elementary operation of each of qθ when acting on its own:

> when an event happens a sense begins and an engine activates to implement an input.
>
> when an outcome happens-to a memory ends and a mechanism enables to execute an output.
>
> when an intention does a will starts and a driver mobilizes to accomplish an effect.
>
> when an objective does-to a thought finishes and a processor initiates to achieve a result.

but life is not all that simple. everything is not neatly in a row (aaaa, bbbb, etc): the four operations are not independent of each other. as we saw with aabddcab="it fulfills it" above (p. 13) the four can mix it up in every way through the eight quadrisections. the combinatorial result are these grids of verbal possibilities that we are discovering, every grid a simple 'action trees' tracking units of mental information as they turn into the verbs in our heads and the sentences in our voices.

what was most curious about this trains of thought, coming fom a study of language, was that it was beginning to sound a lot like science. i finally reach for the old biology textbook, where i soon find, in the unit on 'biology of man, chapter on 'body controls', this startling opening statement about our nervous system:

> Your nervous system receives impressions from your surroundings, stores them in the brain, originates activity, and carries impulses to all parts of the body. It coordinates the activities of several millions of cells in a single functioning unit—the control center for body activities. (625)

for here was qθ, lo and behold, in the simple prose of science. the matchups were unmistakable. one could actually stick qθ into that passage without missing a beat—

> [in] your nervous system, [the senses] receive impressions. . .[memory] stores them, [will] originates activity and carries impulses. . .[thought] coordinates—the control center

reading on, one could sense ever stronger the intersections with qθ and the widespread references to particular grammatical sets and groupings in the two um grids. in the extracts below, all is about doers and objects and the verbs they carry out, much of it non-volitional and traceable to *UM* doings: [brackets and abridges mine]

> [senses, will]
> Impulses are carried along nerves in a two way communication system travelling along nerve fibers in one direction only. Fibers of sensory neurons carry impulses to the brain, of motor neurons from the brain, to the tissues and organs.
>
> [will, volition]
> Some areas of the cerebral cortex are *motor areas*. They are centers that control voluntary movement of the muscles.
>
> [senses]
> Some areas of the cerebral cortex are *sensory areas*. Senses such as seeing, hearing, touching, tasting and smelling are interpreted here. The vision center is in the occipital lobes.
>
> [q1-q4]
> The things we see, hear, and feel are registered as impressions in the sensory areas of the cerebral cortex. The things we do are controlled by the motor areas. The two areas are connected by a vast number of association areas.
>
> [thought, will]
> The frontal lobes are centers of emotion, judgment, will power, and self control.
>
> [non-volition, thought]
> The medulla oblongata controls the activity of the internal organs. Respiration. heart action, muscular action of walls of the digestive organs, secretion in the glands, and other automatic activities are controlled here.

[non-volition, will]

> The cerebellum coordinates the muscular activities of the body, without its help impulses from the cerebrum would produce uncoordinated motions. Nervous impulses do not originate from it nor can one control its activities

[non-volition, will]

> The autonomic nervous system is entirely involuntary and automatic. It is composed of two parts: the sympathetic system regulates activity of internal organs—heart action, secretion of glands, blood supply to arteries, action of smooth muscles of digestion. . .

[nonvolition, thought]

> The parasympathetic system opposes the sympathetic and maintains a system of checks and balances; e.g., if the sympathetic system acts to speed up heart action, the parasympathetic vagus nerve slows it down. [625-629]

the book is silent on memory, the hippocampus, hypothalamus etc., but it was enough there i thought to strongly recommend to one's logic and learning that qθ and the grid of verbs that it generates in tagalog are all intimately related to our nervous system's organic processes.

for memory, i turn to j.z.young who has much to say about it in programs of the brain (1978). in the chapter on 'controlling, coding and communicating', section on 'encoding in the nervous system', he writes this:

> Just as each nerve fibre carries only one sort of signal so, with some simplification, we can say that each cell of the brain usually represents one word of information indicating the presence of certain limited features, say a blue rectangle with a given slope. Similarly a motor nerve may provide the command for one small action of a muscle. (50)

it reminds us not to limit our thinking of the work of qθ to the physical phenomena that we are consciously aware of. thought itself, we are being told, is going on not only in our heads but in every living cell of an organism, each cell in its own fashion possessed of {monitors, storage, drivers, and processors} for its own purposes and survival. our own autonomic nervous system is all about bioprocesses that do not need to go to the central brain for instructions.

piecing it all together into a most probable 2x2 permutation, here is how it all appears to fall into place: (fig. 11)

	sensory system	motor system
activity	SENSES	WILL
action	MEMORY	THOUGHT

i propose that the ‘senses’ and ‘memory’ are the two ends of the sensory system, where informations begin and end so to speak. while ‘will’ and ‘thought’ are two parts of the motor system, where performances ‘start’ and ‘finish’ as it were. the senses and will both are ‘activities’ in motion, in the foreground, while ‘memory’ and ‘thought’ are actions in place, in the background as it were.

to turn it into verbs, i look especially for familiar logical verb pairs, and finally decide on the 2x2 permutation below as the core qθ of the tagalog verb grid: (fig. 12)

	inform	perform
empower	stimulate	command
enforce	respond	control

imagine now qθ {senses, memory, will, thought} as four interactive organic circuitries each wired to {stimulate, respond-to, command, or control} each other as needed, and we see where the 16 english keywords for q5-q8 (in fig. 9) have sprung from: (fig. 13)

	q5	q6	q7	q8
	senses	memory	will	thought
stimulate	happen	begin	activate	implement
respond	happen-to	end	enable	execute
command	do	start	mobilize	accomplish
control	do-to	finish	initiate	achieve

we are at the end of our trail. in fig 12 we have what all the evidence of the tagalog grid will have us believe is the wellspring from which all things in language are come to us. one can see the effects of the permutation at work from q1-q8, as the circuits string up the eight elements of language into the verbs and sentences that we understand.

it is a q.e.d. for me, the end of a long lone journey into the meaning of this grid of verbs stumbled into that long ago.

i suspected that the end of the grid would prove to be something also mathematically elegant and axiomatic as the 2x2 permutation of its beginnings and the $^{4}2$ tetration that set its limits in amazing. and indeed it is the same, but deeper, 2x2 permutation that presents itself at the heart of the whole affair, with its potential complexity of organic expressions suggestive of the same rule of progressive tetration of 0s and 1s..

we have reached, without a doubt, the firm ground of the grid upon which we can begin to build a new edifice of knowledge more in keeping with the true and mathematical nature of things, now perhaps made a little less mysterious in its wonders with a grid we now possess.

POSTSCIPT

three things before i go: an answer to a perplexity, a conjecture about language, and a proposal for science.

1

the perplexity is from p. 14 and it asks: what does ‘it commence’ at aaaa in *UM* have in common with ‘i recite’ at the same location in UM, or ‘it expires’ with ‘i bawl’ at abaa? let me show you all of it—here are the upper left corners of both grids, where the most elementary of the um verbs, non-volitional and volitional, are found: (fig. 14a, 14b)

UM{aa--, ab--}	
IT INFORMS	
arise	**pass**
OCCUR	ELAPSE
commence	expire
originate	fleet
advent	transpire
resume	lapse
APPEAR	DISAPPEAR
shine	vanish
flash	evanesce
dawn	set
glimmer	perish
SOUND	REPERCUSS
resound	rasp
report	squeal
reverberate	belch
resonate	gasp
ENERGIZE	RUPTURE
glow	crumble
blaze	split
smoke	pop
boil	curdle

UM{aa--, ab--}	
I INFORM	
express	**oppose**
VOICE	CRY
recite	bawl
utter	yowl
sing	weep
talk	whine
DECLARE	REFUSE
confess	deny
consent	decline
answer	object
decide	complain
CONVEY	CRITICIZE
relay	fault
mention	unmask
cheer	discredit
praise	reproach
SIGNAL	WARN
address	growl
greet	rebuke
call	admonish
notify	caution

in answer, what all these key verbs have in common that distinguish them from the rest of their grids is that they are all ‘informative’ actions. in the nonvolitional *UM* the semantic is ‘it informs (of itself)’. in the volitional UM it is ‘i inform (of myself)’. in either case, column ‘a’ is of ‘beginning’ activities that inform and column ‘b’ of ‘ending’ actions that inform.

there are seven times more of these ‘informative’ kinds of verbs in the language, but in the other affix sets, with every different affix producing a different variant or complication thereof. only when all the affix sets are fully gridded, only then will we see the true semantic range and variety of these informative verbs in a language.

2

by rows, the yellow keywords tell us something else besides. um verbs, remember, tell

the ‘simplest’ actions in tagalog. and running down the columns, we see how q3 (the yellow bars) divides the most elementary of *UM* actions into verbs of {motion, light, sound, and energy} and the corresponding UM actions into verbs of language, that {express, reveal, transmit, and communicate}.

indeed it may be said that {motion expresses, light reveals, sound transmits, and energy communicates}, but perhaps not as metaphorically as the semantic distances may suggest.

a very deep implication is that spoken language must be an evolution of the same information structure and data exchange that is behind organic life. all language, it might be said, is nature embarked on the larger project of a greater unity of communicating organisms (as in a hive or a clan for example).

in which case what all these verbs in a grid amount to is not only a vocabulary of human language but, in its non-volitional aspect, a vocabulary of nature itself, for they are parts of the same story. from the words that our cells speak to the words out of our mouths it is the same qθ in concert, in the ever increasing complexities of nature’s triumphs.

as i opined once in to babel and beyond, in a cut of occam’s razor:

> Why indeed should communication between organic cells operate differently from that between sentient organisms? Reasonably, they must both originate from the same organic principles and operate by the same algorithms.

but deeper still might we go and logically surmise, that the words that our cells speak must be rooted in their turn on the same language that communicates the atoms and molecules of our cells, and especially in its greatest successful complexity, the coding system of the dna and rna molecules that make all life possible.

3

an article in the financial times in june 2019 tells about evolution 2.0, an enormous prize being offered for cracking the mystery of dna, challenging scientists to chemically recreate the molecule. oxford biologist dennis noble, one of the judges, is quoted:

> The biggest problems in science today are: how life got going in the first place and what is the origin of the genetic code. We want to know whether the way information is encoded in DNA is the result of chance or whether there are good chemical reasons why the code should be the way it is. We don’t even know whether it can be won at all—whether anyone can come up with a self-creating system for transmitting information.

i propose that artificial dna can come later. better first, to crack the mystery of the original, is to take the perfection of um and go for all the 4,096 grammatical sets and key verbs of the tagalog-english grid. the result will amount to a language genome and it is my suspicion that it will lead us to understand exactly what all those {a, c, t, g}s of dna and {a, c, u, g}s of rna are saying to each other. and then only for science to attempt to recreate each word and sentence chemically. ■

A famous dictum of Galileo's, which has guided the sciences since their modern origins {was]: nature is simple, and it is the task of the scientist to demonstrate this, from the motion of the planets, to an eagle's flight, to the inner workings of a cell, to the growth of language in the mind of a child. . .

Linguistics has an additional motive of its own for seeking the simplest theory: It must face the problem of evolvability. Not a great deal is known about evolution of modern humans, but the few facts that are well established, and others that have recently been coming to light, are rather suggestive and conform well to the conclusion that the language faculty is near optimal for a computational system, the goal we should seek on purely methodological grounds. . .

The Galilean challenge has to be reformulated to distinguish language from speech, and to distinguish production from internal knowledge—the latter an internal computational system that yields a language of thought, a system that might be remarkably simple, conforming to what the evolutionary record suggests. Secondary processes map the structures of language to one or another sensory-motor system for externalization. These processes appear to be the locus of the complexity and variety of linguistic behavior, and its mutability over time. . .

There are suggestive recent ideas about the neural basis for the operations of the computational system, and about its possible evolutionary origins. The origin of the atoms of computation, however, remains a complete mystery.

noam chomsky, 2016
on-the-evolution-of-language—a-biolinguistic-perspective

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