THE PERFECTION OF UM

towards a biology of language and numbers

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PRELUDE

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

this report continues from two previous in lingbuzz: the grid of language (000996) in 2010 and the amazing rule of four (002823) in 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 is '{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 in amazing, to possibly perfect both grids according to the lines suggested by the surfaced ruling quadrisection (qθ) 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.

a keen appreciation of the range of verbal actions embraced by um’s english keywords (pp. 7-8 below) might give one some inkling of what actually sets um verbs apart from the other affix sets. but it would not be enough, a contrasting reading of at least the mag verbs is essential. later below with the perfected um grids in hand i try anew, with a fresh batch of keywords, to pin down 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)

	q2q3q4			
	involuntary		voluntary	
doer focus	*UM*	*MAG*	UM	MAG
	MA	*MANG*	MA	MANG
object focus	*I*	*IN*	I	IN
	MÅ	*AN*	MÅ	AN

according to q2q3q4, 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, while object-focus(ed) points to an ‘object-acted-upon’. meanwhile, verbal actions are ‘non-volitional’ that are autonomic or involuntary, what are listed in *UM* (in itals), while ‘volitional’ are deliberate or voluntary actions, what are listed in UM. it is this volitional divide that separates the two um grids on pp 7-8, both in the sense that the english keywords are used and that the tagalog verbs behind them are listed.

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] in simpler verbs *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 {do, become, go. get} in the key verbs {move, change, direct, work} below. the um database is vastly larger now and each of the four kinds of verbs now further broken down into 64 semantic sets by virtue of three further successive quadrisections q6q7q8 of the database.

q2 was the second foursome to emerge. and with it the first evidence of a 2x2 permutation at work in the language, clearly pointing to an underlying mathematic behind all the curious foursomes suddenly presenting in the language. in fact, the permutation offered up two more strong candidates for semantic foursomes: in the four doer focus affixes {um, mag, mang, ma} and four object-focus affixes {i, in, an, må} of our verbs—what later would take shape as q3 and q4.

q1 was the last of q1-q4 to make an appearance. and what a dramatic finish. for here would unravel another undeniable 2x2 permutation at the heart of the language, just as powerful as q1, this time in the morphology of the tenses of tagalog's verbs: (figs. 2a-b)

	q1	
repeat syllable	present	future
basic root	past	possible
	inflected affix	basic affix

	q2	
doer-focus	it happens	i do
object-focus	happen to it	do to it
	non-volitional	volitional

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 subsets 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 each affix set, in all their semantic variety, were subject also to four quadrisections, and equally reducible to exactly 256 (=4x4x4x4) semantic subsets.

that 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 *sprachgefühl* 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. first is 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. and second is to find a logical arrangement of those 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 in the language? 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, an, må—would yield any convincing lines of subdivision. though semantic foursomes were cropping up everywhere, always there was some fuzziness preventing a q5q6q7q8 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 [10-ical] 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 entice other prospectors in the field into gridding the language entire with me, a job too big for one. but it was not to be. i took it that the work was too new and eccentric, and really meant for solitary work, to take as far as i can on my own. indeed, keeping the study to my own single deep structure was guarantee that my results, however limited, all added up to an intrinsic whole, a must for a working model. 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 something quite original in the end.

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 reducible to an interplay of four blocks of data relating to organic processes centering in the human brain. (fig. 3)

qθ	
senses	motors
memory	brain

note that fig. 3 revises fig. 0: the keyword ‘mind’ is now replaced by ‘motors’. the change is dictated by a growing understanding of the range of verbs encompassed by this quadrant; these keywords, anyhow, are very unstable. the setup itself of the foursome is directed by the lay of the tenses in q1, memory naturally pointing to the past (see fig. 2). what 2x2 permutation is behind the foursome is of course the big question after the likes of q1 and q2. i finally arrive at a solution to it at the end of this report.

until this qθ result above, 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 quadrisections 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 affix sets any easier and surer?

hoping to add quickly to the four affix sets already gridded in amazing (*UM*, UM, *IN*, IN), i worked on the mag verbs for a year or so, but finally left it. mag is a very busy affix in tagalog in both volitions. it has many complex forms with secondary affixes like magpá-, magká-, mag--án-, etc., plus a peculiar bilateral sense (two-do-together), plus its ever-readiness to turn useful foreign words into tagalog verbs (mag-surf, -apply, -evaporate, -concentrate). i had been there before. despite qθ, the semantic range still proved too vast and layered to submit easily to a complete and reliable gridding.

what was needed to guide the work was a hard and fast result from a smaller, simpler sample that was extensive enough nevertheless to be an exemplar for all the 256 slots of an affix's grid of grammatical possibilities. i decided 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 the most elementary picture of the natural order and logic of the grid, the role of qθ, and the mathematical roots of our information-building. in a perfection of um by way of qθ, i was confident, some very basic things in language and communication would come to light.

fast forward to three years hence and see how it has turned out with the two um grids in the next two 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 small tagalog dictionary's 8,700 entries (talatinigan, del valle & del valle, 1969) all the rootwords that i felt made good um verbs. i have added to them along the way, subtracted a few. they represent pretty thoroughly 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 q2 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 non-volitional values going into both affix sets.

the two grids presented are a picture of the two verb samples each gridded down by four quadrisections (q5-q8) into 256 grammatical sets, logically arrayed in a 4x4x4x4 matrix. english keywords are used to unravel the results at every stage.

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

q5q6q7q8 of *UM*							
IT MOVES				*IT DIRECTS*			
arise	**pass**	**move**	**quit**	**join**	**part**	**travel**	**locate**
OCCUR	ELAPSE	QUICKEN	SUCCUMB	AGREE	VARY	PROPEL	STAY
proceed	transpire	sway	crash	resemble	adjust	flow	remain
recur	fleet	rock	tumble	conform	differ	advance	halt
advent	expire	liven	conk	mix	diverge	fly	rest
originate	lapse	trigger	flop	synchronize	avoid	fall	suspend
APPEAR	DISAPPEAR	OBVERT	REVERT	ATTACH	DETACH	RELEASE	HOLD
shine	vanish	stand	tilt	align	isolate	scatter	cling
flash	evanesce	open	close	adjoin	withdraw	dangle	catch
dawn	set	stretch	sag	connect	disconnect	overflow	bottom
sparkle	perish	orient	upend	stick	unstick	drain	clog
SOUND	REPERCUSS	UNLEASH	CEASE	CONFER	DISPLACE	TRACK	LAND
resound	rasp	rain	discontinue	protect	lift	trail	dock
report	squeal	pelt	stop	support	shift	meander	impact
reverberate	belch	blow	expend	prop	budge	pass	destine
resonate	gasp	fume	exhaust	boost	slip	bypass	arrive
ENERGIZE	RUPTURE	SURGE	SUBSIDE	INDUCE	REPEL	EJECT	PENETRATE
smolder	crumble	swell	recede	suck	retract	spring	infiltrate
blaze	split	erupt	stanch	tug	recoil	spill	pierce
smoke	curdle	secrete	abate	incite	resist	surface	embed
boil	pop	flare	heal	attract	bounce	protrude	sink
IT CHANGES				*IT WORKS*			
become	**alter**	**gain**	**lose**	**absorb**	**reject**	**deliver**	**obtain**
DEFINE	DIM	THRIVE	DECLINE	RECEIVE	BLOCK	PROVIDE	CONSUME
brighten	darken	endure	wither	experience	shield	furnish	devour
color	pale	strengthen	weaken	breathe	bar	supply	deplete
cleanse	dirty	prosper	wane	witness	hinder	fulfill	weardown
clarify	blur	peak	slack	hear	arrest	cause	waste
FORM	DEFORM	INCREASE	DECREASE	ACCEPT	REJECT	REPRESENT	MEASURE
straighten	contort	multiply	diminish	abide	violate	reflect	extend
shape	distort	enlarge	reduce	regard	defy	refer	count
refine	roughen	grow	shrink	like	dislike	denote	contain
upgrade	downgrade	rise	drop	trust	doubt	signify	bear
MATURE	DEGRADE	SUCCEED	FAIL	DESIRE	WHELM	IMPART	ATTAIN
toughen	soften	exceed	lack	crave	ravage	cast	fetchup
thicken	dilute	suffice	need	require	raze	taint	evenup
ripen	spoil	match	miss	lust	disable	imprint	catchup
scent-en	stink	qualify	flunk	dream	exterminate	influence	overtake
DEVELOP	REGRESS	INTENSIFY	EASE	THINK	FORGET	GENERATE	BENEFIT
enliven	deject	discomfit	comfort	remember	delete	reproduce	reap
behave	debase	unsettle	becalm	recognize	scrap	breed	earn
animate	retreat	complicate	relieve	understand	skip	sprout	profit
learn	retard	ache	resolve	imagine	lose	payout	win

Table 2. The *UM* grid

q5q6q7Q8 of UM							
I MOVE				I DIRECT			
express	**oppose**	**exert**	**relieve**	**interact**	**counteract**	**dispatch**	**situate**
VOICE	CRY	MOVE	REST	ASSOCIATE	DISSOCIATE	LAUNCH	SETTLE
recite	bawl	frisk	rest	attune	desert	wander	stay
utter	yowl	rouse	bestill	ally	defect	startout	halt
sing	weep	act	sleep	participate	withdraw	leap	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	lift	kneel	join	backoff	unhand	hold
answer	object	stand	sit	mate	escape	descend	mount
decide	complain	arise	recline	meet	evade	alight	ride
CONVEY	CRITICIZE	PROJECT	VOID	ASSIST	SUBJUGATE	TRANSIT	LOCATE
relay	fault	thrust	discharge	care	abuse	traverse	climb
mention	unmask	slam	exhale	contribute	deceive	transfer	enter
cheer	discredit	throw	excrete	help	obstruct	pass	approach
praise	reproach	impel	expel	rescue	prevent	detour	head
SIGNAL	WARN	APPLY	DISPEL	ENJOIN	AGGRESS	DEPART	ARRIVE
address	growl	play	scratch	invite	fight	evacuate	gather
greet	rebuke	wield	swipe	prompt	hurt	exit	appear
notify	admonish	press	soothe	request	attack	disperse	visit
call	caution	pull	remedy	woo	shoot	embark	return
I CHANGE				I WORK			
confront	**retreat**	**reinforce**	**regulate**	**undertake**	**eliminate**	**commit**	**source**
EXPOSE	HIDE	ENHANCE	LIMIT	IMBIBE	DISMISS	ENGAGE	PARTAKE
peep	screen	prolong	shorten	view	rebuff	serve	feed
uncover	cover	harden	lighten	observe	shutoff	attend	inhale
emerge	conceal	maximize	minimize	study	disregard	tend	taste
surface	submerge	intensify	underplay	learn	discount	mind	chew
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	ATTEMPT	FETCH
look	turnabout	leadoff	fallback	search	ruin	gamble	get
turnup	facedown	position	interpose	aim	wreck	stake	deduct
face	aboutface	cue-up	sidestep	chase	eradicate	venture	draw
point	overturn	adapt	deviate	desire	kill	sneak	catch
PREPARE	BEWARE	ASSIGN	RESIGN	PONDER	NULLIFY	WORK	ACQUIRE
ready	cower	head	relinquish	recall	discard	farm	harvest
brace	prostrate	sit	abscond	identify	omit	plant	procure
await	ward	oversee	quit	discover	erase	make	collect
lookout	fend	substitute	surrender	solve	suppress	invent	select

Table 2. The UM grid

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

q5a	q5d
q5b	q5c

q6a	q6b	q6c	q6d

q7a
q7b
q7c
q7d

q8a
q8b
q8c
q8d

i have labelled the quadrants of every quadrisection {a, b, c, d}. note, thus, how the location of every grammatical set in its grid, may be pinpointed by identifying 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 therefore expressible as the combination of four elementary semantic values, one from each quadrisection, with every possible combination resulting in a different, distinctive keyword.

in perfecting um, my job description was to 1) revisit and finalize its 512 grammatical sets with an eye to the dictates of a qθ; 2) re-arrange UM and *UM* both into some comparable semantic order; and 3) extract from the result the best expression of the four elementary semantic quadrisections underlying q5-q8, in terms hopefully as clear as the lines drawn by the play of affixes in q1-q4.

in the end, the string of semantic foursomes that seemed to work best, for both *UM* and UM, at defining the elemental contribution of each quadrisection to the semantic value of a verb, were the following foursomes of english keywords: (fig. 5)

move	direct
change	work

q5

begin	end	start	finish

q6

perform
execute
deliver
apply

q7

activate
enact
accomplish
achieve

q8

q5. here is the {do, become, give, get} of the big bang of the grid in 1992. it starts with q5b, where i gather all the ‘descriptive’ roots in *UM*, the easiest to sort out for having to do also with our adjectives—whether in conjunction with an adjectival ma- prefix or an article *ang*, or stand alone: t*um*amís (turn-sweet) becoming *ma*tamís (sweet) or *ang* tamis (how sweet); or p*um*angit (turn-ugly) to just *pangit* (ugly). with the descriptives in q5b as a pivot, the other quadrants divide up the rest of the roots approximately into ‘actives’ in q5a, ‘directives’ in q5c, and ‘interactives’ 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, etc. the adjectival keywords {ongoing, completed, consequent, and eventual} also work well here. q6 is very subtle on the surface. of all the quadrisections it was the

last to submit to a perfect arrangement of its columns; it was the perfection of q6 in fact that signalled the perfection of um itself—with the aid finally of figs. 11-12 below.

q7. this quadrisection appears to distinguish four kinds of doer-actions, with varying shades of involvement and attention, according as it is a kind of {performance, execution, delivery, or application} of something. it all seems to do with four different ways that we perceive an action originating and progressing in our consciousness.

q8. in this final quadrisection the same 256 grammatical sets are distinguished into four different results-of-doing-to or object-actions, which are the actions left behind on things by q7's doings. it seems to do with four different ways that we perceive an action coming to a resolution 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 surfacing the rule and role of a qθ. compared to how they presented in amazing, both um grids are much revamped. though much also has kept constant, there are many realignments, many difficult and uncertain assignments in the past that have now found their rightful 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 perfecting 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 finally embraced and 100% represented in the two grids, with any conceivable um verb readily matched to a 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 the clockwise rotation of the affix sets in q2q3 by a single quadrant, what was in amazing (left) is now this below (right). plus, the in and an affix sets have also exchanged positions

mag	mang
um	ma
in	an
i	ma

→

um	mag
ma	mang
i	an
ma	in

the changes obviated a major overhaul of tables 1 and 2, finally affecting only the lay of the keywords in fig. 7 below, a case conceivably 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
TENSE	FOCUS	DOER	OBJECT				
present	nv-d	um	i	move	begin	perform	activate
past	nv-o	ma	ma	change	end	esecute	enact
future	v-d	mag	an	direct	start	deliver	accomplish
possible	v-o	mang	in	work	finish	apply	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 tagalog sentences. q1 and q2 are both backed up by 2x2 permutations, hard evidence of a mathematical order underlying the surface structure of the language. it is 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 true markers in the language and entirely the result of a long and determined search for four semantic quadrisections of an affix set paralleling the syntactic quadrisections of q1-q4. the results finally prove a similar mathematical order underlying the semantic structure of the language. it is the semantic part of the grid—each quadrisection giving rise to a separate component of the verb's meaning.

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 might declare perhaps, that eight separate things in conjunction become 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 set that q5-q8 can combine (permute) to bring us the distinctive verbal actions that turn into the affix set'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. because it can happen in sixteen different affixes (see fig. 1) all together 4,096 grammatical sets make up the language.

it is in q3 that the difference between um and mag arises. and to the sixteen pairings of doer and object generated by q3q4 we can trace the varying semantic effects that um and mag have on the same root, as in t*um*ayô- and *mag*tayô- sa-tayuán (stand- and erect- in-place), t*um*urò- and *mag*turò- ng-*i*turò (point- it-at and teach- it-to), or b*um*uhay- and *mag*buhay- ng-buhay*in* (keep-it-alive and bring-it-to-life).

what then is the difference between um and mag? to be sure, we would need to grid mag down to its own 512 grammatical sets and compare them with um's in every detail. we are only halfway there with the um results. there is some new light thrown on the question, however, from another vantage, this as the hunt continues and we home in on the 2x2 permutation behind qθ which i recount next.

3 THE NATURE OF LANGUAGE

where is qθ in it all? one might ask, and the answer, it seems is, all over the place. it is simply as if all of qθ is in congress with each of qθ. to start with, if we were to turn the four affix-based foursomes of q1-q4 in fig. 7 into english nounal keywords, qθ looks a perfect fit, first, for q2 itself. and then, again, a perfect match for right across the four quadrisections, like so: (fig. 8)

	q1	q2	q3	q4
	senses	memory	motors	brain
	TENSE	FOCUS	DOER	OBJECT
a	senses	event	engine	input
b	memory	outcome	mechanism	output
c	motors	intention	driver	location
d	brain	objective	processor	target

translated thus, it reads as if each of the four quadrisections q1-q4 reflects and defines in its own fashion some different aspect of qθ:

> in its sensitivities, qθ is q1, each of the four {senses, memory,motors, brain} only perceiving and transmitting its own kind of information.
>
> in its abilities, qθ is q2, each responding to information and triggering its own memories of similar events and the reactions indicated.
>
> in its equipments, 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.

the identification of the tenses with qθ was already raised in amazing (when 'motors' was still 'mind'):

> 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. note how um doers at q3a are ‘engines’ and mag doers at q3c are ‘drivers’.

tagalog-speaking readers, aspiring gridders especially, are advised to study fig. 8 above very closely before moving on. one must grasp in what sense these nouns are used to translate the 16 syntactic elements marked out by the affixes in q1-q4 in fig.7. when you feel that you have got it, only then turn your attention to q5-q8 below.

in q5-q8, the keywords are all elementary *verbs* instead. now one is tasked in turn to grasp how each of these verbs may be related semantically to the corresponding noun in q1-q4 above: (fig. 9)

	q5	q6	q7	q8
	senses	memory	motors	brain
	MONITOR	TRIGGER	OPERATE	EMPLOY
a	move	begin	perform	activate
b	change	end	execute	enact
c	direct	start	deliver	transact
d	work	finish	apply	interact

the suggestion is that these pairs of nouns and verbs are expressions of associated informations but in different parts of speech. in theory, we might say that each pair is the sort of noun and verb that each of qθ is either {sensitive to, prompted by, equipped for, or capable of}; and, which nouns and verbs are coincident in an instant of information are what generate the singular mental image that we naturally turn into a sentence.

by these key nouns and verbs of fig. 8 and 9, it is suggested, all the basic elements and possibilities of a sentence are represented. thus, one might read any eight-string code of abcd’s (or of digital bytes) as a distinctive *generic* sentence. what ‘brands’ the sentence, what makes like sentences different, are the particular nouns and verbs that are used to singularize the information.

take the random string aabddcab, e.g. aabd (q1-q4) tells us that this is an ongoing non-volitional *UM*x*in* event. looking then in the *UM* grid, we see that dcab (q5-q8) is the key verb ‘fulfill’. the generic sentence for it therefore is “it fulfills (or is-fulfilling) something”. a particular usage might be “the apology makes-good some promise”.

be mindful that while the sixteen elementary verbs of fig. 9 are meant to apply generally to all the affix sets, the keywords appearing in the *UM* and UM grids are specific only to um verbs and their grammatical sets. of course, any of these keywords may also serve in other affix sets but it would always be in a different semantic sense. in practice i avoid repeating keywords when 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 from q3-q8 are meant to have both volitional and non-volitional semantic values as per q2. 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 very human mental experience, yet the grid is telling us that phenomenal nature also has its own brand of qθ and that the 256 grammatical sets of *UM* are its combined work at the most elementary levels.

as one grows more familiar with the semantic layout of the two grids one is apt to be surprised at the uneven 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.

but elsewhere 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, e.g., did ‘it commencel’ 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 by those more 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 that 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 surely 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 link-up the nouns of q1-q4 with the verbs of q5-q8 above into minimal sentences, we arrive at the sixteen logical constructions in the white boxes below: (fig. 10)

	q1q5	q2q6	q3q7	q4q8
	senses	memory	motors	brain
	MONITOR	TRIGGER	OPERATE	ENPLOY
a	senses move	begin event	engine performs	activate input
b	memory changes	end outcome	mechanism executes	enact output
c	motors direct	start intention	driver delivers	transact location
d	brain works	finish objective	processor applies	interact target

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

> the senses monitor {sensor movements, memory changes, motor directions, and brain work}
>
> memory triggers {beginning of events, ending of outcomes, starting of intentions, and finishing of objectives}.
>
> motors operate {engines that perform, mechanisms that execute, drivers that deliver, and processors that apply}.
>
> brain employs {inputs to activate, outputs to enact, locations to transact, targets to interact}.

put this way, the four sentences appear to be actually defining the functions of each of qθ in the 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, motors bring into motion, and the brain puts into action.

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

> when a sensor moves, an event begins and an engine performs, activating an input.
>
> when memory changes, an outcome is ended and a mechanism executed, enacting an output.
>
> when a motor directs, an intention start and a driver delivers, transacting a location.
>
> when a brain works, an objective is to be finished and a processor applied, interacting a target.

in real life, of course, everything does not come so neatly in rows of a's, b's, c's and d's: the four are not independent of each other. the {a, b, c, d}'s can mix it up in every way serially, across the eight quadrisections, as we have seen before with aabddcab="it fulfills something" (p. 13). indeed, it is the combinatorial result of all the verbal possibilities thus engendered that we are discovering in the tagalog grid.

in effect fig. 10 disentangles the grid in terms of the separate parts played in it by each of qθ. but what was intriguing here was how the sentences generated from the aligned keywords were all sounding a lot like science. at last i reach for the old biology textbook

(*modern biology*, velasquez & asis, 1980) and soon find under ‘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 match-ups 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, [motors] originate activity, carry impulses. . .[brain] coordinates—the control center.

reading on, one could sense ever stronger the nervous system’s intersections with qθ and the widespread references to particular grammatical sets and alignments 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 mine]

> [senses, motors]
> 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, those of motor neurons carry them *from* the brain to the tissues and organs.
> [motors, 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.
> [brain, motors]
> The frontal lobes are centers of emotion, judgment, will power, and self control.
> [non-volition, brain]
> 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, motors]
> 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, motors]
> 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. . .
> [non-volition, brain]
> 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 textbook is silent on memory, on 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 were all intimately related to our nervous system's organic processes.

for memory, i turn to j z. young who writes extensively about it in *programs of the brain* (oxford university press, 1978). in the chapter on 'controlling, coding & communicating', section on 'encoding in the nervous system', he tells this, very simply:

> 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 ourselves are awake to. 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 fashion possessed of its own qθ of {sensors, files, devices, and appications} for its own needs 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)

	autonomic system	volitional system
in progress	SENSES	MOTORS
in place	MEMORY	BRAIN

i propose that the 'senses' and 'memory' are two ends of the autonomic nervous system, where informations begin and end so to speak, while 'motors' and 'brain' are the two terminals of the volitional system, where performances start and finish as it were. the two systems run in parallel both the 'senses' and 'motors' being 'activities-in-progress', and 'memory' and 'brain' both being 'actions-in-place'—one might imagine the former as in foreground and the latter in the background.

turning it all into key verbs, i look especially for familiar logical verb pairs, and finally fix on the 2x2 permutation below as the core qθ of the tagalog-english verb grid: (fig. 12)

	inform	perform
empower	stimulate	command
enforce	respond	control

imagine now qθ's {senses, memory, motors, and brain} as four interactive organic circuitries each wired to {stimulate, respond-to, command, and control} each other as needed, and we see where the 16 english keys of q5-q8 have sprung from: (fig. 13)

	q5	q6	q7	q8
	senses	memory	motors	brain
stimulate	move	begin	perform	activate
respond	change	end	execute	enact
command	direct	start	deliver	transacr
control	work	finish	apply	interact

here is the end of our trail. in figs 11-12 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. from q1-q8 one can see the effects of the permutation at work, as the circuits string up the eight elements of language into the verbs and sentences that we speak.

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 expected that the end of the grid should prove to be something just as simple and mathematically elegant 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 much deeper, 2x2 permutation that presents itself at the heart of the whole affair, with a potential complexity of organic expressions suggestive of the same rule of progressive tetration of 0's and 1's.

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.

POSTSCRIPT

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 all of it—here below are the upper left corners of both grids, where the most elementary of the um verbs, non-volitional and volitional, are found: (figs. 14a, 14b)

UM {aa-- ab--}	
arise	**pass**
OCCUR	ELAPSE
proceed	expire
recur	fleet
advent	transpire
originate	lapse
APPEAR	DISAPPEAR
shine	vanish
flash	evanesce
dawn	set
sparkle	perish
SOUND	REPERCUSS
resound	rasp
report	squeal
reverberate	belch
resonate	gasp
ENERGIZE	RUPTURE
blaze	crumble
smoke	split
burn	pop
boil	curdle
it presents self	

UM {aa--, ab--}	
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
i present self	

in the bottom row is the solution i propose: what all these key verbs have in common that sets them apart from the rest of their grids is that they are all ‘self-prensentations’ of a kind. in the non-volitional *UM* the semantic is ‘it presents itself’. in the volitional UM it is ‘i present myself’. in both cases, column ‘a’ is of ‘beginning’ activities that self-present and column ‘b’ of ‘ending’ actions that self-present.

there are seven times more of these ‘self-presenting’ verbs in the language, with every different affix producing a different variant or complication thereof. only when all the affix sets are fully gridded will we see the full semantic range of these kinds of verbs in a language.

2

by rows, the yellow keywords of fig 14 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 energy—of {motion, light, vibration, and heat}—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, vibration transmits, and heat communicates}, not as metaphors but in the very real sense of the physics of these natural forces.

a very deep implication is that spoken language must be an evolution of the same energy system and data exchange that is behind the science of organic life. all animal language, it might be construed, 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 (2013) 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. (95)

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 understanding 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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