A PERIODIC TABLE OF CONCEPTUAL ELEMENTS

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Sec 1. **Introduction**

Given a sentence S", the meaning of the sentence can, in the abstract, be stated as in equation (1) below.

(1) $M(S") = M_D(S") + M_G(S") + M_C(S")$

where the total meaning of the sentence is analyzed into its discourse meaning $M_D(S")$, its grammatical meaning $M_G(S")$, and its conceptual meaning $M_C(S")$. The discourse component $M_D(S")$ is definable as in (2).

(2) $M_D(S") = [[U \rightarrow I_d] \wedge \mathbb{C}^*] = I_i$

where the utterance U entails a direct illocution I_d (which can well be a statement, question, directive, or exclamation); the entailment is then conjoined with the cooperative principle at least one maxim of which is being blatantly flouted to yield the indirect illocution I_i (which may well be a representative/ informative/ commisive/ directive/ expressive/ affective). The grammatical component $M_G(S")$ is what is familiarly given in (3) as

(3) $M_G(S") = S(S") + R(S")$

where S(S") and R(S") are the sense and reference of S" respectively. The conceptual component $M_C(S")$ is yet to be formalized. But, meanwhile, let one interesting question be broached: What would translation of S" from one language (SL) to another one (TL) mean? The present writer's tentative answer to the question is given in (4) and (5).

(4) $M_C(S"_{SL}) = M_C(S"_{TL})$ and

(5) $M_D(S"_{SL}) + M_G(S"_{SL}) \approx [M_D(S"_{TL}) + M_G(S"_{TL})]$

His answer is advisedly tentative because the current theory of conceptual meaning harbours the still open problem of semantic roles. What occasions Quirk et al. (1985: 741) to remark that "analysis of [semantics] roles has not achieved a general consensus, nor has it fully explored all distinctions" remains unchanged in 2024. We still have to ask the question: What are the fundamental conceptual entities, predicates, and elements? We intend to originate a periodic table of conceptual elements and, from it, derive an instrument of conceptual formalization.

Sec 2. **Theoretical Preliminaries**

For the task at hand let us propose three axioms.

Axiom 1: Natural-language predicates are reducible to fundamental conceptual predicates.

Axiom 2: Fundamental conceptual predicates are universal across natural languages.

Axiom 3: Fundamental conceptual predicates correlate with newtonian forces.

Newtonian forces in Axiom 3 are the subject of Newton's laws of motion that we state in (6) below.

(6i) $\mathbf{F}_{net} = m\mathbf{a} = \mathbf{0}$ (Newton's first law of motion)

(6ii) $\mathbf{F}_{net} = m\mathbf{a} \neq \mathbf{0}$ (Newton's second law of motion)

(6iii) $\mathbf{F}_{1\rightarrow2} = -\mathbf{F}_{2\rightarrow1}$ (Newton's third law of motion)

In (6i) and (6ii) a net force $\mathbf{F}_{net}$ acting on a body equals the product of body mass m and acceleration **a** which, in Newton I, equals **0**; and, in Newton II, is non-zero. In (6iii) a force $\mathbf{F}_{1\rightarrow2}$ exerted by body 1 on body 2 is equal to a force $\mathbf{F}_{2\rightarrow1}$ exerted oppositely by body 2 on body 1. We now turn to the immediate consequences of Axiom 3. Newton I is about pure motion of a body such that

$\mathbf{F}_{net}$ = $\underline{m\mathbf{a} = \mathbf{0}}$

(i) [B]/[Z]

(ii) [B]/[Z] [R]

where [B]/[Z], [R] are change-bearer / non-change bearer, reference respectively correlating with $\mathbf{F}_{net}$ and $m\mathbf{a} = \mathbf{0}$ respectively.

Newton II is about causation of change such that

$\mathbf{F}_{net}$ = $\underline{m\mathbf{a} \neq \mathbf{0}}$

[C]/[K] [E]

where [C]/[K], [E] are dynamic causer/ static causer, causee respectively correlating with $\mathbf{F}_{net}$ and $m\mathbf{a} \neq \mathbf{0}$ respectively.

Newton III is about contact motion such that

$\mathbf{F}_{1\rightarrow2}$ = $\underline{-\mathbf{F}_{2\rightarrow1}}$

[N]/[T] [A]

where [N]/[T], [A] are dynamic contactor/ static contactor, contactee respectively with $\mathbf{F}_{1\rightarrow2}$ and $\mathbf{-F}_{2\rightarrow1}$ respectively.

In the light of Axioms 1 and 2, functional sentence patterns appear to be the immediate correlates of Newton's laws of motion. The functional sentence patterns of English are:

(1) S V

(2) S V C

(3) S V Adl

(4) S V O

(5) S V O C

(6) S V O Adl

(7) S V O O

where S, V, C, Adl, O are the syntactic functions of subject, verb, complement, adverbial, and object.

Sec 3. **The Periodic Table of Conceptual Elements**

The adjoining Table is the Periodic Table of Conceptual Elements foreshadowed in Sec 1. The following is its concise characterization. It is made up of:

(i) nine (9) conceptual groups (vertical arrangements (1-9)) determined by the nine (9) fundamental conceptual predicates which are derived from Axioms 1-3 and Newton I-III in Sec 2.

(ii) ten (10) conceptual peroids (horizontal arrangements (I-X)) determined by twenty (20) conceptual entities in binary combinations (intra- and interperiodically).

(iii) 120 conceptual elements – an element yΠ being constituted by the entity y and predicate Π.

(iv) eleven (11) entity modifiers:

q (quantity)	φ (form)	γ (degree)
d (direction)	o (order)	μ (natural gender)
v (volition)	w (perception)	u (cognition)
g (axiological)	τ (whole)	

The Periodic Table of Conceptual Elements

Period \ Group	1 B	2 Z	3 R	4 C	5 K	6 E	7 N	8 T	9 A
I		cZ	cR	cC		cE	cN		cA
		kZ	kR		kK	kE		kT	kA
II	xB	xZ	xR	xC	xK		xN	xT	xA
		pZ	pR						
III		sZ	sR						
		nZ	nR						
IV		lZ	lR						
		σZ	σR						
V		tZ	tR						
	mB	mZ	mR	mC	mK		mN	mT	mA
VI	aB	aZ	aR	aC	aK		aN	aT	aA
	eB	eZ	eR	eC	eK		eN	eT	eA
VII	rB	rZ	rR	rC	rK		rN	rT	rA
	λB	λZ	λR	λC	λK		λN	λT	λA
VIII	fB	fZ	fR	fC	fK		fN	fT	fA
	zB	zZ	zR	zC	zK		zN	zT	zA
IX	hB	hZ	hR	hC	hK		hN	hT	hA
	iB	iZ	iR	iC	iK		iN	iT	iA
X	bB	bZ	bR	bC	bK		bN	bT	bA
	ωB	ωZ	ωR	ωC	ωK		ωN	ωT	ωA

The conceptual entities posited in the Table and sequenced according to the putative conceptual complexity are:

c (change)	k (non-change)	x (abstract object)
p (proposition)	s (set)	n (number)
l (space)	σ (shape)	t (time)
m (mass)	a (force)	e (energy)
r (concrete object)	λ (living object)	f (plant)
z (animal)	h (human)	i (institution)
b (supernatural being)	ω (universe)	

From Sec 3 we recall that yΠ is the general conceptual element where y and Π stand for entity and predicate respectively. If M_C (S") = p and predicate logic delivers $p = y_1\Pi_1 y_2\Pi_2$ as the generalized proposition, then a potentially powerful tool of conceptual formalization emerges.

Sec 4. **Conceptual Analysis of a Limited Sentence Corpus**

For sentences 1-14, conceptual analysis is to take place in the following stages:

(i) determination of the functional sentence pattern

(ii) determination of conceptional elements and the overall conceptual predicate

(iii) setting up of a conceptual equation showing the conceptual compound analysed into its elements

(iv) correlation of the functional sentence pattern with the overall newtonian predicate

In the case of Sentences 15-72, on the other hand, conceptual analysis is to contrastively go through the following stages:

(i) determination of the finctional sentence pattern

(ii) a traditional version of conceptual analysis of the sentence

(iii) our version of conceptual analysis of the same sentence

(iv) correlation of the functional sentence pattern with the overall newtonian predicate

Sentences 1-53 are taken from Quirk et al. (1985: 53, 56,754)

(1) Someone **was laughing**.

(i) S V

(ii) h(v)B [B]

(iii) h(v)B = h(v)B

(iv) <S V> -: [B]

(2) The country **became** totally independent.

(i) S V C

(ii) i(v)B [B]

(iii) i(v)B = i (v)B

(iv) <S V C> -: [B]

(3) I **have been** in the garden.

(i) S V Adl

(ii) h(v)B [ZR] lR

(iii) h(v)ZlR = h(v)Z + lR

(iv) <S V Adl> -: [ZR]

(4) My mother **enjoys** parties.

(i) S V O

(ii) h(g)N [NA] cA

(iii) h(g)NcA = h(g)N + cA

(iv) <S V O> -: [NA]

(5) Most people consider these books rather expensive.

(i) S V O C

(ii) h(g)T [T[Z]A] rZ

(iii) h(g)T[rZ]A = h(g)T + rZ + kA

(iv) <S V O C> -: [T[Z]A]

(6) You **must put** all the toys upstairs.

(i) S V O Adl

(ii) h(v)C [C[BR]E] rB lR

(iii) h(v)C[rBlR]E = h(v)C + rB + lR + cE

(iv) <S V O Adl> -: [C[BR]E]

(7) Mary **gave** the visitor a glass of milk.

(i) S V O O

(ii) h_1(v)C [C[NA]E] h_2N rA

(iii) h_1(v)C[h_2(g)NrA]E = h_1(v)C + h_2(g)N + rA + cE

(iv) <S V O O> -: [C[NA]E]

(8) Prices rose.

(i) S V

(ii) xB [B]

(iii) xB = xB

(iv) <S V> -: [B]

(9) Your face **seems** familiar.

(i) S V C

(ii) τ(h)Z [Z]

(iii) τ(h)Z = τ(h)Z

(iv) <S V C> -: [Z]

(10) My sister **lives** next door.

(i) S V Adl

(ii) h(v)Z [ZR] lR

(iii) h(v)ZlR = h(v)Z + lR

(iv) <S V Adl> -: [ZR]

(11) Elizabeth enjoys classical music.

(i) S V O

(ii) h(g)N [NA] xA

(iii) h(g)NxA = h(g)N + xA

(iv) <S V O> -: [NA]

(12) The president declared the meeting open.

(i) S V O C

(ii) h(g)N [N[B]A] cZ

(iii) h(g)N[cZ]A = h(g)N + cZ + kA

(iv) <S V O C> -: [N[B]A]

(13) The doorman showed the guests into the drawing room.

(i) S V O Adl

(ii) h(v)C [C[BR]E] h(q)B lR

(iii) h(v)C[h(q)BlR]E = h(v)C + h(q)B + lR + cE

(iv) <S V O Adl> -: [C[BR]E]

(14) We all wish you a happy birthday.

(i) S V O O

(ii) h_1C [C[NA]E] h_2N xA

(iii) h_1C[h_2NxA]E = h_1C + h_2N + xA + cE

(iv) <S V O O> -: [C[NA]E]

(15) She **is** happy.

(i) S V C

(ii) aff attrib

(iii) h(w)Z [Z]

(iv) <S V C> -: [Z]

(16) He **turned** traitor.

(i) S V C

(ii) agent attrib

(iii) h(v)B [B]

(iv) <S V C> -: [B]

(17) The Sahara **is** hot.

(i) S V C

(ii) loc attrib

(iii) lZ [Z]

(iv) <S V C> -: [Z]

(18) Last night **was** warm.

(i) S V C

(ii) temp attrib

(iii) tZ [Z]

(iv) <S V C> -: [Z]

(19) The show **was** interesting.

(i) S V C

(ii) event attrib

(iii) cZ [Z]

(iv) <S V C> -: [Z]

(20) It **is** windy.

(i) S V C

(ii) *it* attrib

(iii) xZ [Z]

(iv) <S V C> -: [Z]

(21) He **was** at school.

(i) S V Adl

(ii) aff loc

(iii) h(v)Z [ZR] i(l)R

(iv) <S V Adl> -: [ZR]

(22) She **got** into the car.

(i) S V Adl

(ii) agent loc

(iii) h(v)B [BR] r(l)R

(iv) <S V Adl> -: [BR]

(23) He **is lying** on the floor.

(i) S V Adl

(ii) pos loc

(iii) h(v)Z [ZR] lR

(iv) <S V Adl> -: [ZR]

(24) The meeting **is** at eight.

(i) S V Adl

(ii) event temp

(iii) cZ [ZR] tR

(iv) <S V Adl> -: [ZR]

(25) He **was working**.

(i) S V

(ii) agent

(iii) h(v)B [B]

(iv) <S V> -: [B]

(26) She **is standing**.

(i) S V

(ii) pos

(iii) h(v)Z [Z]

(iv) <S V> -: [Z]

(27) The curtains **disappeared**.

(i) S V

(ii) aff

(iii) rB [B]

(iv) <S V> -: [B]

(28) The wind **is blowing**.

(i) S V

(ii) ext

(iii) xB [B]

(iv) <S V> -: [B]

(29) It **is raining**.

(i) S V

(ii) *it*

(iii) xB [B]

(iv) <S V> -: [B]

(30) He **threw** the ball.

(i) S V O

(ii) agent aff

(iii) h(v)C [C[B]E] rB

(iv) <S V O> -: [C[B]E]

(31) Lightning **struck** the house.

(i) S V O

(ii) ext aff

(iii) cN [NA] rA

(iv) <S V O> -: [NA]

(32) He **is holding** a knife.

(i) S V O

(ii) pos aff

(iii) h(v)T [TA] rA

(iv) <S V O> -: [TA]

(33) The stone **broke** the window.

(i) S V O

(ii) instr aff

(iii) r_1C [C[B]E] r_2B

(iv) <S V O> -: [C[B]E]

(34) She **has** a car.

(i) S V O

(ii) recip aff

(iii) h(v)T [TA] rA

(iv) <S V O> -: [TA]

(35) We **paid** the bus driver.

(i) S V O

(ii) agent recip

(iii) h_1(v)C [C[NA]E] h_2N

(iv) <S V C> -: [C[NA]E]

(36) The will **benefits** us all.

(i) S V O

(ii) instr aff

(iii) xA [TA] h(g)T

(iv) <S V O> -: [TA]

(37) They **climbed** the mountain.

(i) S V O

(ii) agent loc

(iii) h(v)N [NA] rA

(iv) <S V O> -: [NA]

(38) The bus seats thirty.

(i) S V O

(ii) loc aff

(iii) rA [TA] h(v)T

(iv) <S V O> -: [TA]

(39) They **fought** a clean fight.

(i) S V O

(ii) agent cog

(iii) h(v)C [CE] cE

(iv) <S V O> -: [CE]

(40) I **wrote** a letter.

(i) S V O

(ii) agent result

(iii) h(v)C [C[B]E] xB

(iv) <S V O> -: [C[B]E]

(41) They **had** an argument.

(i) S V O

(ii) agent event

(iii) h(v)C [CE] cE

(iv) <S V O> -: [CE]

(42) He **nodded** his head.

(i) S V O

(ii) agent result

(iii) h(v)C [C[B]E] xB

(iv) <S V O> -: [C[B]E]

(43) He **declared** her the winner.

(i) S V O C

(ii) agent aff attrib

(iii) h(v)C [C[B]E] hB

(iv) <S V O> -: [C[B]E]

(44) The sun **turned** it yellow.

(i) S V O C

(ii) ext aff attrib

(iii) r_1C [C[B]E] r_2B

(iv) <S V O C> -: [C[B]E]

(45) The revolver **made** him afraid.

(i) S V O C

(ii) instr aff attrib

(iii) r_1C [C[B]E] r_2B

(iv) <S V O C> -: [C[B]E]

(46) I **found** it strange.

(i) S V O C

(ii) recip aff attrib

(iii) h(g)N [N[Z]A] rZ

(iv) <S V O C> -: [N[Z]A]

(47) He **placed** it on the shelf.

(i) S V O Adl

(ii) agent aff loc

(iii) h(v)C [C[BR]E] r_1B r_2(l)R

(iv) <S V O Adl> -: [C[BR]E]

(48) The storm **drove** the ship ashore.

(i) S V O C

(ii) ext aff loc

(iii) cC [C[BR]E] rB lR

(iv) <S V O Adl> -: [C[BR]E]

(49) A car **knocked** it down.

(i) S V O Adl

(ii) instr aff loc

(iii) r_1C [C[BR]E] r_2B lR

(iv) <S V O Adl> -: [C[BR]E]

(50) I **prefer** them on toast.

(i) S V O Adl

(ii) recip aff loc

(iii) h(g)T [T[ZR]A] r_1Z r_2(l)R

(iv) <S V O Adl> -: [T[ZR]A]

(51) I **bought** her a gift.

(i) S V O O

(ii) agent recip aff

(iii) h_1(v)C [C[NA]E] h_2N rA

(iv) <S V O O> -: [C[NA]E]

(52) She **gave** the door a kick.

(i) S V O O

(ii) agent aff event

(iii) h(v)C [C[NA]E] rN cA

(iv) <S V O O> -: [C[NA]E]

(53) She **knitted** me a sweater.

(i) S V O O

(ii) agent recip result

(iii) h_1(v)C [C[NA]E] h_2N rA

(iv) <S V O O> -: [C[NA]E]

Sentences 54-72 are drawn from Huddleston & Pullum

(54) Kim **signed** the letter.

(i) S V O

(ii) agent

(iii) h(v)N [NA] rA

(iv) <S V O> -: [NA]

(55) The dog **snarled**.

(i) S V

(ii) agent

(iii) z(v)B [B]

(iv) <S V> -: [B]

(56) The rain **ruined** the crop.

(i) S V O

(ii) causer

(iii) r(q)C [C[B]E] f(q)B

(iv) <S V O> -: [C[B]E]

(57) I **cut** the lace **with** the knife.

(i) S V O O

(ii) instr

(iii) h(v)C [C[C[B]E]E] r_2B r_1C

(iv) <S V O O> -: [C[C[B]E]E]

(58) They **hit** me.

(i) S V O

(ii) agent/ causer patient

(iiia) h_1(v)N [NA] h_2A

(iiib) rN [NA] hA

(iv) <S V O> -: [NA]

(59) He **hates** me.

(i) S V O

(ii) experiencer stimulus

(iii) h_1(g)T [TA] h_2A

(iv) <S V O> -: [TA]

(60) We **know** the reason.

(i) S V O

(ii) experiencer stimulus

(iii) h(u)T [TA] xA

(iv) <S V O> -: [TA]

(61) She **fell off** the balcony.

(i) S V Adl

(ii) theme

(iii) hB [BR] lR

(iv) <S V Adl> -: [BR]

(62) She **is on** the balcony.

(i) S V Adl

(ii) theme

(iii) hZ [ZR] lR

(iv) <S V Adl> -: [ZR]

(63) She **ran** home.

(i) S V Adl

(ii) theme goal

(iii) h(v)B [BR] lR

(iv) <S V Adl> -: [BR]

(64) He **gave** me the key.

(i) S V O O

(ii) theme

(iii) h_1(v)C [C[NA]E] h_2N rA

(iv) <S V O O> -: [C[NA]E]

(65) The key **is** mine.

I **possess** a key.

(i) S V O

(ii) theme

(iii) h(v)T [TA] rA

(iv) <S V O> -: [TA]

(66) She **went** mad.

(i) S V C

(ii) theme

(iii) hB [B]

(iv) <S V C> -: [B]

(67) She **was in** a happy frame of mind.

(i) S V Adl

(ii) theme

(iii) hZ [ZR] kR

(iv) <S V Adl> -: [ZR]

(68) A hole **appeared in** the roof.

(i) S V Adl

(ii) theme

(iii) rB [BR] lR

(iv) <S V Adl> -: [BR]

(69) She **ran from** the post office **via** the railway station **to** the bus-stop.

(i) S V Adl Adl Adl

(ii) theme source path goal

(iii) h(v)B [[[BR]BR]BR] l_1R l_2R l_3R

(iv) <S V Adl Adl Adl> -: [[[BR]BR]BR]

(70) The meeting **is at** noon.

(i) S V Adl

(ii) theme

(iii) kZ [ZR] tR

(iv) <S V Adl> -: [ZR]

(71) Kim **gave** the key **to** Pat.

(i) S V O O

(ii) recipient

(iii) hZ [ZR] kR

(iv) <S V Adl> -: [ZR]

(72) I **shall open** the door **for** you.

(i) S V O O

(ii) beneficiary

(iii) h_1(v)C [C[BR]E] rB h_2R

(iv) <S V O O> -: [C[BR]E]

Sec 5. **Discussion of Results**

We can now record two major results exactly matching our objectives set out in Sec 1. While the Periodic Table of Conceptual Elements is presented in Sec 3, the correlations of fundamental sentence patterns with newtonian predicates are displayed here below.

(1) <S V> -: [B]/[Z]

(2) <S V C> -: [B]/[Z]

(3) <S V Adl> -: [BR]/[ZR]

(4) <S V O> -: [C[B]E]/[Z]/[K[Z]E]/[NA]/[TA]

(5) <S V O C> -: [C[B]E]/[Z]/[K[Z]E]

(6) <S V O Adl> -: [C[BR]E]/[K[ZR]E]

(7) <S V O O> -: [C[C[B]E]E]/[K[K[Z]E]E]/[C[NA]E]/[K[TA]E]

Special attention should be directed to sentences 65 and 69. In "The key is mine", the noun phrase "the key" is not a logical subject. Hence, we paraphrase the sentence into the sentence "I possess a key" in which "I" is both a logical and grammatical subject. Sentence 69 is non-canonical, for any two of the three adverbials are omissible as adjuncts.

To conclude this paper we wish to cite two linguists in the Chomskyan mould in relation to the long-standing problem of semantic role theory. Richard Larson and Gabriel Segal write:

> [W]e record the questions of which thematic roles there are and how they are defined as empirical ones, to be resolved in the usual way: by investigations that construct specific theories making detailed and specific predictions. Preliminary theories of this kind have been proposed; however, it is likely that resolving thematic roles precisely will require a great deal of investigation, involving domains beyond linguistics. It is worth remembering that fully 22 centuries elapsed between the first suggestion of the atomic theory of matter, in which all substances were factored into earth, water, air, and fire, and the elaboration of atomic theory by John Dalton, in which a more complete and satisfactory set of atomic constituents was proposed. Finding elementary constituents can evidently be a long-term project.
>
> Larson & Segal (1998:489)

From three axioms and Newton's three laws of motion we deduce the nine and only nine fundamental conceptual predicates, which, we might justifiably dub "newtonian" in our parlance. What remains to be seen is whether our proposed solution to the problem of semantic role theory prompts a fresh dispassionate look at the Language Acquisition Device (LAD) and its outgrowth Universal Grammar (UG). We believe that the rather metaphysical aura surrounding LAD and UG could give way to the eventual anchorage of semantics to classical mechanics.

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