PRELIMINARY NOTES ON SEMANTIC FORMULAE

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Is it conceivable for a semanticist or lexicographer to formalize sememes just like a chemist who confronts us with formulae of substances such as H_2SO_4 (sulphuric acid), CH_4 (methane), $Na_4[Fe(CN_6)]$ (sodium hexacyanoferrate (II)) and NaCl (sodium chloride)? In the following notes I essay to develop a preliminary solution to the question of semantic formalizability.

Consider a sentence as in (1)

(1)   Ali opens the door with a key.

The action of opening stretches from Ali to the door via the key. Ali is the volitional agent; the key is the instrument, while the door is the entity affected in the action. If, instead of (1), we constructed the sentences (2)- (4), the semantic roles of agent, instrument and affected would remain intact.

(2)   Ali opens the door.

(3)   A key opens the door.

(4)   The door is opened.

In standard predicate logic (1) is formalizable as

(5)   open < Ali, key , door >

Admittedly, a well-formed formula as in (6) would be the full-fledged formalization attainable in standard predicate logic.

(6)   Oakd

[O = df "open", a =df "Ali", k= df "a key" and d= df "the door"]

For the purpose at hand, I posit the following componential-role predicates in (7)

(7) C   concrete   A   abstract

     P   physical   M   mental (or imagined)

     L   spatial   R   material

     T   temporal   B   biotic

     H   human   I   institutional

     S   supernatural

I stipulate that in (7) C, A, P and M are also state-of-affairs predicates and are interrelated as in (8).

(8a) [+C]   ≡ [-A]

      [+C]   ≡ [±M, ±P, -A]

(8b) [+P]   ≡ [-M]

      [+P]   ≡ [±A, ±C, -M]

(8c) [+M]   ≡ [±C, ±A, -P]

(8d) [+A]   ≡ [±P, ±M, -C]

The following semantic role variables are posited.

(9) a   the affected   c   the agent   e   the effected

     g   the receiver   i   the identificatum

     m   the meronym   o   the reference

p   the permanently positioned   q   the permanent attribute

r   the represented   **s**   the sender

t the instrument

Associated with each semantic role in (9) is a state-of- affairs variables in (10).

(10) a′   affectedness   c′   agency   e′   effectedness

g′   reception   i′   identity   **m′**   meronym

o′   referencing   p′   positionedness

q′   permanent attribution r′   representation

s′   emission   **t′**   instrumency

In (11) I stipulatively define extrinsic predicates, i.e. predicates which may operate on predicates in (7) and (8).

(11) V   attitudinally   Q   quantitatively

O   initially   F   finally

G   gradationally   N   numerically

W   willingly/tendentially   D   directionally

Z   interpunctually

Returning to (1), we note that the action of opening is volitional; Ali, being the agent, takes a key as an instrument to affect the door. Hence, the formalization of (1) is suggested in (12).

(12)   Pt′ WHc R_1t R_2a

From the statement in (12) I now proceed to formalize the state-of-affairs of opening the human agent (Ali), the nonhuman opener or instrument (the key) and the nonhuman affected entity (the door).

(13a) Pt' [: WHc R_1t R_2a]   the action

(13b) WHc [Pt' : R_1t' R_2a]   Ali, the human opener

(13c) R_1t [Pt' WHc : R_2 a]   the key

(13d) R_2 a [Pt' WHc R_1a :]   the door

Suppose Ali is not explicitly mentioned. Then

(14) R_1t [Pt' : R_1a]

formalizes (3). Furthermore, if neither Ali nor the key is mentioned, then

(15) R_2a [Pc' :]

formalizes (4). It might be prudent at this juncture to state the rules of semantic formalization. If π and Φ are componential–role and state-of affairs predicates respectively, i.e. if π and Φ are INTRINSIC predicates while Ψ is an EXTRINSIC one, then (16) and (17) formalize statements and entities in

(16) $\Phi\theta_\iota' \; \pi_1\theta_1 \; \textbf{.} \; \textbf{.} \; \textbf{.} \; \pi_\nu\theta_\nu$

(16a) $\Phi\theta_\iota'$ [: $\pi_1\theta_1 \; \textbf{.} \; \textbf{.} \; \textbf{.} \; \pi_\nu\theta_\nu$]

(16b) $\pi_\lambda\theta_\lambda' \, [\Phi\theta_\iota' \; \textbf{.} \; \textbf{.} \; \textbf{.} \; :_\lambda \; \textbf{.} \; \textbf{.} \; \textbf{.}]$

(17) $\Phi\theta_\iota' \; \textbf{.} \; \textbf{.} \; \textbf{.} \; \Psi\pi_\lambda\theta_\lambda \; \textbf{.} \; \textbf{.} \; \textbf{.}$

(17a) $\Psi\pi_\lambda\theta_\lambda \, [\Phi\theta_\iota' \; \textbf{.} \; \textbf{.} \; \textbf{.} \; :_\lambda \; \textbf{.} \; \textbf{.} \; \textbf{.}]$

where $1 \leq \iota \leq \nu$ and $1 \leq \lambda \leq \nu$.

Further examples of componential-role formalization follow.

(18)	Ali is singing.	Pc' WHc
(18a)	the singer Ali	WHc [Pc' :]
(19)	Ali represents the university.	Cr' WHr WIo
(19a)	the representative Ali	WHr [Cr' :WIo]
(19b)	the university representative	WHr WIo [Cr' : :]
(20)	The string has broken.	Pa' Ra
(20a)	the broken string	Ra [Pa' :]
(20b)	the breaking of the string	Pa' [: Ra]
(21)	Ali sharpened the knife.	Pc' WHc Ra
(22)	Ali dug a hole.	Pe' WHc Le
(22a)	the hole digger Ali	WHc Le [Pe' ::]
(23)	Ali ran a kilometre.	Pc' WHc NQLo
(24)	Ali threw the ball to Musa (to catch).	Ps' WHs Ra WH$_2$g
(25)	Ali went to Kampala.	Pc' WHc Flo
(26)	Ali is arriving from Nairobi.	Pc' WHc OLo
(27)	Ali travelled via Kampala.	Pc' WHc ZLo
(28)	Ali gave the book to Musa.	Ps' WHs Ra WH$_2$g
(29)	Ali got the cassette from Musa.	Pg' Ra WHg OH$_2$o
(30)	Ali contacted Musa via Aminah.	Mc' WH$_1$c H$_2$a BH$_3$o

(31)	The bag weighs two kilogrammes.	Pa' Ra NQAo
(32)	Ali knows the answer.	Mg' Aa Hg
(33)	Ali owns a cat.	Pg' Ba Hg
(33a)	the cat owner Ali	Ba Hg [Pg' ꞉ ꞉]
(34)	Ali is sad.	Ma' Ha
(35)	The child is sleeping.	Ma' Ha
(36)	The room is large.	Pa' La
(37)	The university is famous.	Aa' Ia
(38)	Ali is the convener	Aa' WHa
(39)	Ali turned traitor.	Aa' WHa
(40)	Yesterday was hot.	Pa' Ta
(41)	The lecture is interesting.	Ma' Aa
(41a)	the interesting lecture	Aa [Ma' ꞉]
(42)	Ali was at school.	Pa' WHa Io
(43)	Ali got into the car.	Pc' WHa FLo
(44)	Ali is lying on the floor.	Pa' WHa Lo
(45)	The lecture is at ten.	Aa' Aa To
(46)	Ali is working.	Pc' WHc
(47)	Ali is standing.	Pp' WHp
(48)	The curtains disappeared.	Pa' QRa
(49)	Lightening struck the theatre.	Pc' Ac Ra

(50)	Ali is holding a book.	Pc' WHc Ra
(51)	Ali has a book.	Pg' Ra Hg
(52)	Ali paid the taxi-driver.	Ps' WHs WH_2g
(53)	Ali wrote a letter.	Pe' WHc Re
(54)	The will benefits the children.	Aa' Aa WQHo
(55)	The car seats four	Pa' NQHa Ro
(56)	Ali sung a song.	Pe' WHc Ae
(56a)	a song sung	Ae [Pe' WHc **:**]
(57)	Ali nodded his head.	Pt' WHc Rt
(58)	Ali climbed the mountain	Pa' WHc La
(59)	The sun turned the plant yellow.	Pa' Rc BaB_2q
(60)	Ali placed the book on the shelf.	Pc' WHc $RaFR_2o$
(61)	The storm drove the boat ashore.	Pc' Ac Ra Flo
(62)	Ali bought her a gift.	Pc' WHc Ra WH_2g
(62a)	the gift buyer Ali	WHc Ra[Pc' **::**WH_2g]
(63)	Ali kicked the door.	Pc' WHc Ra
(64)	Ali knitted his sister a sweater.	Pc' WHc Re WH_2g
(65)	Ali loves Aminah.	Mc' VHc H_2a
(66)	The plane flew northwards.	Pt' Rt DLo
(67)	Nairobi University is older than Kenyatta University.	
	Pq' GIq I_2o	

(68)   God loves humankind.   Ac' VSc QHa

(69)   Nairobi is situated between Nakuru and Mombasa.
                                          Pp' Lp ZL_2o FL_2o

(70)   Ali teaches Kiswahili to a group of students.
                                          Mc' WHc Aa WQH_2g

(71)   Ali learns English.   Mg' Aa WHg

(71a)   the learner of English Ali   Aa WHg [Mg' ::]

(72)   A cross stands for Christianity.   Pr' Rr Ao

(73)   The School of Education is part of the University.
                                          Pm' Im I_2o

(74)   Kampala is the capital city of Uganda.
                                          Pi' Ii I_2o

(75)   The small lake is twenty kilometres from Kampala
                                          Pp' Lp NQLo OL_2o

In the above examples the following ordering principle for semantic roles is discernible.

(76)

c				
	t			
s				
		a		
		e		
			g	
				o
q				
i				
m				
r				
p				

The sole objective pursued in this contribution has been to stimulate thinking in the direction of componential-role formalization. Whether the perennial problem of what and how many semantic roles are to be posited has been brought somewhere closer to its solution or not, remains to be seen.