A DOMAINAL ROLE THEORY

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ABSTRACT

The problem of determining the nature and number of semantic roles has its origin in the mid-1960s as the work of Charles Fillmore would evidence. The sole objective pursued in the present paper is to enunciate a theory of semantic roles that purports to resolve the aforementioned problem. The proposed solution resides in the definition of seventeen entity types together with seventeen correlated situation and domain types, and twenty-four role types. In the ensuing domainal role theory, meaning is formalizable as $\theta\ \tau\ (\delta)$*, where* θ, τ*, and* δ *is a role, semantic category (i.e. entity or situation type) and domain type respectively.*

In order to state the problem to be tackled in this paper, I propose to make contact with four texts on English Language and linguistics. The intended contact pertains to their treatment of role theory.

In their influential grammar of the English language Quirk et al (1985: 741) duly remind us that

> analysis of participant roles has not achieved a general consensus, nor has it fully explored all distinctions … [their] description must therefore be considered tentative.

On the other hand, Brown and Miller (1991: 308) justify their description of role theory by "its offering a degree of both generality and particularity [although] it has no easily defended validity … [and] there seems to be no alternative in the current state of knowledge."

While Fromkin et al (2003: 192) prefix their list of roles with a reassurance to the effect that "the list is not complete", Larson and Segal's (1995: 489) considered stance on the nature and number of semantic roles is the most pessimistic, for they write:

> The upshot is that we regard the question 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.

Admittedly, the development of atomic theory was tortuous; but we need not resign ourselves to a similar state-of-affairs with regard to role theory. The objective I am poised to pursue in this paper is to bring the problem of determination of semantic roles closer to its solution by propounding a domainal role theory.

First, I posit seventeen entity types: propositional (p), quantitative (g), numerical (n), spatial (l), material (m), temporal (t) , artificial (r) , plant (f), animal (z), corporal (v), mental (b), psychomotor (k) , emotional (or axiological) ((e) , cognitive (c), linguistic (s), human (h), and institutional (i) entity types. Correlated with the entity types are seventeen situation (i.e. change or nonchange) types: p', g', n', l', m', t' r', f ', z ' , v ' , b', k ' e ' , c ' , s ', h' and i '. The seventeen situation types are, in turn, correlated with seventeen domain types: p'', g'', n'', l'' m'' ,t'', r'', f '', z'', v '', b'', k'', e'', c'', s '', h '', and i ''.

Second, I posit twenty-four role types: nonchange bearer (Z), change bearer (B), distal reference (F), proximal reference (N), contacted (O), container (K), direction (D), comitant (J), source (S), mediation (M), goal (G),whole (W),

measure (Q), causer (C), letter (L), attempter (U), failer (R),instrument (V), effected (E), possessor (H), intaker (I), emitter (X), affector (T), affected (A).

Third, if **θ , δ ,** and **τ** stand for semantic role , semantic domain, and semantic category (i.e. semantic entity (**ϵ**) or semantic situation (**ϵ'**)) respectively, I define two general formation rules.

Formation Rule 1:	$\theta\ \tau\ (\delta)$
Formation Rule 2:	$\theta_1\tau_1\ (\delta_1)\theta_2\ \tau_2\ (\delta_2)$

More specifically and precisely, the formation rules (FR) are:

FR 1	$Z\ \tau\ (\delta)$
FR 1	$\mathbf{B}\ \tau\ (\delta)$
FR 3	$\mathbf{Z}\ \tau_1\ (\delta_1)\ \Delta\ \tau_2\ (\delta_2)$, where Δ = F,N,O,K,D,J,S,M,G,W,Q
FR 4	$B\ \tau_1\ (\delta_1)\ \Delta\ \tau_2\ (\delta_2)$
FR 5	$\Phi\ \tau_1\ (\delta_1)\ \mathbf{E}\ \tau_2\ (\delta_2)$, where Φ= C,L, U, R, V
FR 6	$\psi\ \tau_1\ (\delta_1)\ \mathbf{A}\ \tau_2\ (\delta_2)$, where ψ = H, I, X, T, V
FR 7	A formula is a well-informed formula if and only if it accords with FR 1 -6.

It is axiomatized that a category **τ** either persists or changes in a particular domain δ such that the meaning of an expression is formalizable as $\theta\ \tau\ (\delta)$, where

θ is the role. In other words, the meaning of an expression is determined by role θ , domain δ, and category τ .

Before exemplifying formalization of meaning, let me interrelate the entity, situation, and domain types in the adjoining table.

	Entity Type ϵ	**Situation Type ϵ′=σ**	**Domain Type ϵ′′= σ′ = δ**
Propositional	p	p′	p″
Quantitative	g	g′	g″
Numerical	n	n ‘	n′′
Spatial	l	l′	l′′
Material	m	m ‘	m ‘′
Temporal	t	t′	t′′
Artificial	r	r ‘	r ‘′
Plant	f	f ′	f′′
Animal	z	z′	z′′
Corporal	v	v′	v′′
Mental	b	b′	b′′
Psychomotor	k	k′	k′′
Emotional (axiological)	e	e′	e′′
Cognitive	c	c′	c′′
Linguistic	s	s′	s′′
Human	h	h′	h′′
Institutional	i	i′	i′′
Table: Entity , Situation , and Domain Types			

With the formal language of domainal role theory in place, I now analyse and formalize 78 sentences, sixty-six of which are taken from Quirk et al (1985: 754) (sentences (1)- (39)), Brown and Miller (1991:309) (sentences (40)- (57)) and Fromkin et al (2003: 192-3) (sentences (58)- (66)).

(1)	She is happy.	Zh(e")
(2)	He turned traitor.	Bh(e")
(3)	The Sahara is hot.	Zl(m")
(4)	Last night was warm.	Zt(m")
(5)	The show was interesting.	Zh'(e")
(6)	It is windy.	Zm'(m")
(7)	He was at school.	Zh(l")Nl(l")
(8)	She got into the car.	Bh(k")Kr(l")
(9)	He is lying on the floor.	Zh(k")Ol(l")
(10)	The meeting is at eight.	Zh'(t")Nt(t")
(11)	He was working.	Zh(h")
(12)	She is standing.	Zh(l")
(13)	The curtains disappeared.	Br(l")
(14)	The wind is blowing.	Bm'(m")

(15)	It is raining.	Bm'(m")
(16)	He threw the ball.	Ch(k")E[Br(l")]
(17)	Lightning struck the house.	Tm'(m")Ar(m")
(18)	He is holding a knife.	Ch(k")E[Zr(l")Oh(v")]
(19)	The stone broke the window.	Vm(m")E[Bm(m")]
(20)	She has a car.	Hh(h")Ar(l")
(21)	We paid the bus driver.	Ch_1(k)E[Hh_2(e")Aτ(e")]
i.e.	We paid (money) to the bus driver.	
(22)	The will benefits us all.	Vs(s")Ah(e")
(23)	They climbed the mountain.	Th(k")Al(l")
(24)	The bus seats thirty.	Zh(h")Kr(l")
(25)	They fought a clean fight.	Ch(k")Ek'(e")
(26)	I wrote a letter.	Ch(k")Er(s")
(27)	They had an argument.	Ch(s")Es(s")
(28)	He nodded his head .	Ch(k")E[Vv(v")]
(29)	He declared her the winner.	Xh_1 (s")A[Zh_2 (h")]
(30)	The sun turned it yellow.	Cm_1 (m")E[Bm_2 (m")]
(31)	The revolver made him afraid.	Vr(r")E[Bh(e")]

(32) I found it strange. Th(k")Aτ (e")

(33) He placed it on the shelf. Ch(k")E[Bτ(l")Ol(l")]

(34) The storm drove the ship ashore. Cm(m")E[Br(r")Gl(l")]

(35) A car knocked it. Vr(r")E[Bϵ(m")Gl(l")

(36) I prefer them on toast. Th(k")A[Zm_1(m")Om_2 (m")]

(37) I bought her a gift. B[Ch_1(k")E[Hh_1(k")Ar(r")]]Nh_2(h")

(38) She gave the door a kick. Ch(k")E [Tk(l")Ar(r")]

(39) She knitted me a sweater. B[Ch_1 (k")Er(r")]Nh_2(h")

(40) She was singing. Xh(s")

(41) The string broke. Bm(m")

(42) John sharpened the knife. Ch(k")E[Br(r")]

(43) The dog is digging a hole. Cz(k")El(l")

(44) Harold ran a mile. Bh(k")Q(l(l")

(45) Susan went to Denmark. Bh(k") Gl(l")

(46) Yasuko is arriving from Kyoto. Bh(k") Sl(l")

(47) Helen traveled via Samarkand. Bh(k") Ml(l")

(48) She gave the book to Bill. Ch_1 (k")E[Hh_2 (k")Ar(r")]

(49) I got the cassette from David. B[Hh_1 (k")Ar(r")]Sh_2(k")

(50) I contacted Jane via her sister. B[Th_1 (h")Ah_2(h")]Mh_3(h")

(51) The painting cost £5,000. Zr(r″) Qe(e″)

(52) Miranda knew all the answers. Hh(c″) Ac(c″)

(53) Harriet owns a cat. Hh(h″) Az(z″)

(54) Celia is cold/sad. Zh(e″)

(55) The child is sleeping. Zh(h″)

(56) The town is dirty, Zl(l″)

(57) Fiona is the convener. Zh(h″)

(58) Joyce ran. Bh(k″)

(59) Mary found the puppy. Th(k″)Az(z″)

(60) It_rains is Spain. Bm′(m″)Kl(l″)

(61) He put the cat on the porch. Ch(k″)E[Bz(z″)Ol(l″)

(62) He flew from Iowa to Idaho. B[Bh(k″)Sl_1(l″) Gl_2(l″)

(63) Jo cuts hair with a razor. Ch(k″)E[Vr(r″)E[Bv(v″)

(64) Helen heard Robert playing the piano. Th_1(k″)A[Th_2(k″)Ar(r″)]

(65) The wind damaged the roof. Tm(m″)Ar(r″)

(66) The tail of the dog wagged furiously.

i.e. The tail of the dog wagged in a furious way. Bv(k″)Ne′(e″)

(67) Our home faces the beach $Zr(l'')Dl(l'')$

(68) Our house is far way from the beach $Zr(l'')Fl(l'')$

(69) The man went to the beach with his wife. $B[Bh_1(l'')Gl(l'')]Jh_2(l'')$

(70) The man causes his son to leave the room.

$Ch_1(k'')E[Bh_2(k'')Sl(l'')]$

(71) The man lets his son leave the room. $Lh_1(k'')E[Bh_2(k'')Sl(l'')$

(72) The man tries to have his son leave the room.

$Uh_1(k'')E[Bh_2(k'')Sl(l'')]$

(73) The man fails to have his son leave the room.

$Rh_1(k'')E[Bh_2(k'')Sl(l'')$

(74) The city of Kampala is geographically part of Buganda.

$Zl_1(l'')Wl_2(l'')$

If we assume that all entities result from changes (i.e. dynamic situations), we can formalize the changes to obtain semantic equations as in (75)-(78)

(75a) h_1 kissed h_2 .

(75b) $Th_1(h'')Ah_2(h'') \longrightarrow Zh_1[Th_1(h'')Ah_2(h'')]'$ kisser

$+ Zh_2[Th_1(h'')Ah_2(h'')]'$ kissee

(76a) h_1 pays r to h_2

(76b) Ch_1 (k")E[Hh_2 (k")Ar(l")] ⟶ Zh_1[Ch_1(k")E[Hh_2(k")Ar(l")]' payer

+Zh_2[Ch_1(k")E[Hh_2(k")Ar(l")]' payee

+Zr[Ch_1(k")E[Hh_2(k")Ar(l")]' payment

(77a) h_1 teaches τ to h_2.

(77b) Ch_1(h")E[Ih_2(h")Aτ (δ) ⟶ Zh_1[Ch_1(h")E[Ih_2(h")Aτ(δ)]' teacher

+ Zh_2[Ch_1(h")E[Ih_2(h")Aτ(δ)]' pupil/learner

+ Zτ[Ch_1(h")E[Ih_2(h")Aτ(δ)]' teaching

(78a) h bakes r in l.

(78b) B[Ch(k")Er(m")]Nl(l") ⟶ Zh[B[Ch(k")Er(m")]Nl(l")]' bakery worker

+ Zr[B[Ch (k")Er(m")]Nl(l")]' bakery product

+ Zl[B[Ch(k")Er(m")] Nl(l")]' bakery

From (75) – (78), it is clear that the general semantic formula for the category type τ is (79).

(79) Zτ[σ]'

To conclude, what purports to constitute a solution to the problem of determining roles resides in the evidenced formalizing superiority of the new

formal logical language which incorporates roles as predicates and ontological categories as object variables.

References

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