A Periodic System of Conceptual Elements

What is the general logical structure of scientific thinking? This is the question to be tackled in this Chapter which is the cornerstone of the inquiry.

I regard the following concepts (which I symbolise for the task ahead) as scientifically universal and fundamental:

A (a) predicate or property (in the logical sense)   Q
   (b) space   L
   (c) matter   M
   (d) change   C
   (e) time   T
   (f) forces (gravitational interaction)   K
   (g) electric currents (electromagnetic interaction)   A
   (h) heat (thermal energy)   W
   (i) light (optical energy)   B
   (j) plants   F
   (k) animals   Z
   (l) humans   H
   (m) material objects   R
   (n) non-material objects   X
   (o) numbers   N
   (p) propositions   P
   (q) systems   S

B (a) possession   h
   (b) conjunction   j
   (c) disjunction   d
   (d) mutation   v
   (e) gradation   g
   (f) similarity   s
   (g) equality   e
   (h) relativity   m
   (i)   y
   (j) perception   w
   (k) will   l
   (l) attempting   u
   (m) thinking   k
   (n) initiation   i
   (o) augmentation   q
   (p) affecting   a
   (q) causation   c
   (r) repetition   f
   (s) possibility   p
   (t) necessity   n

A formal logician studies systems (S) of propositions (P) which, in turn, are obtained by ascribing properties (Q) to theoretical objects. A pure mathematician concentrates on spaces (L) and numbers (N). A pure physicist is interested in forms of matter (M), changes and states of matter (C), time (T) forces, (K), electric currents (A), thermal energy (W), optical energy (B) and material objects (R). A pure chemist studies transformations of matter. A pure biologist studies plants (F), animals (Z) and the special animal the human being (H).

In order to establish a connection between the concepts of both lists, I introduce the symbols π and ω to represent them. The symbol p stands for what I will call conceptual periods, i.e. Q, L, M,…N, P, S. The symbol W stands for what I label conceptual bonds, i.e. h, j, d,…f, p, n. Whenever the mind relates (or bonds) two entities from one or two conceptual periods, a conceptual union takes place according to the conceptual equation in (1).

1. $\pi_1\pi_2 = \pi_1\,\Psi_1 + \pi_2\,\Psi_2$
   where $= \pi_1\,\Psi_1$ and $\pi_2\,\Psi_2$ are conceptual elements. The equation in (1) can be read as "Pie-one omega pie-two equals pie-one gamma-one plus pie-two-gamma-two". Taking the bonds one at a time, we write down equations (2)-(24)

2. for the possessive bond
   $\pi_1\,h\,\pi_2 = \pi_1\,h + \pi_2\,o$

3. for the conjunctive bond
   $\pi_1\,j\,\pi_2 = \pi_1\,j + \pi_2\,o$

4. for the disjunctive bond
   $\pi_1\,d\,\pi_2 = \pi_1\,d + \pi_2\,o$

5. for the mutative bond
   $\pi_1\,v\,\pi_2 = \pi_1\,v + \pi_2\,r$

6. for the gradative bond
   $\pi_1\,g\,\pi_2 = \pi_1\,g + \pi_2\,o$

7. for the similative bond
   $\pi_1\,s\,\pi_2 = \pi_1\,s + \pi_2\,o$

8. for the equative bond
   $\pi_1\,e\,\pi_2 = \pi_1\,e + \pi_2\,o$

9. for the relative bond
   $\pi_1\,m\,\pi_2 = \pi_1\,m + \pi_2\,o$

10. for the directive bonds (10) - (13)
    $\pi_1\,y\,\pi_2 = \pi_1\,y + \pi_2\,o$

11. for the perceptive bond
    $\pi_1\,w\,\pi_2 = \pi_1\,w + \pi_2\,o$

12. for the volitive bond
    $\pi_1\,l\,\pi_2 = \pi_1\,l + \pi_2\,o$

13. for the probative bond
    $\pi_1\,u\,\pi_2 = \pi_1\,u + \pi_2\,r$

14. for the cogitative bond
    $\pi_1\,k\,\pi_2 = \pi_1\,k + \pi_2\,r$

15. for the initiative bond

$\unicode{x265B}_1 \; i \; \unicode{x265B}_2 = \unicode{x265B}_1 \; i + \unicode{x265B}_2 \; r$

16. for the augmentative bond

$\pi_1 \; q \; \pi_2 = \pi_1 \; q + \pi_2 \; r$

17. for the affective bond

$\unicode{x265B}_1 \; a \; \unicode{x265B}_2 = \unicode{x265B}_1 \; a + \unicode{x265B}_2 \; b$

18. for the causative bond

$\pi_1 \; c \; \pi_2 = \pi_1 \; c + \pi_2 \; r$

19. for the repetitive bond

$\pi_1 \; f \; \pi_2 = \pi_1 \; f + \pi_2 \; r$

20. for the possibility bond

$\unicode{x265B}_1 \; p \; \unicode{x265B}_2 = \unicode{x265B}_1 \; p + \unicode{x265B}_2 \; r$

21. for the necessity bond

$\pi_1 \; n \; \pi_2 = \pi_1 \; n + \pi_2 \; r$

In (1) ♛$_1$ and ♛$_2$ are variables for conception groups. Consequently, $\unicode{x265B}_1$ h, $\unicode{x265B}_2$ o, $\unicode{x265B}_1$ j, π_1 d... π_2 r, ...π_2 b... ...π_2 n are conceptual elements. Let these elements be systematised in Table 1.

The 341 conceptual elements in the periodic system of conceptual elements are arranged according to increasing conceptual complexity or dependence. As soon as we agree to start with properties (Q), we must posit space (L). Matter occupies space. When matter undergoes change (C), the concept of time (T) becomes possible. Force (K) presupposes or depends on L, M, C and T. Electric currents are electrons (M) in motion. Electrical energy is transformable into thermal energy (W). Biotic periods F, Z and H depend on changes in the preceding periods. H is more complex than Z; and Z is more complex than F. Matter (M) manifests itself in objects R. The human mind produces non-material objects X, numbers N, propositions P. Finally, there are natural and human-made systems S.

The left-hand side of (1) can be used to formalise propositions in a calculus, which I am presenting here. Prior to examples of formalisation in (22)-(121) let me present the conceptual periods, the conceptual bonds together with their mode of reading and, to facilitate the learning of the symbols, the motivation of the choice of the letters.

Symbols	Mode of reading		Motivation
Q	property		"quality"
L	space		"length"
M	matter, mass		"mass"
C	change		"change"
T	time		"time"
K	force	Ger. *Kraft*	"force"
A	electric matter		"ampere"
W	thermal energy	Ger.*Wrme*	"heat"
B	optical energy		"brightness"

F	plant	Ger. *Pflanze*	"plant"
Z	animal	Gk *zoon*	
H	human	Lat. *humanus*	"human"
R	material object	Lat. *res*	"thing"
X	non-material object	(to be specially noted)	
N	number		"number"
P	proposition		"proposition"
S	system		"system"
h	has, is		"has"
j	and		"joins"
d	or		"disjoins"
v	becomes		"varies"
g	is greater than		"greater"
s	is similar to		"similar"
e	equals		"equals"
m	is in		"medium"
y	faces........ [according to usual practice in mathematics and physics]		
w	perceives	Ger. *wahrnehmen*	"to perceive"
l	likes (to)		"likes"
u	attempts to		"undertakes"
k	thinks that		"cogitates
i	begins to		"initiates"
q	intensifies		"quickens"
a	acts on		"affects"
c	brings about		"causes"
f	repeats		"-fold"
p	can		"possibility"
n	must		"necessity"

Groups 2, 6 and 19 are the groups of bearer, result and affected respectively; but they are not required at this stage of the exposition. To be particularly noted are the following modified and logical symbols:

(a) ⌐⌐ is the contradictive of Ω.
(b) ∃∀ are logical quantifiers.
(c) o′ is a non ⁻o ; o· is the contradictive of o.
(d) Ω′ is the negated Ω.
(e) Ω⁻ is a contrapositive of Ω such that if o_1 Ω o_2 is a union, then o_2 Ω⁻ o_1 is the same union; i.e. $[o_2$ Ω⁻ $o_1]$
     = def.$[o_1$ Ω$o_2]$
(f) $[o_1$ Ω⁰ $o_2)] =$ def.$[[o_1$ Ω′ $o_2]$ j $[o_1$ Ω′ $o_2]$ i.e. Ω⁰ is the neutral of Ω.
(g) o^0 is the neutral of o .

22. Ali is in the house.
    H m L

23. Kaguta's car is red.

R h Q

24. The road widens here.

$[[L_o \text{ h Q'}] \text{ v } [L_o \text{ h Q }]] \text{ m L}$

25. This crucible contains molten steel.

$R_1 \text{ m } R_o$

26. Ice is frozen water.

$R_1 \text{ h } R_2$

27. The workmen spoiled the carpet with their boots.

$[R_1 \text{ h Q'}] \text{ v } [R_1 \text{ h Q}]$

$R_2 \text{ c } [[R_1 \text{ h Q'}] \text{ v } [R_1 \text{ h Q }]]$

$H \text{ c } [R_2 \text{ c } [[R_1 \text{ h Q'}] \text{ v } [R_1 \text{ h Q}]]]$

28. The liquid boiled.

$[R \text{ h Q'}] \text{ v } [R \text{ h Q }]$

29. John boiled the liquid.

$H \text{ c } [[R \text{ h Q'}] \text{ v } [R \text{ h Q}]]$

30. John opened the door with the key.

$[R_1 \text{ h Q'}] \text{ v } [R_1 \text{ h Q}]$ (The door opened.)

$R_2 \text{ c } [[R_1 \text{ h Q'}] \text{ v } [R_1 \text{ h Q}]]$ (The key opened the door.)

Thus, $Hc \text{ } [R_2 \text{ c } [[R_1 \text{ h Q'}] \text{ v } [R_1 \text{ h Q}]]]$

31. A thief broke my mother's bowl.

$H \text{ c } [[R \text{ h Q'}] \text{ v } [R \text{ h Q}]]$

32. My mother's bowl was broken by a thief.

$[[R \text{ h Q'}] \text{ v } [R \text{ h Q}]] \text{ c}^- \text{ H}$

33. The hammer smashed the glass.

$R_2 \text{ c } [[R_1 \text{ h Q'}] \text{ v } [R_1 \text{ h Q}]]$

34. The hammer struck the glass.

$R_2 \text{ a } R_1$

35. Caesar was assassinated in Rome.

$[H_1 \text{ h Q'}] \text{ v } [H_1 \text{ h Q}]$ (Caesar died.)

$H_2 \text{ c } [[H_1 \text{ h Q'}] \text{ v } [H_1 \text{ h Q}]]$ (H_2 assassinated Caesar.)

$[[H_1 \text{ h Q'}] \text{ v } [H_1 \text{ h Q}]] \text{ c}^- \text{ } H_2$ (Caesar was assassinated by H_2.)

$[[[H_1 \text{ h Q'}] \text{ v } [H_1 \text{ h Q}]] \text{ c}^- \text{ } H_2] \text{ m L}$

36. The terrorists sent the Prime Minister a letter bomb.

$H \text{ c } [[R \text{ m}' \text{ H}] \text{ v } [R \text{ m } H_1]]$

37. Ruth knitted Bryan a sweater.

$[H_1 \text{ c}[R'\text{v R}]] \text{ j } [H_1 \text{ c } [[H_2 \text{ h R'}] \text{ v } [H_2 \text{ h R}]]]$

38. Ali bakes .

H c C

39. Ali bakes in the kitchen.

$[H \text{ c C}] \text{ m L}$

40. John believed that he would win.

$H \text{ k } [[H \text{ h Q'}] \text{ v } [H \text{ h Q}]]$

41. He (H_1) and his wife (H_2) are coming.

$[[H_1 \text{ j } H_2] \text{ m L'}] \text{ v } [[H_1 \text{ j } H_2] \text{ m L}]$

42. The farmer loaded the truck (R_2) with hay (R_1).

H c [[R_2 j R'_1] v [R_2 j R_1]]

43. The farmer loaded hay (R_1) onto the truck (R_2).

H c [[R_1 m′ R_2] v [R_1 m R_2]]

44. The eclipse of the sun is tomorrow.

C m T

45. $7 + 9 = 16$

[N_1 j N_2] e N

46. $7 < 9$

N_1 g N_2

47. 7 is a prime number.

N h Q

48. Germans are Europeans.

$\forall$H [H h Q]

49. Professor Walusimbi is a member of the Faculty.

H h⁻ X

50. The helium atom has two electrons.

R h [R_1 j R_2]

51. $9 > 7$

N_2 g N_1

52. 3.142 is approximately equal to 22/7.

N_1 s N_2

53. o∫² 2 x d x = 4

N_1 e N_2

54. The solution turns red.

[R h Q'] v [R h Q]

55. The earth R rotates about its axis L.

[[R_1 m L_1] v [R_1 m L_2]] m L

56. A stream of electrons strikes a metal target.

R_1 a R_2

57. The stream of electrons R causes the emission of x-rays.

R c [B' v B]

58. A chemist smells chlorine.

H w M

59. The cat wants to jump.

Z l [[[Z m L_1] v [Z m L_2]] z L]

60. The cat tries to jump.

Z u [[[Z m L_1] v [Z m L_2]] z L]

61. Ali learns Chinese.

H c [H w X]

62. The piece of litmus paper turns either blue or red.

[[R h Q'$_1$] j [R h Q'$_2$]] v [[R h Q$_1$] d [R h Q$_2$]]

63. Frowning is a sign of disapproval.

C_1 e C_2

64. Kenyans remember the colonial period.

H k [H m T⁻]

65. The girl prefers the book R_o.
$\exists R\ [[H\ l\ R_o]\ g\ [H\ l\ R]]$

66. The lawyer believes the statement.
$H\ k\ P$

67. The lawyer withholds the statement.
$H\ k\ P^o$

68. The lawyer understands the statement.
$H\ w\ P$

69. The lawyer contrives a statement.
$H\ c\ [[P'\ v\ P\ ]\ j\ [H\ k\ P^o]]$

70. Light travels through a vacuum.
$[[B\ m\ L_1]\ v\ [B\ m\ L_2]]\ m\ L$

71. Sound travels through a copper wire.
$[[C\ m\ L_1]\ v\ [C\ m\ L_2]]\ m\ R$

72. The volume L of the gas R increases.
$[R\ h\ L_1]\ q\ [\ R\ h\ L_2]$

73. The post office L1 is to the right of the bank L_2.
$[\ L_1\ m\ L\ ]\ x\ L_2$

74. John climbed up on the mountain R_o.
$H\ c\ [\ [\ [H\ m\ L_1\ ]\ v\ [\ H\ m\ L_2]]\ z\ R_o]$

75. John climbed the mountain.
$H\ a\ R$

76. She is happy.
$H\ h\ Q$

77. The Sahara is hot.
$L\ h\ Q$

78. Last night was warm.
$T^{\cdot}\ h\ Q$

79. The show was interesting.
$C\ h\ Q$

80. It is windy.
$[K\ m\ L_1]\ v\ [K\ m\ L_2]$

81. He was at school.
$H\ m\ L$

82. She got into the car.
$[H\ m\ R']\ v\ [\ H\ m\ R]$

83. The meeting is at eight.
$C\ m\ T$

84. He was working.
$H\ c\ C$

85. She is standing.
$H\ h\ Q$

86. The wind is blowing.
$[K\ m\ L_1]\ v\ [K\ m\ L_2]$

87. It is raining.
$[M\ m\ L´\ ]\ v\ [M\ m\ L]$

88. Lighting struck the house.

C a R

89. He is holding a knife.

H c [H c [R m L]]

90. She has a car.

H h R

91. I wrote a letter.

H c [R' v R]

92. He has left the town.

[H m L] v [H m L']

93. The meeting lasted two hours.

[C m T_1] v [C m T_2]

94. Time passes.

T_1 v T_2

95. AB meets CD

L_1 a L_2

96. He knows the Pythagorean Theorem.

H h P

97. The variable approaches 0.

[X y N] v [X s N]

98. The variable assumes the value 0.

[X e' N] v [X e N]

99. Ali cooked the rice in a pot.

H c [[[R h Q'] v [R h Q] m R_o]

100. Ali cooked the rice in the kitchen.

H c [[R h Q'] v [R h Q] m R_o] m L

101. Fatuma gave the book to Ali.

H_1 c [[H_2 a' R] v [H_2 a R]]

102. He turned traitor.

[H h Q'] v [H h Q]

103. He threw the ball upwards.

H c [[R m H] v [R m L]]

104. The curtains disappeared.

[[R m L] j [H p [H w R]]] v [[R m L'] j [H p' [H w R]]]

105. The bus seats thirty.

H p [H m R]

106. They had an argument yesterday.

[H c C] m T·

107. The revolver made her afraid.

R c [[H h Q'] v [H h Q]]

108. I found it strange.

H k [X h Q]

109. He resembles his father.

H_1 s H_2

110.　　　I am taking the bus.
　H c [[[H m R] m L₁] v [[H m R] m L₂]]
111.　　　They treat the birds badly.
　[H a Z] h Q
112.　　　Ten divided by five equals two.
　[N₁ a⁻ N₂] e N₃
113.　　　The storm drove the ship ashore.
　K c [[R m L₁] v [R m L₂]]
114.　　　He placed it on the shelf.
　H c [[R₁ m R'₂] v [R₁ m R₂]]
115.　　　The sun turned it yellow.
　R₁ c [[R₂ h Q'] v [R₂ h Q]]
116.　　　The will benefits us all.
　X l⊢ H
117.　　　The man fell asleep.
　[H h Q'] v [H h Q]
118.　　　The shop opens at eight.
　[[L h Q'] v [L h Q]] m T
119.　　　He is thinking about his wife.
　H₁ k [P m H₂]
120.　　　He opened the door for his wife.
　H₁ c [[[R₁ h Q'] v [R₁ h Q]] m H₂]
121.　　　My hair dried in the sun.
　R c [[Rₒ h Q'] v [Rₒ h Q]]

Returning to the periodic system of conceptual elements, we note that some slots in the system remain vacant. The explanation for the empty slots is that only the biotic entities F, Z, H, X (like God) and S (e.g. human institutions) can perceive, like and try to do something. Further, only H, X and S are mentally endowed and can, therefore, think or ratiocinate systematically.

So far I have generated the periodic system by considering the general conceptual union involving o_1, o_2 and ⧆. In (122)-(126) I show how conceptual elements combine to form conceptual molecules.

122.　　　$o_1 . ⧆o_2 = o_1$ ⌘$_1$ + o_2 ⌘$_2$ = o_1 [o_2 ⌘$_1$] ⌘$_2$
123.　　　$o_1 . ⧆o_2 = o_1$ ⌘$_1$ + o_2 ⌘$_2$ = o_2 [o_1 ⌘$_1$] ⌘$_2$
124.　　　**a)** The man sees the bus.
　H w R
b) the man who sees the bus
　H w R = H w + Ro
　　　= H [Ro]w
c) The bus which is seen by the man.
　H w R = H w + Ro
　　　= R [H w]o

125.   **a)** Der Mann kocht die Suppe.
The man boils the soup.
H c [[R h Q'] v [R h Q]]
b) Die Suppe wird (vom Mann) gekocht.
The soup is boiled (by the man).
[[R h Q'] v [R h Q]] c⁻ H
c) H c [[R h Q'] v [R h Q]]
= H c [R [Q'$_o$] h v R [Q$_o$]h]
= H c [R[Q'$_o$] hv + R[Q$_o$] hr]
= H c R [R [Q'$_o$] hr Q$_o$] hr
= H c +R [R [Q'$_o$] hv Q$_o$] hr^2
d) der die Suppe kochende Mann
the soup boiling man
the man who is boiling the soup
the soup-boiling man
H[R[R[Q'o]hv.Qo]hr^2] c
e) die von dem Mann gekochte Suppe
the by the man boiled soup
the soup which is boiled by the man
R[Hc [Q'o]hv Qo] hr^2
126.   **a)** baker
H c C   (Some person bakes.)
H c C = Hc + Cr
= H [Cr]c   (baker)
b) bakery
C m L   (Baking happens in some place.)
C m L = Cm + Lo = L [Cm]o   (bakery)

In (122)-(126), it can now be claimed, I show that my conceptual calculus goes further than standard predicate calculus in formalising the inner logical structure of propositions and objects. In the next Section I wish to formulate the theory of scientific terminology which I have all along been referring to. It should be particularly appreciated that my concept of theory is identical to that of logicians, mathematicians and theoretical physicists. The sketch of Newtonian theory in Section I.3 springs to mind. The viability of the theory will rest on its power to describe, retrodict, explain, predict and classify phenomena of terminology modernization.