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The chapters where a work is cited are indicated by the numbers in brackets at the end of a listing.

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Glossary

These ambiguities, redundancies, and deficiencies recall those attributed by Dr. Franz Kuhn to a certain Chinese encyclopaedia entitled Celestial Emporium of Benevolent Knowledge. *On those remote pages it is written that animals are divided into (a) those that belong to the Emperor, (b) embalmed ones, (c) those that are trained, (d) suckling pigs, (e) mermaids, (f) fabulous ones, (g) stray dogs, (h) those that are included in this classification, (i) those that tremble as if they were mad, (j) innumerable ones, (k) those drawn with a very fine camel's hair brush, (l) others, (m) those that have just broken a flower vase, (n) those that resemble flies from a distance.*

Jorge Luis Borges, "The Analytical Language of John Wilkins," *Other Inquisitions*

This glossary lists most of the formal notations used in this book. Omissions fall primarily into the following four categories:

- Symbols that are highly specific to a problem or to a narrow microworld, such as "john," "table," and "heat_flow."
- Standard mathematical notation that is infrequently used, such as "sin(X)".
- Grouping symbols: parentheses, brackets, and commas.
- Notations that are dependent on a particular structuring of symbols, rather than on the use of a particular symbol, such as $\alpha^{\mathcal{I}}$, meaning the interpretation of α under interpretation $\mathcal{I}$.

An entry in this glossary consists of the following four parts, separated by periods.

1. The symbol and its use. A prefix symbol is followed immediately by its arguments. For a symbol that is not a prefix, we first list the symbol, then illustrate its placement relative to its arguments.

As in the text, object-level variables are represented by italicized capital symbols; metalevel variables are represented by Greek letters.

2. The category of the symbol. This is one of the following:
   - First-order logical symbol
   - Constant symbol
   - Function symbol
   - Predicate symbol
   - Special symbol; a symbol that appears inside a first-order formula, but is not interpreted in a standard way; syntactic sugar
   - Modal operator
   - Metalevel symbol
   - Symbol associated with plausible reasoning.
3. Explanation of the symbol, including the sorts or categories of its arguments.
4. Reference to the page where the symbol is defined.

Some symbols are given more than one definition. Some of these are symbols that have different categories in different theories, such as "know," which can be either a modal operator or a predicate with a string argument. Others are symbols that have been overloaded, such as square brackets, which can be used for grouping, to indicate a closed interval, or to indicate the sign of a quantity.

$\neg\phi$.	Logical. Negation of sentence ϕ. [p. 31]
$\vee$. $\phi \vee \psi$.	Logical. Boolean operator: Formula ϕ or formula ψ. [p. 31]
$\wedge$. $\phi \wedge \psi$.	Logical. Boolean operator: Formula ϕ and formula ψ. [p. 31]
$\Rightarrow$. $\phi \Rightarrow \psi$.	Logical. Boolean operator: Formula ϕ implies formula ψ. [p. 31]
$\Leftrightarrow$. $\phi \Leftrightarrow \psi$.	Logical. Boolean operator: Formula ϕ if and only if formula ψ. [p. 31]
$\dot{\vee}$. $\phi \dot{\vee} \psi$.	Logical. Boolean operator: Either formula ϕ or formula ψ but not both. [p. 31]
$\forall\mu\alpha(\mu)$.	Logical. Universal quantifier: Formula α holds for all values of variable μ. [p. 36]

$\exists\mu\alpha(\mu)$.	Logical. Existential quantifier: Formula α holds for some value of μ. [p. 36]
$\exists^1\mu\alpha(\mu)$.	Logical. Unique existential quantifier: Formula α holds for a single value of μ. [p. 47]
0.	Constant. Zero. [p. 155]
∞.	Constant. Infinite quantity. [p. 151]
$\perp$.	Constant. Null value. [p. 44]
$\emptyset$.	Constant. The empty set. [p. 49]
[ ]. $[L,U]$.	Function. Closed interval from quantity L to quantity U. [p. 151]
[ ]. $[X]$.	Function. Sign of quantity X, or interval containing X in some fixed partition. [p. 161, 168]
+. $X+Y$.	Function. Sum of quantities X and Y. [p. 155]
{ }. $\{X1, X2, \ldots Xk\}$.	Function. The set containing $X1, X2, \ldots Xk$. [p. 48]
$-X$.	Function. Negative of differential quantity X. [p. 155]
$-$. $X-Y$.	Function. Difference of quantities X and Y. [p. 155]
$-$. $S-T$.	Function. Difference of sets S and T. [p. 50]
$\cup$. $S \cup T$.	Function. Union of sets S and T. [p. 50]
$\cap$. $S \cap T$.	Function. Intersection of sets S and T. [p. 50]
<>. $< X1, X2 \ldots >$.	Function, Tuple of entities $X1, X2 \ldots Xk$. [p. 50]
$\cdot$. $X \cdot Y$.	Function. Product of quantity X with quantity Y. [p. 157]
ΔX.	Function (relative to two implicit situations). Change in parameter X from one situation to the other. The value of ΔX is in the differential space of the range of X. [p. 161]
$\|\|$. $\| S \|$.	Function. The cardinality of set S. [p. 158]

∂X.	Function. Sign of the derivative of parameter X. ∂X is a fluent whose range is the differential space of the range of X. [p. 166]
$\sim A$.	Function. Negation of state A. $\sim A$ is a state. [p. 224, 402]
(). (X, Y).	Function. Open interval from quantity X to quantity Y. [p. 152]
=. $X = Y$.	Predicate. Entity X is equal to entity Y. [p. 43]
<. $X < Y$.	Predicate. Quantity X is less than quantity Y. [p. 147]
$\in$. $X \in S$.	Predicate. Entity X is an element of set S. [p. 48]
$\subseteq$. $S \subseteq T$.	Predicate. Set S is a subset of set T. [p. 50]
$\ll$. $X \ll Y$.	Predicate. Quantity X is negligible as compared to quantity Y. [p. 180]
$\neq$. $X \neq Y$.	Predicate. Entities X and Y are not equal. [p. 43]
$\sim$. $X \sim Y$.	Predicate. Sign X is compatible with sign Y. [p. 161]
$\propto_{Q+}$. $F \propto_{Q+} G$.	Predicate (sort of; see text). Parameter F is qualitatively proportional to parameter G. [p. 322]
$\propto_{Q-}$. $F \propto_{Q-} G$.	Predicate (sort of; see text). Parameter F is inversely qualitatively proportional to parameter G. [p. 322]
{ | }. { μ | $\alpha(\mu)$ }.	Special. The set of all μ such that α holds. [p. 48]
$\prec\succ$. $\prec$ABCDE$\succ$.	Special. String of characters ABCDE. [p. 78]
@. $\prec$@X@$\succ$.	Special. Splice the name of X into a character string. [p. 370]

!. $\prec!X!\succ$. Special. Splice X with an extra level of quotation into a character string. [p. 370]

↓. $\prec\downarrow X\downarrow\succ$. Special. Splice string X into a character string. [p. 370]

$\iota(\mu)\alpha(\mu)$. Special. μ is a variable, and α is an open formula. The unique μ such that $\alpha(\mu)$ holds. [p. 48]

$\models$. $\models \phi$. Metalevel. Sentence ϕ is universally valid. [p. 29]

$\models$. $\mathcal{I} \models \phi$. Metalevel. Sentence ϕ is true in interpretation $\mathcal{I}$. [p. 29]

$\models$. $\Gamma \models \phi$. Metalevel. Sentence ϕ is a semantic consequence of set of sentences Γ. [p. 29]

$\vdash$. $\Gamma \vdash \phi$. Metalevel. Formula ϕ can be proven from set of formulas Γ. [p. 29]

ab(X). Predicate. Entity X is abnormal (used in nonmonotonic inference). [p. 113]

abut(**RR, PP, FF**). Predicate. Regions **RR** and **PP** abut in boundary **FF**. [p. 258]

acquainted(AA). Function. State of all the agents in set AA having common knowledge of their respective names. [p. 438]

action($ACTOR, ACTION, OBJECT, SOURCE, DESTINATION$). Function. In conceptual dependency, the event type of agent $ACTOR$ performing action type $ACTION$ on object $OBJECT$ taking it from location *SOURCE* to location *DESTINATION*. [p. 450]

active(S, P). Predicate. Process P is active during situation S. [p. 323]

actor_of(E). Function. The agent who is the actor of event type E. [p. 410]

after(θ, ϕ). Modal. The state that follows if event ϕ occurs in a situation where state θ holds. [p. 231]

always. Constant. The set of all situations. [p. 224]

angle(**X,Y,Z**). Function. The angle formed by the rays **Y** − **X** and **Y** − **Z**. [p. 251]

angle($\hat{E}, C$). Function. The angle between direction $\hat{E}$ and the x axis of coordinate system C (in two dimensions). [p. 298]

angle($\mathcal{F}, C$). Function. The angle between the x axes of coordinate systems $\mathcal{F}$ and C (in two dimensions). [p. 298]

apply($O, A1 \ldots Ak$). Function. Combines a string O, which spells out an operator, with strings $A1 \ldots Ak$, which spell out arguments, and returns the string that spells out the application of O to $A1 \ldots Ak$. [p. 78]

assumptions(S). Metalevel. In natural deduction, the assumptions of proof step S. [p. 87]

atrans. Constant. In CD, the action type of transferring possession. [p. 452]

attend. Constant. In CD, the action type of focusing a sensory organ. [p. 452]

before(I, J). Predicate. Interval I ends strictly before interval J begins. [p. 148]

believe(A, ϕ, S). Modal. Agent A believes sentence ϕ in situation S. (S may be omitted if time is not an issue.) [p. 356, 381]

believe(A, P, S). Predicate. Agent A believes the sentence spelled out by string P in situation S. (S may be omitted if time is not an issue.) [p. 356, 367]

believing(A, ϕ). Modal. The state of agent A believing sentence ϕ. [p. 381]

believing(A, P). Function. The state type of A believing the sentence spelled out by P. [p. 381]

bel_acc($A, W1, W2$). Predicate. Possible world $W2$ is accessible from world $W1$ relative to the beliefs of A. [p. 72, 365]

border(**RR, PP,**S). Predicate. In TOUR, path **PP** is on the border of region **RR**. S is a Boolean, indicating

whether the forward direction of **PP** goes clockwise or counterclockwise around **RR**. [p. 281]

boundary(**AA**). Function. The boundary of region **AA**. [p. 258]

bounded(**RR**). Predicate. Region **RR** is bounded. [p. 255]

bpc($A, B1, B2$). Predicate. Behavior $B2$ is compatible with the perceptions of agent A in behavior $B1$. [p. 388]

bulk(**RR**, $\tilde{D}$). Predicate. Region **RR** is bulk with radius $\tilde{D}$ (see text for formal definition). [p. 343]

can_achieve(A, G, S). Predicate. Agent A can achieve goal G in situation S. [p. 422]

can_do(A, P, S). Predicate. Agent A can perform plan P in situation S. [p. 422]

card(S). Function. Cardinality of set S. [p. 158]

change(F, D). Function. Event type of quantity-valued fluent F changing in direction D. [p. 452]

circle(**O**, $\tilde{D}$). Function. The circle with center **O** and radius $\tilde{D}$. [p. 251]

CIRC($\mathcal{T}, \mu$). Plausible. The circumscription of theory $\mathcal{T}$ in predicate μ. [p. 111]

ck_acc($FAA, W1, W2$). Predicate. Possible world $W2$ is accessible from world $W1$ relative to the common knowledge of FAA. FAA is a fluent ranging over sets of agents. [p. 439]

clock_time. Constant. The fluent that gives the clock time in a given situation. [p. 190]

close(X, Y). Predicate. The difference between quantities Y and X is negligible as compared to their magnitude. [p. 180]

colinear(**X, Y, Z**). Points **X, Y, Z** are colinear. [p. 251]

common_know(SAA, P, S). Predicate. The agents in the set denoted by string SAA have common knowledge of the sentence spelled out by string P in situation S. [p. 438]

complement(**RR**). Function. The complement of region **RR**. [p. 255]

concs($\mathcal{S}, \mathcal{D}, \mathcal{E}$). Plausible. In default logic, the conclusions from the set of sentences $\mathcal{S}$ using default rules $\mathcal{D}$ in extension $\mathcal{E}$. [p. 116]

concurrent($E1 \ldots Ek$). Function. The event type of event types $E1 \ldots Ek$ occurring concurrently. [p. 228]

cond($A, E1, E2$). Function. The event type "If state type A holds, then event type $E1$, else event type $E2$." [p. 225]

cond(θ, ϕ_1, ϕ_2). Modal. If state θ, then event ϕ_1, else event ϕ_2. [p. 231]

congruent(**AA,BB**). Predicate. Regions **AA** and **BB** are congruent without reflection. [p. 255]

conj(Q). Function. Conjugate of quaternion Q. [p. 302]

connected_component(**CC, XX**). Predicate. Region **CC** is a connected component of region **XX**. [p. 255]

connected(**XX**). Predicate. Region **XX** is connected. [p. 255]

contains(I, J). Predicate. Interval I contains interval J. [p. 149]

content($\mathcal{S}$). Metalevel. In natural deduction, the content of proof step $\mathcal{S}$. [p. 86]

coor1(**P**, $\mathcal{C}$). Function. Maps a k-dimensional point **P** and a coordinate system $\mathcal{C}$ onto a $k+1$-by-1 column array consisting of the coordinates of **P** in $\mathcal{C}$ followed by 1. [p. 297]

coordinates(**P**, $\mathcal{C}$). Function. The coordinates (a k-tuple) of k-dimensional point **P** in coordinate system $\mathcal{C}$. [p. 247, 295]

cylinder($\tilde{L}, \tilde{R}, \mathcal{F}$). Function. The right circular cylinder of height $\tilde{L}$ and radius $\tilde{R}$ with the bottom face in the x-y plane of coordinate system $\mathcal{F}$ centered at the origin. [p. 274]

d_belief(A, ϕ). Modal. The degree (a real number) to which agent A believes sentence ϕ. [p. 370]

dbl_quote(S). Function. String S with an extra level of quotation (a string). [p. 81]

dboundary(**RR**). Function. Boundary of two-dimensional region **RR** directed counterclockwise around **RR**. [p. 276]

dboundary(**RR**). Function. Boundary of three-dimensional region **RR** directed outward from **RR**. [p. 343]

declarative. Constant. Declarative mode of illocutionary acts.

dedge(**X**,**Y**). Function. Directed edge from **X** to **Y**. [p. 276]

deliberate(A, E). Function. Event type of the deliberate performance by A of the action denoted by string E. [p. 414]

delta(X). Function (relative to two implicit situations). Change in parameter X from one situation to the other. The value of delta(X) is in the differential space of the range of X. [p. 160]

denotation(S). Function. The entity denoted by string S. [p. 81]

deriv(P). Function. The derivative of parameter P with respect to time. deriv(P) is a parameter whose range is in the differential space of the range of P. [p. 165]

diameter(**RR**). Function. The diameter (a length) of region **RR**. [p. 249]

direction(**X**,**Y**). Function. The direction of the ray from **X** to **Y**. [p. 251]

dir_cosines($\hat{D}$, $\mathcal{C}$). Function. Maps k-dimensional direction $\hat{D}$ and coordinate system $\mathcal{C}$ to the k-tuple of directional cosines. [p. 295]

disable(S, E). Predicate. In CD, state S makes event E impossible. [p. 453]

distinct($X_1 \ldots X_k$). Predicate. Entities $X_1 \ldots X_k$ are all unequal. [p. 43]

dist(**X**,**Y**). Function. The distance (a length) between points **X** and **Y**. [p. 249]

do(A, E).	Function. The event type of agent A performing action type E. [p. 410]
during(I, J).	Predicate. Interval I starts after and ends before interval J. [p. 148]
empty(**RR**).	Function. State of region **RR** being empty. [p. 343]
enable(S, E).	Predicate. In CD, state S makes event E possible. [p. 453]
end(I).	Function. Maps an interval I to its least upper bound. [p. 151]
eql(F, G).	Function. The state type of fluent F being equal to fluent G. [p. 189]
equal(I, J).	Predicate. Intervals I and J are equal. [p. 148]
event_part($K1, K2$).	Predicate. Event token $K1$ is part of event token $K2$. [p. 192]
expel.	Constant. In CD, the action type of emitting something from the body of the agent. [p. 452]
FALSE.	Metalevel. Falsehood. [p. 32]
feasible(P).	Function. State of plan P being feasible. [p. 398]
filled_liquid(**RR**).	Function. State of region **RR** being filled with liquid. [p. 343]
finishes(I, J).	Predicate. Interval I starts after interval J, but they end together. [p. 148]
fixed(O).	Predicate. Object O is immovable. [p. 334]
flow_through(**F**).	Function. Fluent of the flow of liquid through directed face **F**. [p. 343]
future(ϕ).	Modal. State ϕ will hold at all future times. future(ϕ) is a state. [p. 231]
goal(A, G, S).	Predicate. In situation S, agent A has the goal denoted by string G. [p. 414]
goes_through(**FF, PP**).	Function. Event type of region-valued fluent **FF** going through region **PP**. [p. 262]

goodness(E, S). Function. The ethical value (a quantity) of event type E in situation S. [p. 449]

grasp. Constant. In CD, the action type of the agent grasping an object. [p. 452]

H(S). Plausible. Entropy. S is a probability distribution defined on a frame of discernment. [p. 131]

happiness(A). Function. In CD, the fluent of agent A's happiness over time. [p. 452]

health_val(A). Function. In CD, the fluent of agent A's health over time. [p. 452]

horizontal(**PP**). Predicate. Planar surface **PP** is horizontal. [p. 255]

illoc(AS, AH, M, P). Function. The event type of agent AS performing an illocutionary act with agent AH being the hearer, M being the mode, and string P being the content. [p. 442]

imperative. Constant. The imperative mode of an illocutionary act. [p. 442]

ind. Constant. The interval of all quantities. [p. 161]

infinite_on_left(I). Predicate. Interval I is unbounded below. [p. 151]

infinite_on_right(I). Predicate. Interval I is unbounded above. [p. 151]

influence(P, Q). Function. The influence of process P on parameter Q. influence(P, Q) is a fluent ranging over the differential space of Q. [p. 323]

ingest. Constant. In CD, the action type of consuming an object. [p. 452]

initiate(S, M). Predicate. In CD, action of state S initiates mental state M. [p. 453]

inside(**II, RR**). Predicate. Region **II** is an inside of region **RR**. [p. 251]

instrumental($E1, E2$). Predicate. In CD, action $E1$ is instrumental to action $E2$. [p. 453]

intersect(I, J). Predicate. Intervals I and J have more than a single point in common. [p. 207]

interval(I). Predicate. I is an interval. [p. 150]

is_constant(S). Predicate. String S is a constant. [p. 80]

is_inside(**II, BB**). Predicate. Region **II** is inside the box **BB**.

is_meaningful(S). Predicate. String S is meaningful (a term or a formula). [p. 80]

is_sentence(S). Predicate. String S is a sentence. [p. 80]

is_symbol(S). Predicate. String S spells out a single symbol. [p. 80]

is_term(S). Predicate. String S is a term. [p. 80]

join(I, J). Function. If I and J are intervals that meet, join(I, J) is the interval that starts with the beginning of I and ends with the end of J. [p. 149]

know(A, ϕ, S). Modal. Agent A knows sentence ϕ in situation S. (S may be omitted if time is not an issue.) [p. 373]

know(A, P, S). Predicate. Agent A knows the sentence spelled out by string P in situation S. (S may be omitted if time is not an issue.) [p. 373]

know_acc($A, W1, W2$). Predicate. Possible world $W2$ is accessible from world $W1$ relative to the knowledge of agent A. [p. 377]

know_fluent(A, F, S). Modal. In situation S, agent A knows the current value of fluent F. [p. 382]

knowing(A, ϕ). Modal. The state of agent A knowing sentence ϕ. [p. 381]

knowing(A, P). Function. The state type of agent A knowing the sentence spelled out by P. [p. 381]

know_val(A, τ, S). Modal. Agent A knows the value of term τ in situation S. [p. 378]

know_val(A, T, S). Predicate. Agent A knows the value of the term spelled out by string T in situation S. [p. 378]

know_whether(A, ϕ, S). Modal. Agent A knows in situation S whether sentence ϕ is true. [p. 378]

know_whether(A, P, S). Predicate. Agent A knows in situation S whether the sentence spelled out by string P is true. [p. 378]

kp_satisfied(A, E, S). Predicate. The knowledge preconditions of the action spelled out by string E are satisfied for agent A in situation S. [p. 419]

L(ϕ). Modal. ϕ is necessarily true. Used in this book as a generic modal operator. [p. 60]

label($\mathcal{S}$). Metalevel. In natural deduction, the label of proof step $\mathcal{S}$. [p. 86]

leads_to(P, G). Function. A state in which the execution of plan P will lead to the accomplishment of goal G. [p. 398]

liquid_at_rest(**RR**). Function. The state type of all the liquid in region **RR** being at rest. [p. 343]

liquid_in(**RR**). Function. The fluent of the quantity of liquid in region **RR**. [p. 342]

lower_bound(X, I). Predicate. X is a lower bound for interval I. [p. 151]

M(ϕ). Modal. ϕ is possibly true. Used here as a generic modal operator. [p. 60]

mbuild. Constant. In CD, the action type of making a mental construction. [p. 452]

meaning_of(S, K). Function. The meaning of string of phonemes S in speech-act token K. meaning_of(S, K) is a string of symbols in a formal language. [p. 443]

measure($\tilde{M}, \mathcal{C}$). Function. The measure (a real number) of length $\tilde{M}$ in coordinate system $\mathcal{C}$. [p. 295]

meets(I, J). Predicate. Interval I ends as interval J begins. [p. 148]

mloc(M, P). Function. In CD, the fluent of mental location P containing mental object M. [p. 452]

mode_of(S, K). Function. The mode of string of phonemes S in speech-act token K. For example, mode_of(S, K) may be "declarative" or "imperative." [p. 443]

monotonic(QD, QI, QF, SG). Predicate. Parameter QD depends on parameter QI in the direction indicated by sign SG for fixed values of parameter QF. [p. 163]

motionless(O). Function. The state of object O being motionless. [p. 345]

move. Constant. In CD, the action type of moving a body part. [p. 452]

mtrans. Constant. In CD, the action type of communicating information from one mental location to another. [p. 452]

name_of(X). Function. A constant string denoting entity X. [p. 81]

neg. Constant. The interval of negative quantities. [p. 161]

normal(**RR**). Predicate. Region **RR** is normal. [p. 258]

null. Constant. The event type of a no-op. [p. 226]

obligatory(E, S). Predicate. Event type E is obligatory in situation S. [p. 449]

occurs(I, E). Predicate. Event type occurs during interval I. [p. 192]

occurs(I, ϕ). Modal. Event ϕ occurs during interval I. [p. 231]

occurs_exclusively(K). Predicate. Event token K constitutes all that occurs during its time period. [p. 230]

occurs_in(I, E). Predicate. Event type E occurs some time during interval I. [p. 412]

Odds(E). Plausible. The odds on event E. [p. 129]

Odds($E \mid F$). Plausible. The odds on event E given event F. [p. 129]

on_path(**PP**, $\mathbf{X}_1, \ldots \mathbf{X}_k$). Predicate. In TOUR, places $\mathbf{X}_1 \ldots \mathbf{X}_k$ appear in that order on path **PP**. [p. 281]

opening(**OO**, **XX**, **II**). Predicate. Region **OO** is an opening of barrier region **XX** into interior region **II**. [p. 261]

ordered(X, Y). Predicate. Quantities X and Y are ordered with respect to one another. [p. 150]

origin(C). Function. The origin (a point) of coordinate system C. [p. 251]

OU($E|F$). Plausible. The update in the odds of event E given event F. [p. 130]

overlaps(I, J). Predicate. Interval I overlaps interval J from the left. [p. 148]

overlap_of(I, J). Function. The common subinterval of overlapping intervals I and J. [p. 149]

overlap_reg(**XX**, **,YY**). Predicate. Regions **XX** and **YY** overlap. [p. 251]

owner_of(O). Function. The fluent of object O's owner (an agent) over time. [p. 451]

P(E). Plausible. The *a priori* probability of event E. [p. 120]

P($E \mid F$). Plausible. The conditional probability of event E given event F. [p. 120]

past(ϕ). Modal. State ϕ held at all future times. past(ϕ) is a state. [p. 231]

pc($A, L1, L2$). Predicate. Layout $L2$ is compatible with layout $L1$ relative to the perceptions of A. [p. 387]

permits(A, E). Function. State type of agent A permitting event type E. [p. 451]

permitted(E, S). Predicate. Event type E is permitted in situation S. [p. 449]

place(O). Function. The fluent of the region occupied by object O over time. [p. 328]

planar(**RR**). Predicate. Region **RR** lies in a plane. [p. 255]

plan(A, P, S). Predicate. In situation S, agent A intends to carry out the plan described in string P. [p. 414]

plausible(Γ, ϕ). Plausible. Generic plausible inference. Sentence ϕ is a plausible inference given Γ, in the absence of evidence against ϕ. [p. 101]

pos. Constant. The interval of positive quantities. [p. 161]

position(O). Function. The fluent of solid object O's position over time. In each situation, position(O) is a rigid mapping. [p. 328]

possible_occur(S, E). Predicate. It is possible for event type E to occur starting in situation S. [p. 213]

precedes($S1, S2$). Predicate. Situation $S1$ precedes situation $S2$. [p. 190]

present_in(O, S). Predicate. Entity O exists in situation S. [p. 191]

prevent(E). Function. The event type of preventing event type E. [p. 215]

prim_change(I, F). Predicate. Primitive fluent F changes during interval I. [p. 204]

prim_fluent(F). Predicate. F is a primitive fluent. [p. 204]

prim_state(F). Predicate. F is a primitive state. [p. 204]

primitive(E). Predicate. Event type E is primitive. [p. 230]

primitive_component(KP, KC). Predicate. Event token KP is a primitive component of compound event token KC. [p. 230]

primitive_routine(ACT, A). Predicate. ACT, a function from arguments to an action type, is a primitive robotic routine for agent A. [p. 419]

process(P, A). Predicate. P is a process of type A. [p. 323]

prohibited(E, S). Predicate. Event type E is prohibited in situation S. [p. 449]

pronunciation(P, S, L). Predicate. String of phonemes P is an acceptible pronunciation of string of characters S in language L. [p. 441]

propel. Constant. In CD, the action type of exerting a force on an object. [p. 452]

ptrans. Constant. In CD, the action type of moving an object. [p. 452]

quat($\mathbf{P}$, $\mathcal{F}$). Function. The quaternion corresponding to point $\mathbf{P}$ in coordinate system $\mathcal{F}$. [p. 302]

real_chronicle. Constant. In a branching theory of time, the chronicle that actually occurs. [p. 213]

reason(M, E). Predicate. In CD, mental state M is a reason for action E. [p. 453]

rectangle($\mathcal{C}, IX, IY$). Function. The rectangle of points with coordinates in $IX \times IY$ in coordinate system $\mathcal{C}$. [p. 251]

regular($\mathbf{RR}$). Predicate. Region $\mathbf{RR}$ is regular. [p. 258]

result(S, E). Function. In the situation calculus, the result of performing action type E in situation S. [p. 217]

result(E, S). Predicate. In CD, event E results in state S. [p. 453]

scale$_U(X)$. Function. The measure of quantity X relative to unit quantity U. [p. 156]

sequence($E_1 \ldots E_k$). Function. Event type of the occurrence of event types $E_1 \ldots E_k$ in sequence. [p. 225]

sequence($\phi_1 \ldots \phi_k$). Modal. Event of the occurrence of events $\phi_1 \ldots \phi_k$ in sequence. [p. 231]

set(S). Predicate. S is a set. [p. 49]

shape(O). Function. The shape (a region) of object O. [p. 328]

sign(X). Function. The sign (an interval) of differential quantity X. [p. 161]

simply_connected(**RR**). Predicate. Region **RR** is simply connected. [p. 256]

sincere(K). Predicate. Speech-act token K is sincere. [p. 443]

solid(O). Predicate. O is a solid object. [p. 342]

solid_coating(**RR**, $\tilde{D}$). Function. The state of region **RR** being the "coating" within distance $\tilde{D}$ of solid objects. [p. 343]

some_future(ϕ). Modal. State ϕ will be true at some point in the future. some_future(ϕ) is a state. [p. 231]

some_past(ϕ). Modal. State ϕ will be true at some point in the past. some_past(ϕ) is a state. [p. 231]

sort_of(O). Function. The sort of entity O. [p. 45]

speak(P). Function. The event type of speaking the phoneme string P. [p. 441]

speak. Constant. In CD, the action type of making a sound. [p. 452]

star(**X**, $< \mathbf{PP}_1, S_1 >, \ldots, < \mathbf{PP}_k, S_k >$).
Predicate. In TOUR, places $\mathbf{PP}_1 \ldots \mathbf{PP}_k$ meet at place **X**. Moreover. the directed paths $\mathbf{PP}_i$ with sense S_i occur counterclockwise around **X**. [p. 281]

start(I). Function. The greatest lower bound (a quantity) of interval I. [p. 151]

starts(I, J). Predicate. Interval I starts with interval J, but finishes first. [p. 148]

subst($SNEW, SVAR, SOLD$).
Function. The result (a string) of substituting $SNEW$ for every occurrence of variable symbol $SVAR$ in string $SOLD$. [p. 80]

success(P, G). Function. The fluent giving the degree to which plan P will succeed in achieving goal G in each starting situation. [p. 409]

sum_over(S, F). Function (second order). The sum of F over set S. F is a function from S to some differential quantity space. [p. 158]

surf_norm(**PP, X**). Function. The surface normal (a vector) pointing out of region **PP** at surface point **XX**. [p. 263]

Th($\mathcal{S}$). Metalevel. The set of first-order consequences of theory $\mathcal{S}$. [p. 116]

time_of(K). Function. The time interval in which event (or state) token K occurs. [p. 191]

token_of(K, E). Predicate. Event (or state) token K is a token of event (state) type E. [p. 191]

tolerance(**CC**, $< \mathbf{EE}_1, \tilde{D}_1 >, \ldots < \mathbf{EE}_k, \tilde{D}_k >$). Predicate. Directed edges $\mathbf{EE}_1 \ldots \mathbf{EE}_k$ approximate directed curve **CC** within tolerances $\tilde{D}_1 \ldots \tilde{D}_k$. [p. 275]

transfer(O, A). Function. Action type of transferring possession of object O to agent A. [p. 451]

true_in(S, A). Predicate. State A is true in S. S is a situation, a possible world, or a layout. [p. 56, 73, 188, 365, 389]

true_in(S, ϕ). Modal. State A is true in situation S. [p. 231]

TRUE. Metalevel. Truth. [p. 32]

true(P). Predicate. String P spells out a true sentence. [p. 81]

tuple($X_1 \ldots X_k$). Function. The tuple of $X_1 \ldots X_k$ in order. [p. 50]

twilight_zone. Constant. Imaginary situation that results from an impossible event "occurring." [p. 400]

two_d(**FF**). Predicate. Region **FF** is two dimensional. [p. 258]

unit_length($\mathcal{C}$). Function. The unit of length in coordinate system $\mathcal{C}$. [p. 251]

upper_bound(X, I). Predicate. Quantity X is an upper bound of interval I. [p. 151]

use_of(E, A, O). Event type E constitutes a use of object O by agent A. [p. 451]

valid(P, G). Function. State type of plan P being a valid way to accomplish goal G in a situation. [p. 398]

value_in(S, F). Function. Value of fluent F in S. S is a situation, a possible world, or a layout. [p. 58, 73, 160, 188, 365, 387]

value_in(S, τ). Modal. Value of term τ in situation S. [p. 231]

volume(**RR**). Function. The volume of region **RR**. [p. 263]

w0. Constant. The real world. [p. 74]

wait(T). Function. The action of waiting for time duration T. [p. 410]

wait_until(Q). Function. The action of waiting until state Q becomes true. [p. 410]

wait_while(E). Function. The action of waiting until event E is complete. [p. 410]

while(A, E). Function. Event type E occurs repeatedly as long as A holds at the beginning of each iteration. while(A, E) is an event type. [p. 225]

while(θ, ϕ). Modal. Event ϕ occurs repeatedly as long as θ holds at the beginning of each iteration. [p. 231]

x_axis($\mathcal{C}$). Function. The positive x direction in coordinate system $\mathcal{C}$. [p. 251]

z_coor(**P**, $\mathcal{C}$). Function. The z coordinate (a real number) of point **P** in coordinate system $\mathcal{C}$. [p. 256]

z_y_z_euler($\mathcal{F}, \mathcal{C}$). Function. The Z-Y-Z Euler angles (a triple of real numbers) of the orientation of coordinate frame $\mathcal{F}$ relative to coordinate frame $\mathcal{C}$. [p. 274]

Index of Names

X, Y, Z

General Index

D

E

F

G

T