STAGE AND STRUCTURAL-DEVELOPMENTAL THEORY

Cognitive Complexity

Piaget · Commons · Fischer · Jaques

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A Furtherance reference compendium on the intellectual terrain behind organisational design, executive capability, and leadership transformation.

This is the first of five reference papers Furtherance maintains on vertical-development theory — the bodies of work concerned with how human capability, meaning-making, and worldview mature in structured, predictable ways across the lifespan. Taken together, the five papers map the intellectual terrain that sits underneath sound organisational design: how to reason about the capability a role genuinely demands, the people who fill it, and the alignment of complex systems, increasingly including artificial ones. It is the thinking beneath the Furtherance Fractional COO engagement, set down in full.

The cognitive-complexity tradition is the empirically tightest of the four camps. It treats developmental level as a measurable property of the mind: the order of abstraction at which a person can reliably operate, the structural complexity of the tasks they can complete, and the time-horizon over which they can hold intention. The four theorists examined here built models that are, in principle, falsifiable. Two of them — Commons and Jaques — produced quantitative instruments still used in scientific and applied settings.

> **IN THIS PAPER**
> Cognitive-complexity models answer the question: what kind of work, judgement, or reasoning can this person actually perform — and at what scale? They do not answer questions of values, identity, or worldview. Those belong to the other three camps.

Jean Piaget 1896–1980

Swiss developmental psychologist; trained as a biologist and epistemologist. Founder of the field of cognitive development. Director of the International Centre for Genetic Epistemology, Geneva.

CORE THESIS

Cognition is constructed, not received. Children build mental structures (schemata) through interaction with the environment, advancing through qualitatively distinct stages by means of two complementary processes: **assimilation** (fitting experience into existing schemata) and **accommodation** (modifying schemata to fit new experience). **Equilibration** between these processes drives the transition between stages. Each stage is a structured whole with its own internal logic, and stages are invariant in sequence.

THE FOUR STAGES

Stage	Approx. age	Defining capability	Limitation
Sensorimotor	0 – 2	Object permanence; coordination of senses and action.	No symbolic representation.
Preoperational	2 – 7	Symbolic thought, language, pretend play.	Egocentric; cannot conserve quantity; centration.
Concrete operational	7 – 11	Logical operations on concrete objects: classification, conservation, reversibility.	Cannot reason about hypotheticals or pure abstractions.
Formal operational	11 +	Hypothetico-deductive reasoning; abstract thought; systematic problem-solving.	Treated by Piaget as the terminal stage; later researchers contest this.

METHODOLOGY

Piaget's evidence base was the *méthode clinique*: structured but flexible interviews with children, often his own three. He paired these with observational tasks (e.g. the conservation-of-liquid task, the three-mountains task) which became canonical instruments. The work is qualitative; sample sizes were small but the tasks have been replicated cross-culturally with broadly stable results, though the ages at which stages emerge vary.

INFLUENCE AND CRITIQUE

- **Influence:** Foundational for every subsequent stage theory in psychology – Kohlberg, Loevinger, Kegan, Commons, Fischer all build on or react to Piaget.
- **Critique:** Underestimates infant capability (replications using non-verbal measures show object permanence earlier); over-states the universality of the formal-operational stage (cross-cultural studies show many adults do not reliably reason at this level on novel tasks); under-specifies the mechanisms of stage transition.
- **Post-formal extension:** A research programme initiated by Riegel, Basseches, Commons, Fischer and others argues for stages beyond formal operations – systematic, metasystematic, paradigmatic, cross-paradigmatic – addressing Piaget's neglect of adult cognition.

Michael Commons **b. 1939**

Behavioural scientist and developmental psychologist; Assistant Clinical Professor at Harvard Medical School. Originator of the Model of Hierarchical Complexity (MHC).

CORE THESIS

Developmental stage is not a property of the person but of the **task**. Any task can be assigned an order of hierarchical complexity by counting how it is constructed: a higher-order task is one that (i) is defined in terms of two or more lower-order tasks, (ii) organises those lower-order tasks in a non-arbitrary way, and (iii) cannot be reduced to them. The MHC therefore provides a domain-independent, mathematically defined measurement of complexity, applicable to human cognition, animal behaviour, and artificial systems alike.

THE SEVENTEEN ORDERS OF HIERARCHICAL COMPLEXITY

Order	Name	Characteristic operation
0	Calculatory	Performs basic computational steps.
1	Automatic	Single conditioned responses.
2	Sensory or motor	Discriminates stimuli; simple motor acts.
3	Circular sensory-motor	Coordinates sensory and motor schemes.
4	Sensory-motor	Forms concepts from objects and events.
5	Nominal	Names objects; uses single words referentially.
6	Sentential	Forms simple relations; pronouns; sequences.
7	Pre-operational	Symbolic representation; classes.
8	Primary	Arithmetic; simple deductive logic.
9	Concrete	Concrete operations; reversibility on objects.
10	Abstract	Variable use; abstract categories; stereotypes.
11	Formal	Hypothetico-deductive logic; controlled variables.
12	Systematic	Constructs multivariate systems; matrices.
13	Metasystematic	Compares, contrasts and integrates whole systems.
14	Paradigmatic	Builds new fields by integrating metasystems.
15	Cross-paradigmatic	Integrates paradigms into new fields of inquiry.
16	Meta-cross-paradigmatic	Reflects on the construction of paradigms themselves.

METHODOLOGY

The MHC produces an analytic measure: any task or response can be scored for its order. Empirical instruments include the Hierarchical Complexity Scoring System, applied to interview data, leadership decisions, mathematical reasoning, and moral judgements. Scoring inter-rater reliability is reported as high in the Commons group's published work. The model has been applied across domains including child development, primate cognition, judicial reasoning, and organisational decision-making.

SIGNIFICANCE

- **Disentangles person from task:** the unit of analysis is the action, not the actor. This makes the model unusually robust against cultural and linguistic variation.
- Provides the formal apparatus for measuring post-formal cognition — the territory Piaget left unmapped.
- Unique among the camp in being explicitly mathematical: stage is a defined function, not a description.

Kurt Fischer 1943–2020

Developmental psychologist; founding director of the Mind, Brain, and Education programme at Harvard Graduate School of Education. Originator of Dynamic Skill Theory.

CORE THESIS

Development is the construction of **skills** — context-specific capacities for action — rather than the maturation of general cognitive structures. Skills develop through cycles of growth, consolidation, and reorganisation, advancing through thirteen levels grouped in four tiers. Crucially, skill levels are **domain-specific**: a person can operate at level 11 in one domain and level 8 in another. Performance is also **context-dependent**: each person has a functional level (typical performance) and an optimal level (performance with high support), and the gap between them can be substantial.

THE THIRTEEN LEVELS IN FOUR TIERS

Tier	Levels	Defining unit
Reflexive	Rf1 – Rf3	Single reflexes; reflex mappings; reflex systems.
Sensorimotor	Sm1 – Sm4	Single sensorimotor actions; mappings; systems; systems-of-systems.
Representational	Rp1 – Rp4	Single representations; representational mappings; systems; systems-of-systems.
Abstract	Ab1 – Ab4	Single abstractions; abstract mappings; abstract systems; principles.

METHODOLOGY

Fischer's group developed scoring systems for skill level applied to micro-genetic studies — close observation of skill change over short time-scales — and to longer developmental research. The work integrates with neuroscience: Fischer argued for tight coupling between skill-level transitions and identifiable shifts in brain electrical activity (cortical growth spurts), giving the theory a biological substrate beyond Piaget's.

SIGNIFICANCE

- **Domain-specificity:** A direct correction to Piaget's assumption of a single, global stage. Has substantial implications for education, assessment, and any practice that infers general capability from a single observation.
- **Functional vs optimal:** The gap between everyday and supported performance has direct implications for how environments, organisations, and tools either raise or lower the level at which people operate.
- **Neuroeducation:** Fischer's later work positioned developmental theory as the bridge between cognitive neuroscience and educational practice.

Elliott Jaques 1917–2003

Canadian psychoanalyst, social scientist, and management theorist. Co-founder of the Tavistock Institute. Coiner of the term mid-life crisis. Originator of Stratified Systems Theory (SST), Requisite Organization, and the Time Span of Discretion.

CORE THESIS

Human cognitive capability matures in discrete **strata**, each defined by the longest task an individual can hold and complete in their mind without external review. This **time span of discretion** is empirically measurable, correlates tightly with the felt-fair pay people associate with their roles, and predicts the level of organisational role at which a person can operate. Effective organisations must therefore be stratified to match this distribution of capability — **Requisite Organization**.

THE EIGHT STRATA

Stratum	Time span	Typical role	Cognitive demand
I	1 day – 3 months	Operator; frontline worker	Direct action on concrete objects.
II	3 months – 1 year	First-line supervisor	Diagnostic accumulation of information.
III	1 – 2 years	Unit / department manager	Alternative serial paths; trade-off reasoning.
IV	2 – 5 years	General manager	Parallel processing of multiple systems.
V	5 – 10 years	Business unit head; subsidiary CEO	Whole-system conceptualisation.
VI	10 – 20 years	Corporate executive vice-president	Diagnostic reasoning across abstract systems.
VII	20 – 50 years	Corporate CEO	Strategic positioning of the enterprise in society.
VIII	50 – 100 years	Super-corporation; statesman tier	Civilisational frameworks.

MODES OF MENTAL PROCESSING

Within each order of information complexity (concrete verbal, symbolic verbal, abstract conceptual, universal), Jaques identified four recurring modes — declarative, cumulative, serial, and parallel. Strata correspond to ordered combinations of mode and order of abstraction; transitions between strata are not gradual but constitute genuine reorganisations of cognitive processing.

REQUISITE ORGANIZATION

The structural prescription that follows from SST: every managerial layer must be exactly one stratum above its reports. Layers that are too close generate compression and micromanagement; layers that are too far apart generate vacuum, in which the manager cannot meaningfully add value to the reports' work. Jaques argued that the natural number of strata in any organisation, including national armies and multinationals, was no more than seven or eight — an empirical regularity rather than a normative claim.

METHODOLOGY

Jaques' empirical base was three decades of consulting interventions, beginning with the Glacier Metal Company study (1948 onwards) and extending through the British Army, the U.S. Army, and many large corporations. The Time Span of Discretion is operationalised through structured interviews; the Career Path Appreciation instrument extends this into longitudinal capability assessment.

SIGNIFICANCE

- The only model in this camp constructed explicitly for organisational and governmental application. Where Piaget, Commons, and Fischer answer *what is the structure of the mind?*, Jaques answers *what structure must the institution take to fit it?*
- **Empirically distinctive:** time-span correlations with felt-fair pay are reported across cultures and have been replicated in industrial and military contexts.
- **Critique:** The strict stratum-per-layer prescription has been challenged in post-industrial and networked organisations; the predictive power of SST is stronger in stable hierarchies than in flat or matrixed ones. The model also treats capability as largely innate and maturationally fixed, which is contested by skill-theory researchers.

Synthesis

	Piaget	Commons	Fischer	Jaques
Unit of analysis	Child mind	Task complexity	Skill in domain and context	Adult cognitive capability in role
Number of stages	4	17 orders	13 levels in 4 tiers	8 strata
Domain focus	General	Task-defined; domain-neutral	Specific	General; tied to time-horizon
Empirical instrument	Clinical interview	Hierarchical Complexity Scoring	Skill-level scoring	Time Span of Discretion
Falsifiability	Moderate	High	High	High
Primary application	Education; child psych	Cross-domain measurement	Education; neuroeducation	Organisational design

The four models converge on a single underlying claim: cognition is structured, the structures are ordered, and the ordering can be measured. They diverge on the unit of analysis (mind, task, skill, or role), the granularity of stages, and the institutional context in which the theory is meant to be useful. For the Fractional COO reasoning about organisational design and how complex systems fit together, Jaques and Commons are the most directly applicable: Jaques for institutional structure, Commons for the formal complexity of the work being done. Fischer's domain-specificity is the necessary corrective to any over-general application of either. Piaget remains the indispensable point of historical departure.

FOR THE OPERATOR

All four traditions are cognitive, not motivational. They tell you what a person or a task can handle, not what they will do, value, or want. That dimension belongs to the next paper.