

Kim H. Veltman

Questions and Choices

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How do we learn? We ask questions. The basic questions: who, what, where, when, how, why have been around since recorded civilization. Yet the relative emphasis given to these questions and the resulting answers have changed enormously in the course of the past two thousand years.

Plato, for example, as a student of Socrates, was famous for asking questions. Perhaps because he was a philosopher he focussed on why questions. He dabbled in what questions (philosophy, law), in how questions (rhetoric, politics) and made passing references to matters involving when, where and who questions. It is noteworthy that he wrote no biography, geography or history in the way that we know it today. Plato's why questions led him to focus on abstract concepts and to leave out much of physical reality and almost all personal reality.

Plato's most famous student, Aristotle, was more wide ranging in his questions. He too wrote minimal biography (who), little history (when) and some geography (where). Aristotle focussed on three questions who, what and why (fig. 1). It is striking how most of these concepts are static.

It can reasonably be argued that his systematic approach to these three questions established the disciplines of metaphysics, physics, philosophy, and logic (fig. 2). In most of these Quality dominates over Quantity. Even in those cases where Quantity is in play, it is almost strictly in terms of proportion rather than in terms of measurement. This is particularly true of his treatment of space and time. For the next fifteen hundred, some would say nearly two thousand years, Aristotle's model exercised an amazing hold on the western world. With the rise of Christianity why questions continued to be in the foreground. A quiet change also took place. The crystallization of scientific subjects under the rubric of the quadrivium led to a gradual emphasis on Quantity (fig. 3).

Question	Topic	SUMS
Why	Cause	Quality
How	Quality, State, Action, Passion, Relation	Quality
What	Substance, Accident, Quantity	Quality
Where	Place, Position	Space
When	Time	Time
Who	-----	-----

Fig.1 A summary of Aristotle's questions, in relation to basic concepts.

Question	Discipline	Perreault's Relation	SUMS
Why-universe	Metaphysics	Determinative	Quality
Why-nature	Physics		Quality
Why-ideas	Philosophy		Quality
Why-language	Logic	Logical	Quality
What, Why	Philosophy	Subsumptive	Quality
What, How	Arithmetic		Quantity
What, How	Geometry		Quantity
What, How	Music		Quantity
What, How	Astronomy		Quantity
How	Rhetoric	Determinative	Quality
Where	Geography		Space
When	History		Time
Who	Biography		Questions

Fig. 2 A summary of Aristotle's questions, their corresponding disciplines and relations.

Questions	Discipline	Topics	SUMS
	Quadrivium		
Why, How	Arithmetic	Discrete Quantity	Quantity
Why, How	Geometry	Continuous Quantity	Space
What, How	Music	Discrete Quantity to Sound	Quantity
What, How	Astronomy	Continuous Quantity to Sight	Quantity
	Trivium		
What	Grammar	Structure	Quality
Why	Dialectic	Logic	Quality
How	Rhetoric	Effect	Quality
Why, What	Law		Quality
Why, What	Theology		Quality
Where	Geography		Quality
When	History		Quality
Who	Biography		Quality

Fig. 3 A summary of mediaeval questions, their corresponding disciplines and relations.

There were also other subtle changes. While the universities focussed on the trivium and quadrivium at the undergraduate level, the higher faculties concentrated on law, medicine, and theology. The undergraduate subjects focussed on theory rather than practice: the higher faculties included both theory and practice. In terms of our story this was important because it meant that the higher faculties were increasingly concerned with combinations of questions: not just what is an organ, or why is an organ but also how does it function, where is it exactly, when does it function and who knows about it? With the advent of the Renaissance, there was a flourishing of who, where and when questions which saw the emergence of biography, history and geography as major fields of study.

A simple glance at the basic questions and concepts of John Stuart Mill (fig. 4) shows that Quality remains as a concept but Quantity plays a greater role. More significantly, How, which had been mainly a static concept in Aristotle, is now concerned with dynamic principles.

Question	Topic	Modern Category
Why	Cause	Quantity, Quality
How	Agents, Operations, Processes,	Quantity
What	Whole, Thing, Kind, Parts, Materials, Properties	Quality
Where	Place, Position	Space
When	Time	Time
Who	-----	-----

Fig. 4 A summary of John Stuart Mills' questions, in relation to basic concepts.

Questions	University Subject
What, How	Astronomy
What, How	Science, Engineering
What, How	Music
What, How	Mathematics
What, Why	Philosophy
When, How	History
What, How	Languages and Literature
What, When	Art
How, Why	Psychology
How, Why	Sociology
What, How	Law
What, How	Medicine
Why, What	Theology
How	Business
How	Education
How	Information Studies

Fig. 5 Summary view of questions in disciplines in universities of the twentieth century.

If we turn to university subjects of the twentieth century it is striking how the questions have shifted (fig. 5). How now dominates, or rather how to. Questions of why are considered largely impractical, unprofitable and therefore bad. Such a cursory survey of academic disciplines at universities gives only one small measure of today's situation. In fact all six questions are being pursued with an unprecedented intensity. The advent of (relational) databases has led to an enormous upsurge in alphabetical and chronological lists. The pioneering work of Ranganathan on faceted classification has led to the rise of hierarchical lists whereby concepts such as broader and narrower topic are being studied more systematically.

There have also been several attempts to understand the nature of these changes. Marshall McLuhan studied this shift in terms of the *trivium*. He was intrigued how certain periods focus on logic (dialectic) others on structure (grammar) and others on effects (rhetoric). He found an answer in the shifting use of media, shifts from oral to literate culture at the time of the Greeks, to book culture through the advent of printing with Gutenberg in the 15th century and the shift to electronic culture, radio and television in the 20th century.

Category in Perreault	SUMS
Ordinal	Quality
Conditional	
Comparative	
Degree	Quantity
Size	Space
Duration	Time
Positional	
Figurative	Space
Spatial	Space
Temporal	Time
determinative	
Productive	Quality
Lmitative, frame of reference, orientation, destructive	Quality
Interactive	Quality
Concord	
Difference	
Contrariety	
Subsumptive	Quality
Possession, belongingness	
Type/kind	
Whole/part	
Logical ¹	Quality
Reciprocal	
Converse	
Negative	

Fig. 6. Basic categories of relations according to Perrault (1994) and corresponding categories in SUMS.

Classical Discipline	Perreault Category	SUMS
Grammar	Subsumptive	Definitions, Subsumptions, Structures
Dialectic, Logic	Logical	Logic
Dialectic, Logic	Conditional	Conditions
Rhetoric	Determinative	Causes, Effects
	Interactive	Interactions

Fig. 7 Classical disciplines, Perrault's terms and their equivalents in SUMS.

This led to his now famous phrase: the media is the message. In terms of our story the history goes from questions of why (Greeks), to what (Renaissance) to how (twentieth century). In this context the extraordinary development of propaganda, advertising, and marketing as dominating features in our society are reflections of something much deeper than a passing fad.

In the 1920's, Cassirer wrote of a shift from substance to function, from quiddity to relations, from why and what to how. Jacques Perreault, one of the leading individuals of the library world, has focussed on this problem and has suggested a scheme of five basic relations (fig. 6). It will be noted that Perrault's categories focus on the contents of the traditional *trivium*. A minor difficulty with his terms is that they are too complex for everyday use, and some simpler alternatives are therefore suggested (fig. 7).

Precisely because of his focus on the *trivium* rather than the *quadrivium*, there is a further problem with Perreault's approach in that his concept of ordinal relations mixes qualitative and quantitative features. In SUMS the conditional aspect of ordinal is listed under quality while the comparative and positional aspects are listed under quantity.

While it has become fashionable to speak of the noun, quantity, and the adjective, quantitative, as if they were single features, this overlooks a) the distinctions made by Aristotle between continuous and discrete quantity and b) Kant's work claiming an independent role for the categories of space and time. In light of the above, SUMS uses three terms for quantitative and regroups the traditional categories as follows (figure 8).

Discipline	Type of Quantity	SUMS Category
Arithmetic	Discrete	Quantity Numerical
Music	Discrete	Quantity Musical
Geometry	Continuous	Space
Astronomy	Continuous	Space
Chronology	Discrete	Time
History	Discrete	Time

Fig. 8 Classical disciplines, their characteristics and equivalents in SUMS.

One of Marshall McLuhan's interests in the history of these disciplines lay in linking disciplines and media with different senses. He inherited this concern from his elder contemporaries such as Havelock and it was pursued by his students such as Ong. McLuhan was particularly concerned with the shift from aural culture with the rise of literacy to visual culture with the advent of printing.

There is a related problem that deserves much further study, namely, the history of links between particular questions and the senses. In terms of why questions, for example, the Greeks, focussed on verbal criteria for their sense of truth, especially in philosophy and in the subjects which later became the trivium. Apparent exceptions were mathematical disciplines such as geometry, astronomy and chronology. Geometry entailed (visual) diagrams. Astronomy and chronology entailed observation. Yet the proofs were in terms of calculations which were not visual. This helps account for the ambiguous role of figures in ancient geometrical texts. These results are summarized below (fig. 9):

This seemingly unnecessary exercise in distinctions and shuffling words (figs. 7 and 8), allows us to distinguish between those who answered why questions in verbal terms (quality), in terms of mathematical proofs and calculations (quantity) and in visual terms (space). Moreover, if we return to the notion of six basic questions, it is clear that they all apply to some aspects of each of the four basic concepts, quality, quantity, space and time. To put it simply, for a Greek a concept such as space could be answered with a single question, why? Today we think we have a full answer only when we have answers to the who, what, where, when, how and why of space.

McLuhan's phrase about the medium is the message takes on a new meaning here. While the number of questions that one can ask about persons may be endless, the number of questions that one can hope to answer is very much dependent on the medium at hand. In the Middle Ages, when it took a hundred monks some ten years to make a single index of the works of Saint Thomas Aquinas, the number of lists one could make in a lifetime was very limited. Once indexes exist in print form, the amount of time needed to search for someone, or something is amazingly reduced. Once lists can be generated automatically by computers, the possibilities are immensely increased. That is the threshold on which we are standing today.

Question	Discipline	Sense	SUMS
Why	Philosophy	Aural Verbal	Quality Conditional
Why, How	Rhetoric	Aural Verbal	Quality Causes, Effects
Why, How	Dialectic	Aural Verbal	Quality Logic
Why, How	Grammar	Aural Verbal	Definitions
What, How	Arithmetic	Aural Verbal	Quantity Numerical
What	Music	Aural Musical	Quantity Musical
What, How	Geometry	Visual	Quantity Space
What, How	Astronomy	Visual	Space
When	Chronology	Visual	Time
When	History	Aural Verbal	Time

Fig. 9 Questions, classical disciplines, the senses and equivalents in SUMS.

Entailed is a mass of material far greater than any individual can deal with without systematic aids. For this reason the five basic concepts require five further ingredients to produce a useful system. First, one requires a survey of different access methods. Second one needs to calibrate these with and to different approaches to learning: goals, types of learning and kinds of learner. Third, one needs to distinguish different levels of knowledge in order to identify the depth of information that wishes to reach. Fourth, one needs to decide on the kind of media which are being used. Finally, one needs to have a clear survey of the software tools available. Hence SUMS has ten basic entry points which are listed alphabetically: Access, Learning, Levels, Media, Quality, Quantity, Questions, Space, Time, Tools (p. 12).

Search engines today often ignore these distinctions. They assume that one only needs to answer a single question, rather than multiple combinations of questions systematically. The rhetoric today is on education, yet the emphasis is on training. The irony here is that we are using machines to teach us things that are sufficiently mechanical that they will eventually be tasks for machines. We are not yet using computers and the new technologies to help us with learning, with the uniquely human dimensions of our gifts. Needed is an integrating instrument which does three things. First, it provides us with a strategy and methodology for searching and finding material. Second, it provides a structure for organizing what one has found. Third, this structure should provide a framework for self-learning. These are the challenges which SUMS addresses.

¹ Viewed historically this list is instructive because it reduces logic to its minimal relations. In traditional terms Logic would have included much of determinative and subsumptive relations. For instance, Determination, used to mean rendering a notion more definite by adding attributes, while Subsumption meant a proposition subsumed under another: a minor premiss.