# Making it quantitative: early phases of development of a new taxonomy for levels of automation

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**Abstract**

The classic approach to the concept of "Level Of Automation" (LOA) is qualitative in nature: it simply describes the trading of system control between humans and computers. Since Sheridan's seminal work many taxonomies have been proposed, but they are all domain- and task-dependent. This makes it difficult to compare results from different studies. A different approach (that will eventually allow defining LOA quantitatively) has been introduced here. The basic idea was to characterise LOA in terms of number of processes traded by humans and machines. For example, at the information-acquisition level, LOA may be defined in terms of number of features of an object that has to be identified. Automation providing reliable information on 1 out of 4 possible features was set at LOA=.25, whereas for a system providing aid on 2 out of 4 features LOA=.50. In order to start a research program aimed at devising a general model, two experiments were run on 36 participants who were requested to perform a visual search task. Three LOA were tested: 0 (manual), .25 (intermediate), and .50 (high). These first studies were a necessary step in order to study the mathematical relation between LOA and human performance.

**Introduction**

In general, implementing automation support in a complex system implies the introduction an additional element that needs to be managed: humans and automation working together pose several problems in terms of authority for decision and action. As reported by Miller and Parasuraman (2007), in order to discuss alternative forms of automation, it is helpful to have a scheme for characterising roles and responsibilities. Such characterisations have been often made in terms of levels of automation (LOA) that define a spectrum of possible relationships ranging from full human to full automation control.

However, the classic approach to the concept of LOA is qualitative in nature: it simply describes the trading of system control between humans and computers. For example, the 10-point scale proposed in Sheridan's seminal work (Sheridan & Verplank, 1978) only describes the degree of human (or machine) involvement in system control. Consequently, it expresses the level of computer aiding to the human

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