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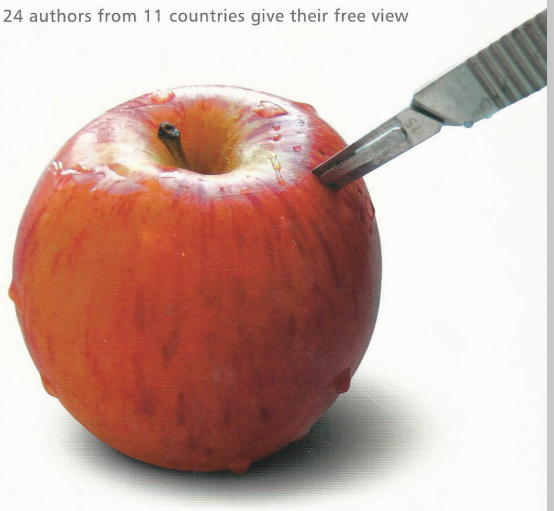

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## Surgical Simulation Classification and Triplication of the Cost. Upgrade to the Next Level of Realism Triplicates the Cost of Surgical Simulation Equipment

***by Maxim D. Gorshkov***

### Background

Global technology revolution has changed the World Health Care considerably. Digital breakthrough was accompanied by legal, financial and social pressure that challenged new types of medical training. The past several decades have witnessed a rapid development of simulation technologies. Simulation has become one of the leading methods for gaining skills in resuscitation, surgery, diagnostics and many other medical fields. High cost of modern educational tools requires a well-balanced approach in its selection. That should be based on a versatile, as well as practical classification of medical simulation devices.

### Present

Several classifications for medical simulation techniques and devices have been offered by now [1–5].

David M. Gaba has defined diverse applications of simulation as per eleven dimensions: aims and purposes of the simulation activity; unit of participation; experience level of participants; health care domain; professional discipline of participants; type of knowledge, skill, attitudes, or behaviors addressed; the simulated patient's age; technology applicable or required; site of simulation; extent of direct participation; and method of feedback used. According to the applicable or required technologies simulators can be grouped as following:

— verbal (role playing);
— standardized patients (actors);
— part-task trainers (physical; virtual reality);
— computer patient (computer screen; screen-based "virtual world");
— electronic patient (replica of clinical site; mannequin-based; full virtual reality).





Thus, a wide variety of the surgical training devices would be mostly positioned either to a part-task trainer group or to a computer patient group.

The typology of simulators offered by Guillaume Alinier in 2007 is another one that is widely accepted by the medical community. It divides both educational simulation tools and techniques to six technological levels: written simulations, 3-D models, screen-based simulators, standardized patients, intermediate fidelity patient simulators, and interactive patient simulators.

As a technique, not a device — standardized patient has been placed to its own group in the middle of classification. Adding to the training a supplemental phantom, e.g. a loudspeaker with pre-recorded auscultation sounds creates a new educational method: hybrid simulation that goes out of the "standardized patient" group frame.

Number of devices with different nature is combined in the "3-D model" group (e.g. skills phantoms, low and hi-fidelity anatomy models, and surgical suture training board) even though they are used for various educational techniques, for different levels of competencies, and have a wide range of acquisition costs. Upgrading a box trainer with a laparoscopy video tower will automatically shift the same device to another group — "screen-based simulators".

Another range of educational products can be classed as screen-based simulation technique. Thus, an e-learning program merely represents the real environment whilst a sophisticated angiography virtual simulator can have a highly realistic setup.

Simulators experience constant development. As Alinier's typology was first proposed in 2007 new generations of patient simulators and virtual reality simulators have come out, brand new types of training devices have been designed, advanced systems combining several interacting simulators have been created. Thus, none of the present classifications include all types of existing simulation devices and describe integration of their features.

Moreover, the existing simulation typologies refer mostly to the patient simulation field, not to the acquisition of skills. Nowadays, to acquire new skills surgeons apply a wide variety of training tools: interactive e-learning media, visual aids, anatomy models, phantoms, box trainers, virtual reality simulators, etc. They all differ by the grade of realism and the cost; however, simulators from different groups can serve for training the same skills. We have tried to establish new practical "classification of surgical simulation devices", taking into consideration their realism, price and skills trained.

### New classification

We tried to group together similar tools used in simulation training and the level of realistic credibility. First of all, taken into consideration were the technologies used. Simulation devices