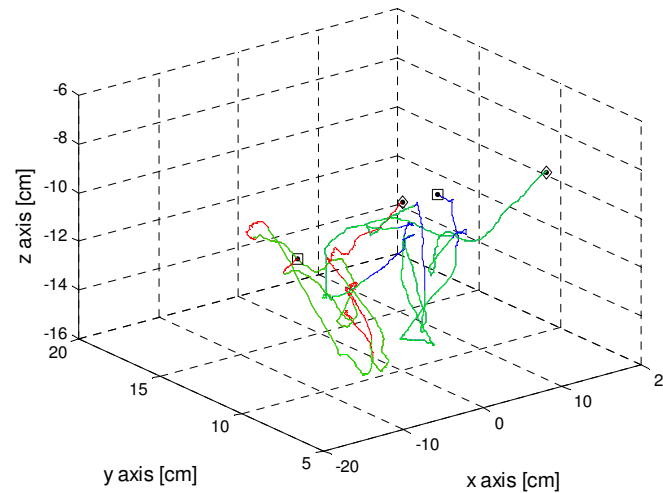


Biomechanical analysis of surgeon's gesture for evaluating skills in virtual laparoscopy



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Introduction

- MIS procedures ensure many advantages to patients
- Surgeons undergo a long and difficult training

Perceptual limitations:

- lack of stereoscopic view
- limited field of view
- reduced force and tactile sensing

Motor limitations:

- reverse motion
- movement scaling
- limited degrees-of-freedom

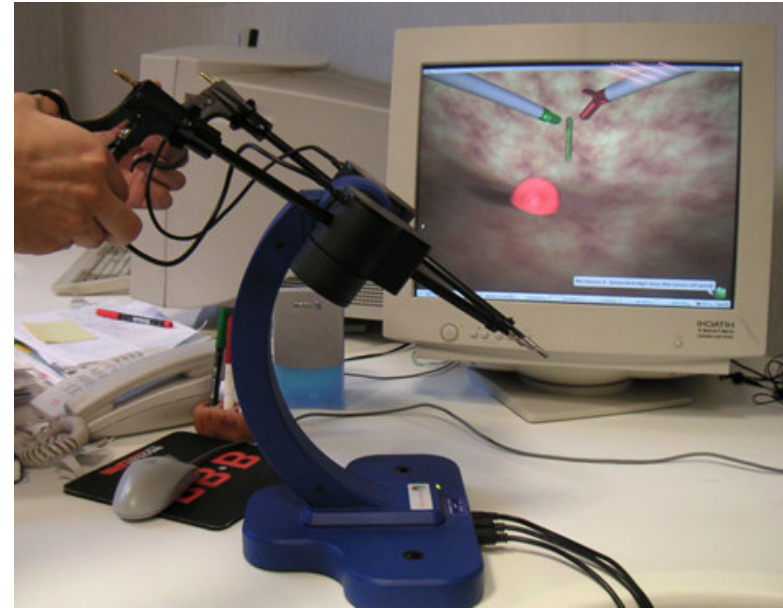


Instrumentation

- LapSim Basic Skills 2.2 (Surgical Science AB, Göteborg, Sweden)
- 2 laparoscopic instrument handles fixed to a mechanical frame
- Sensorized instruments for position tracking

Methods

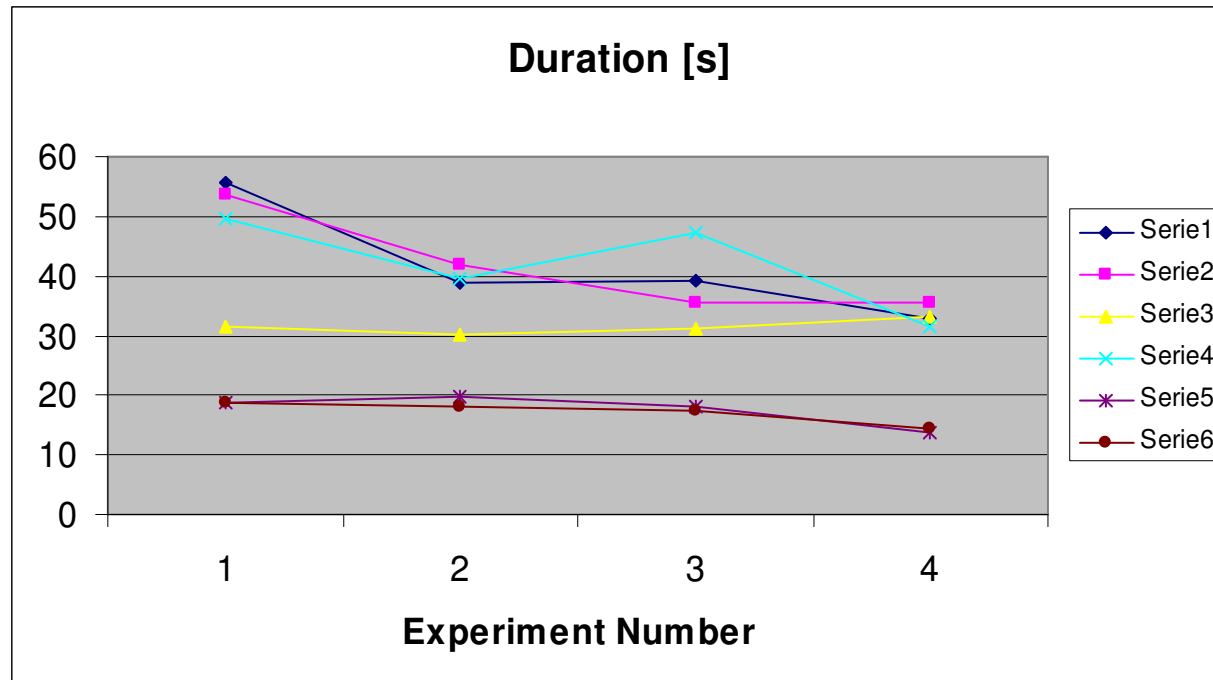
- 4 novices
- 2 expert surgeons
- Session of 4 consecutive trials
- Reaching exercise (10 balls)
- Alternatively use of the right and left hand



Purpose

- Definition of skill evaluation metrics
- Assess the surgeons' experience and performances
- Distinguish expert surgeons from less experienced surgeons

Results



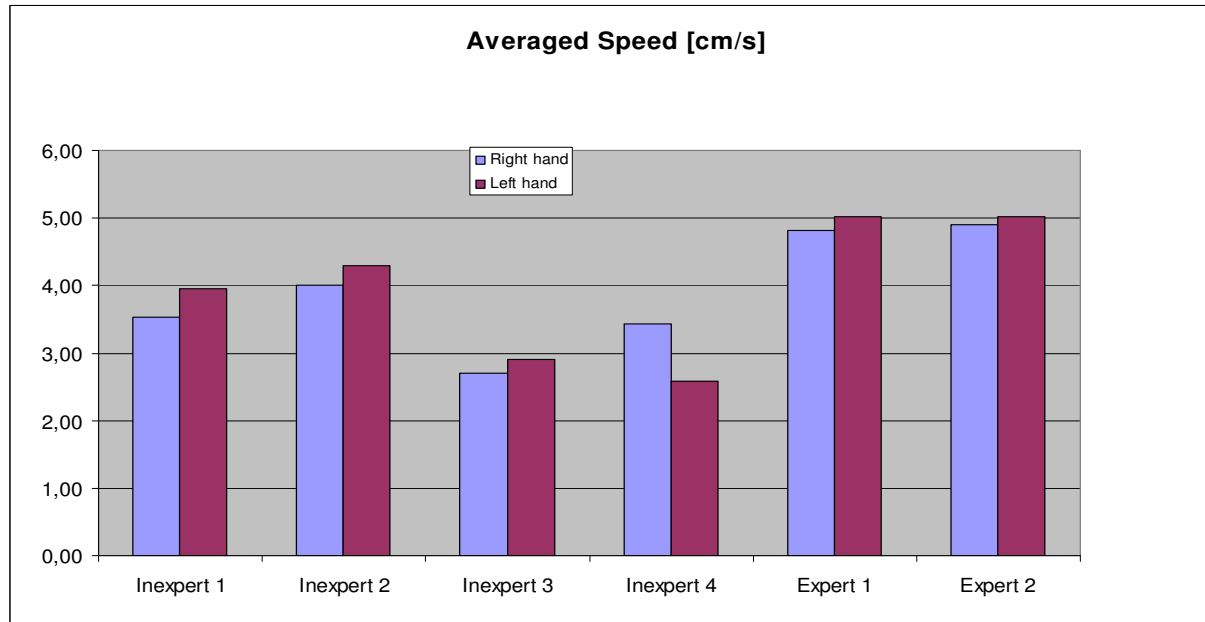
Duration of experiments:

(novices)

- greatly inconstant
- decreasing trend
- high standard deviation

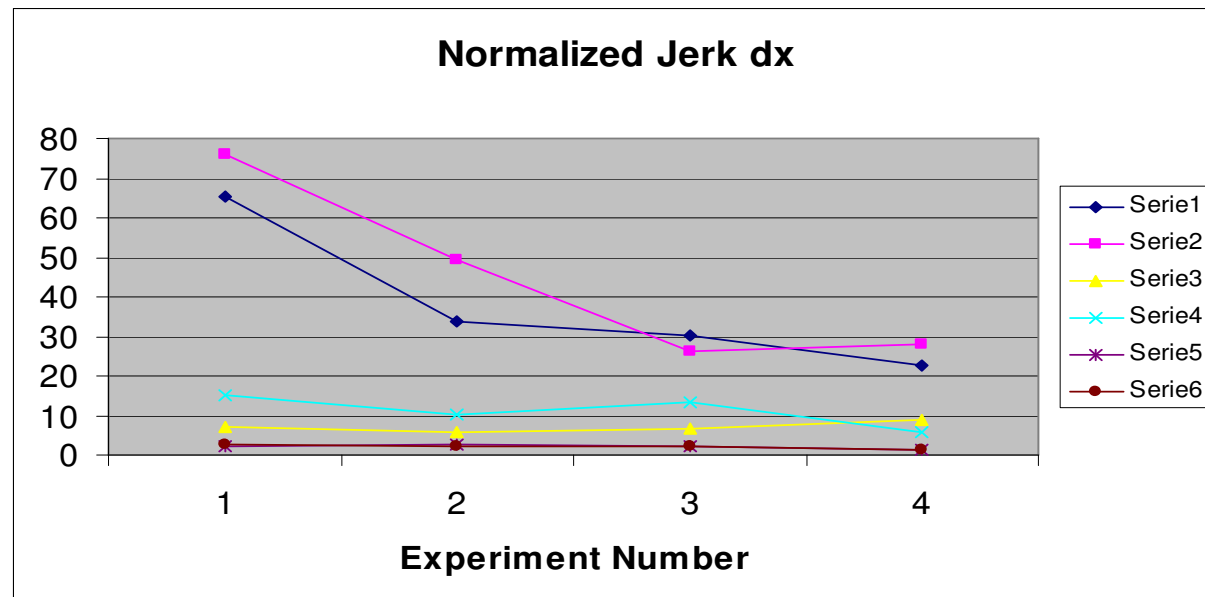
(experts)

- lower mean value
- constant trend
- low standard deviation



Averaged speed:

- experts faster
- novice slower



Normalized jerk:

(novices)

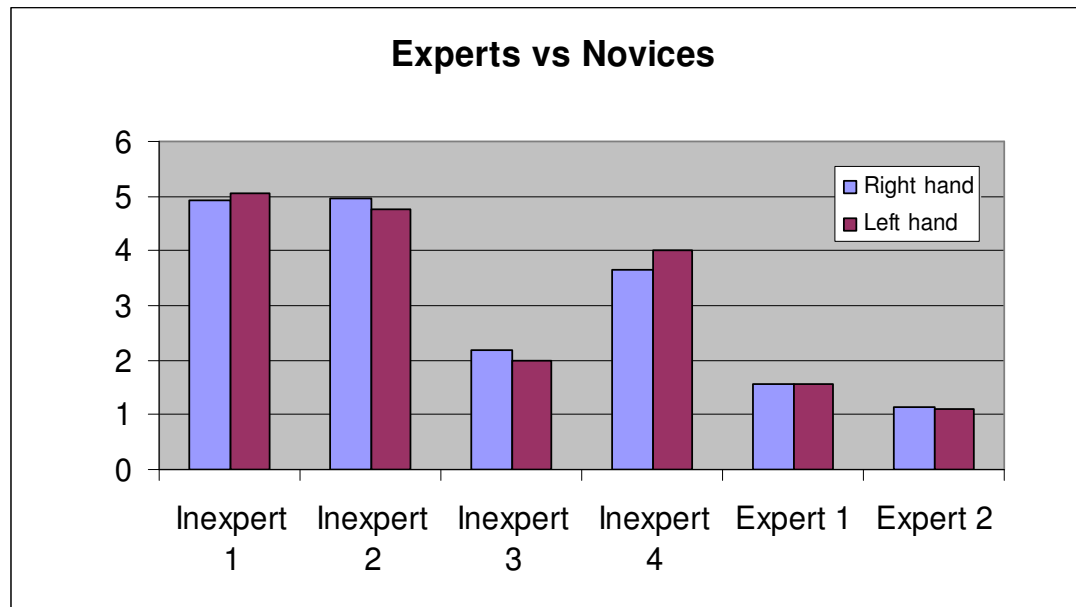
- decreasing trend
- higher values

(experts)

- constant trend
- smoother movements

Discussions and Conclusions

- Evaluation of:
 - Bi-manual management of surgical instruments
 - Depth perception
- Necessity to use different biomechanical parameters
- Distinction between expert and inexperienced surgeons
- Different levels of ability





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