

Context

Better understand surgery

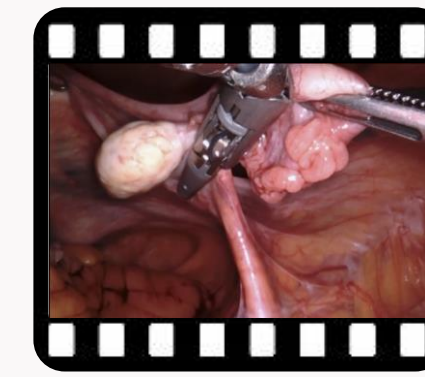
Better outcomes for patients



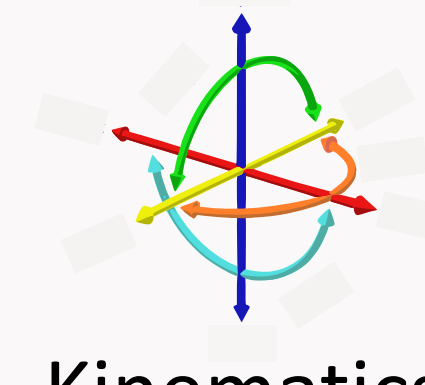
Surgery is a highly **complex** entity to understand with multiple sources of **variability**

Data

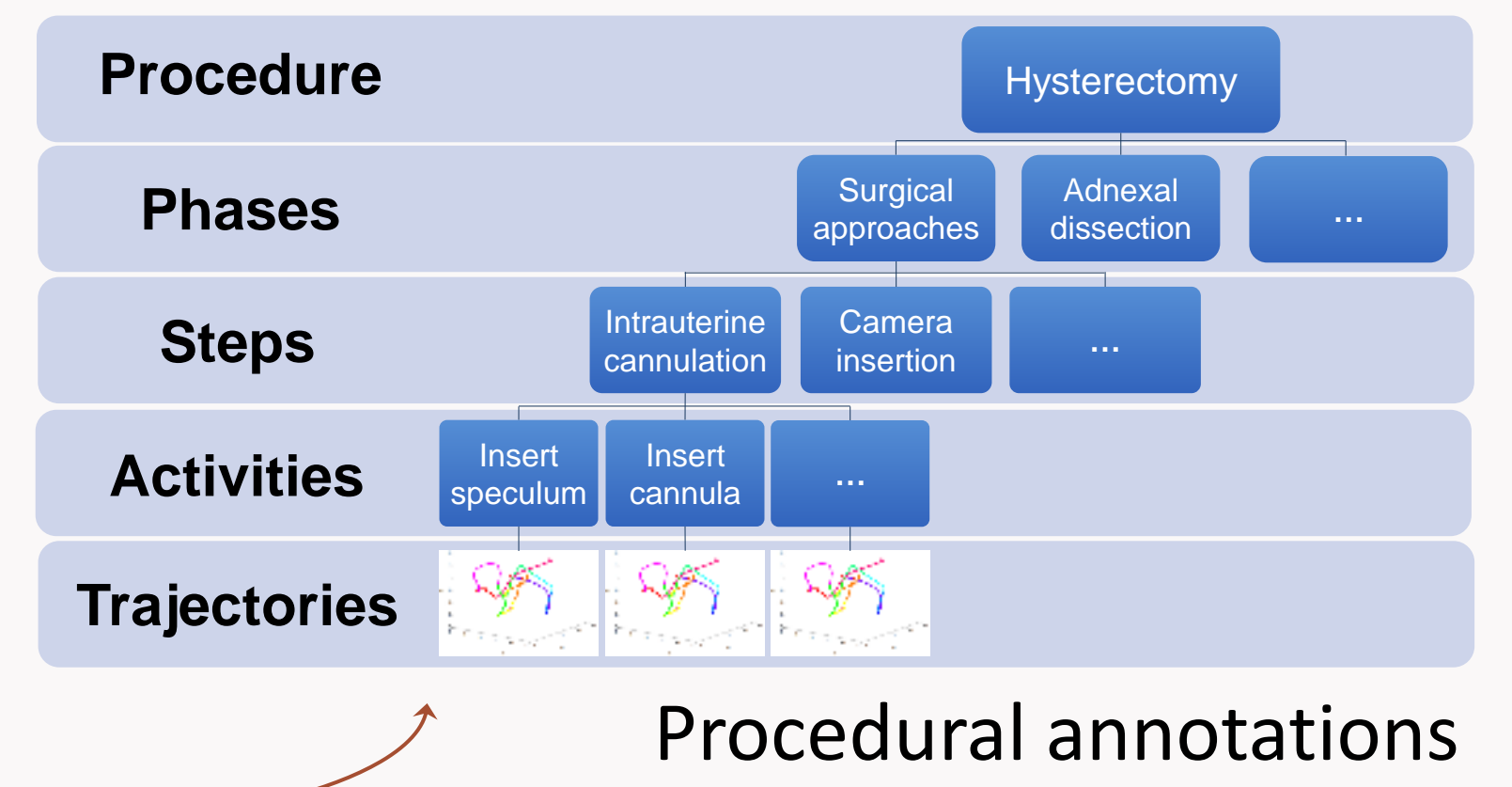
60+ robotic hysterectomies performed in Rennes



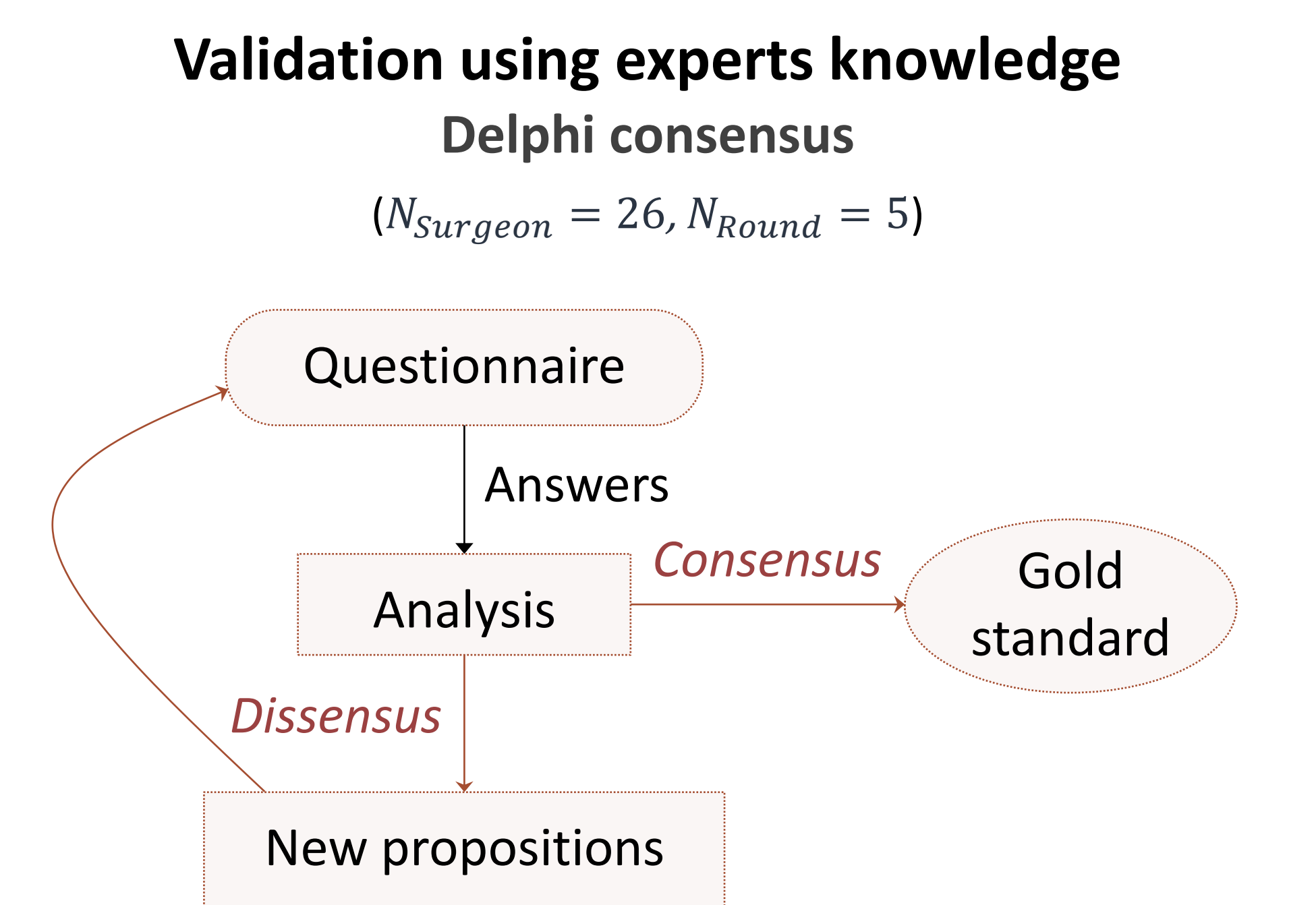
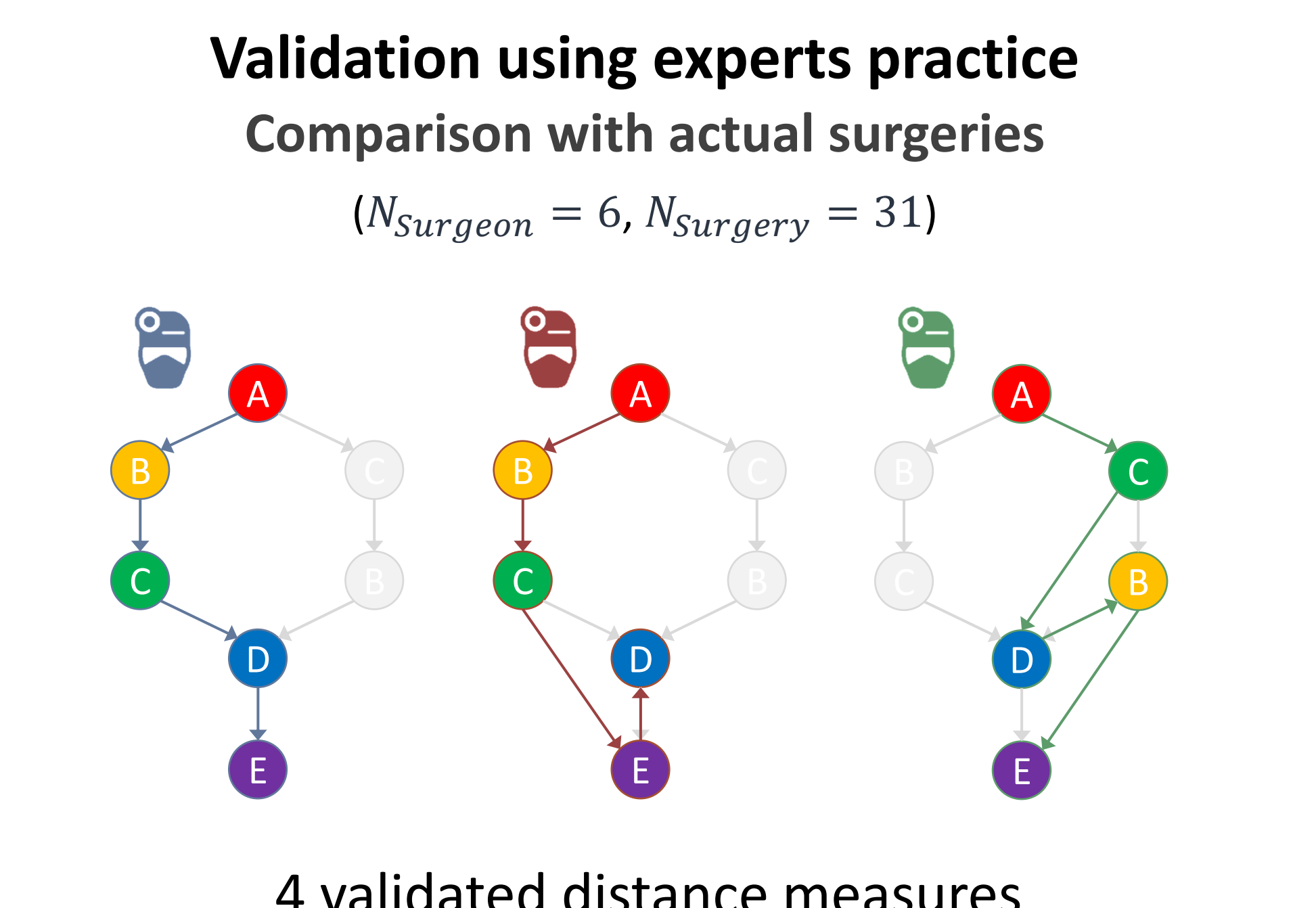
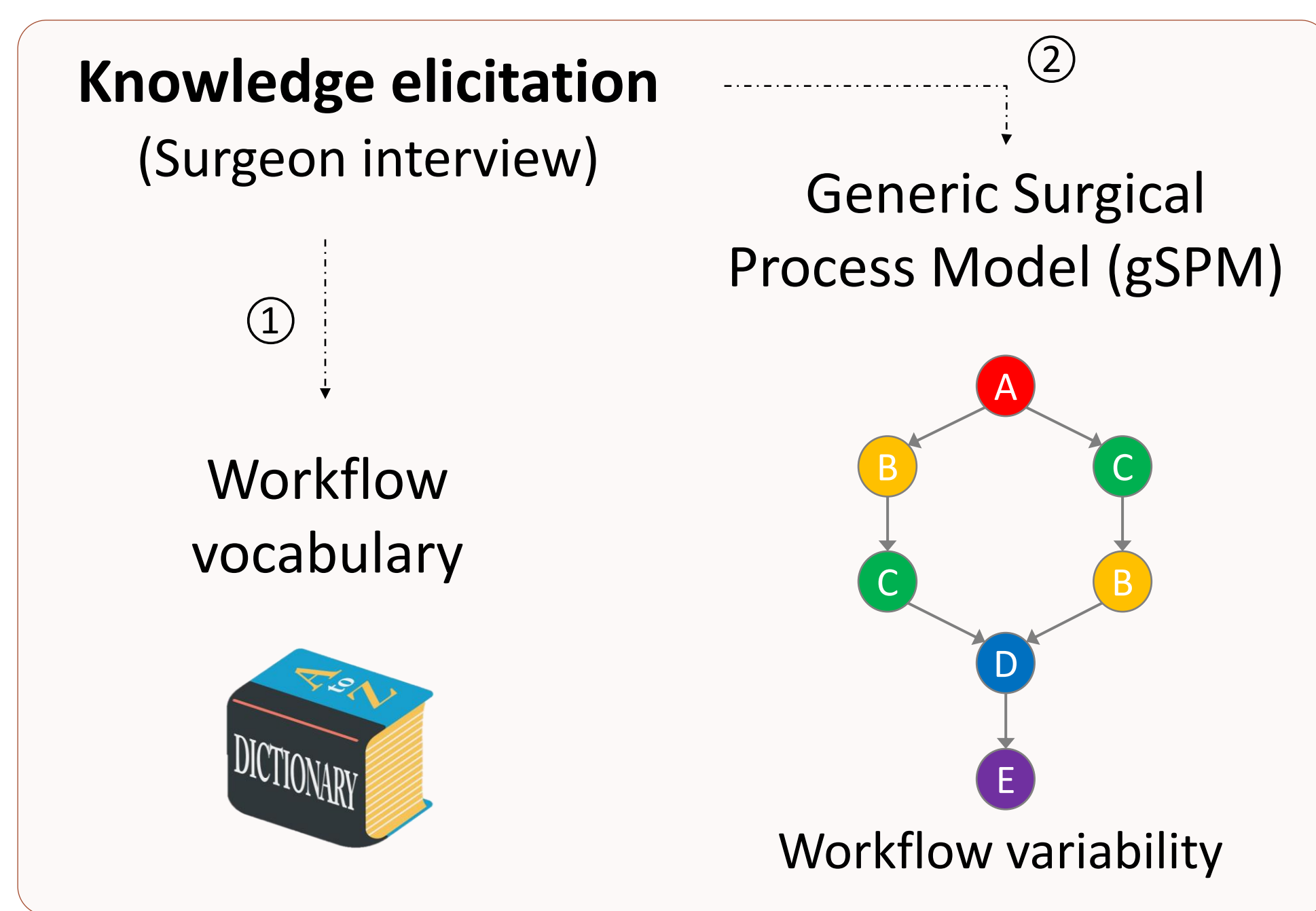
Video



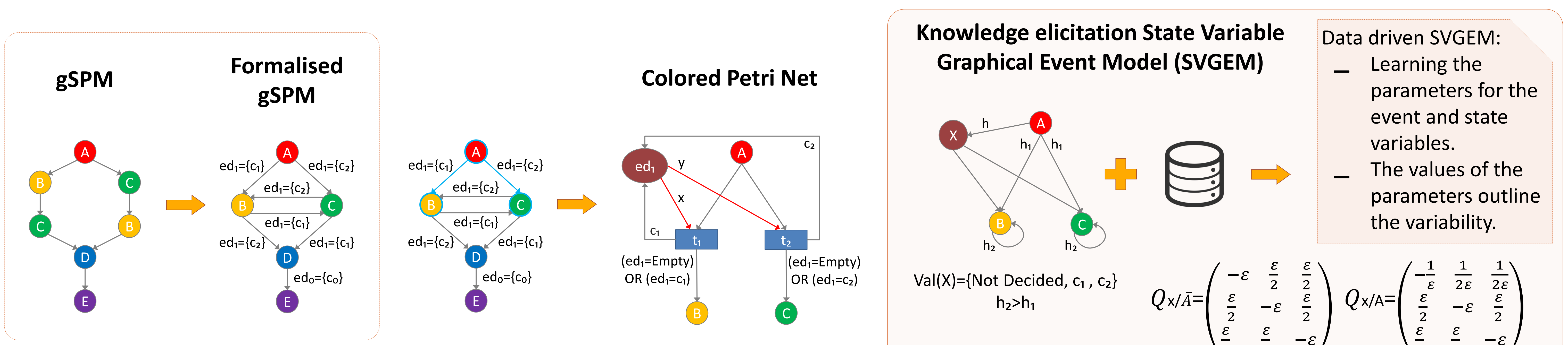
Kinematics



1- Top-down approach: Procedural models of surgical knowledge by Knowledge elicitation



2- Bottom-up approach: Procedural models of surgical practice by Graphical Event Models



3- Developing Methods for Surgical Data Analysis: A Proof-of-Concept Using the PETRAW Dataset

PETRAW Simulated Surgical Tasks

Clustering of Trajectories

Multivariate Time Series Trajectories Data

Select clustering algorithm for MTS
 Choose elastic distance measure
 Apply averaging method

Clustered Trajectories

Evaluation of Clustering Accuracy

Labelling: Assign an activityID to each trajectory

Unsupervised clustering with 2 methods

Compare predicted labels with ground-truth

Results:

Kmeans DTW DBA	0.413
Kmeans SoftDTW SoftDBA	0.501

Adjusted Rand Index (ARI)

Definition of an "Average Trajectory"

Cluster of trajectories for a single activity

Barycenter Computation

SoftDBA averaging

"Average trajectory"

Modus Operandi of that surgical activity

"Average trajectory" along the spatial variables (x, y, z)

Right Hand (blue), Left Hand (red)

'Idle-Hold', 'Hold-Idle'