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### ► **To cite this version:**

Justine Coton, Dominique Vincent-Genod, Julien Veytizou, Guillaume Thomann, Carole Vuillerot. Innovative method using the sensor kinect for motor functions evaluation in SMA Type 2 and 3 Children. Myology Congress, Mar 2016, Lyon, France. hal-01912304

**HAL Id: hal-01912304**

**<https://hal.science/hal-01912304>**

Submitted on 5 Nov 2018

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# INNOVATIVE METHOD USING THE SENSOR KINECT FOR MOTOR FUNCTIONS EVALUATION IN SMA TYPE 2 AND 3 CHILDREN

J. Coton (1), D. Vincent-Genod (2), J. Veytizou (3), G. Thomann (4), C. Vuillerot (5)

(1) PhD student, G-SCOP, Grenoble, France ; (2) Physiotherapist, Hospices Civils de Lyon, France; (3) Post-PhD, G-SCOP, Grenoble, France; (4) Associate Professor, G-SCOP, Grenoble, France; (5) MD, PhD, Escale PMR, Hospices Civils de Lyon, Lyon, France

## CONTEXT: KINECT FOR THE MFM ASSESSMENT IN SMA 2 AND 3

The MFM assessment scale focus on motor functions and is proved to be efficient in measuring motor function in SMA type 2 and 3 [1].

New motion capture tools such as Microsoft Kinect are able to identify a silhouette and its articulations in a 3D space without any markers.

Can those new motion capture tools be used in clinical context and help to qualify the motor capacity of SMA 2 and 3 children ?[2][3]

Note: this project is a continuation of another poster presented here: J. Veytizou « Evaluation of the Microsoft Kinect and KinectLAB software as a clinical assessment tool of functional motor abilities »

## ITEMS SELECTION AND ANALYSIS PROCESS EXPLANATIONS

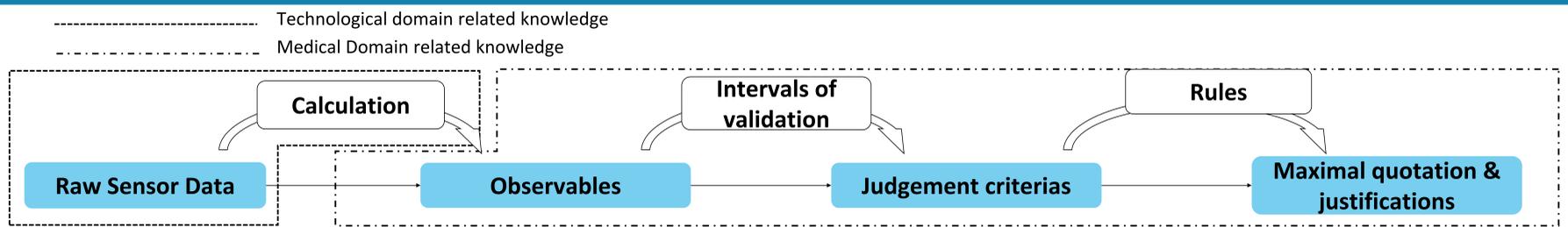
1) Items are selected based on Kinect's capacities : non ambulatory movements with a fully visible silhouette

2) A Delphi survey was deployed in an experts' population to identify which MFM's items are important for an SMA patient

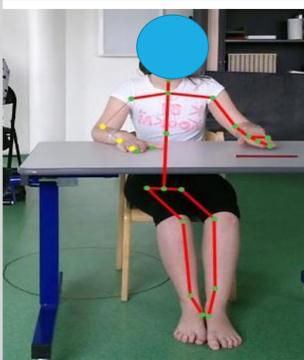
Those items were then monitored with a Kinect sensor and analyzed as follows (see the process below):

1. Kinect data are converted into biomechanical observables
2. A judgment is applied on those observables and a medical term is associated to the movement
3. Depending on terms activated a quotation is generated

## ANALYSIS PROCESS: EXAMPLES OF ITEM 16 AND ITEM 25 OF THE MFM



### Item 16 : Reach the pen by doing an elbow extension



Healthy

elbow angle (°)

Angle: 120° - 170°  
in 1,5 s (a)

Complete extension ✓  
Reptation ✗

3

Elbow fully extended  
Hand lifted and shoulder stable

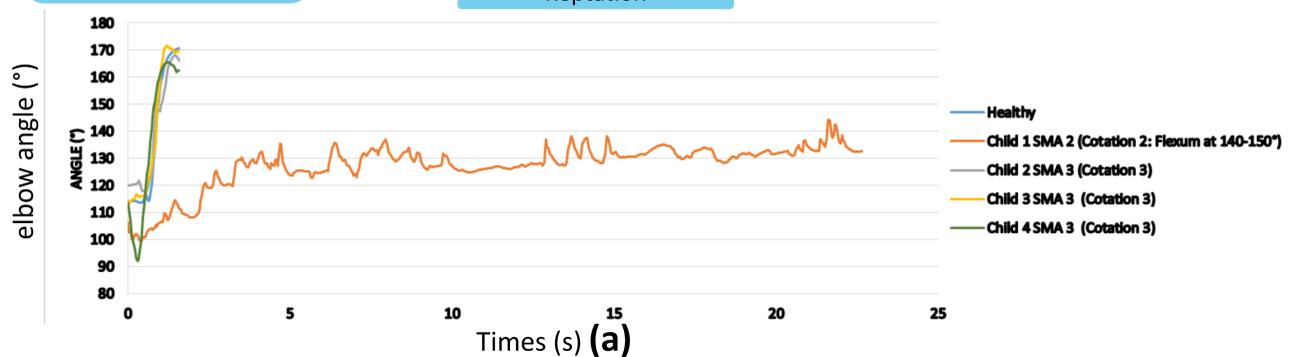
Child 1  
SMA 2

Angle: 110° - 140°  
in 20 s  
noise from ramping on  
the table (a)

Complete extension ✗  
Maximale extension ✓  
Reptation ✓

2

Elbow extended to flexum  
capacity  
And hand reptation



### Item 25 : Standing Straight



Healthy

Lower limb alignment(m)

limb joints gap < 2 cm  
(b)

Stand 5s ✓  
Limbs are straights ✓

3

Stand straight for 5s

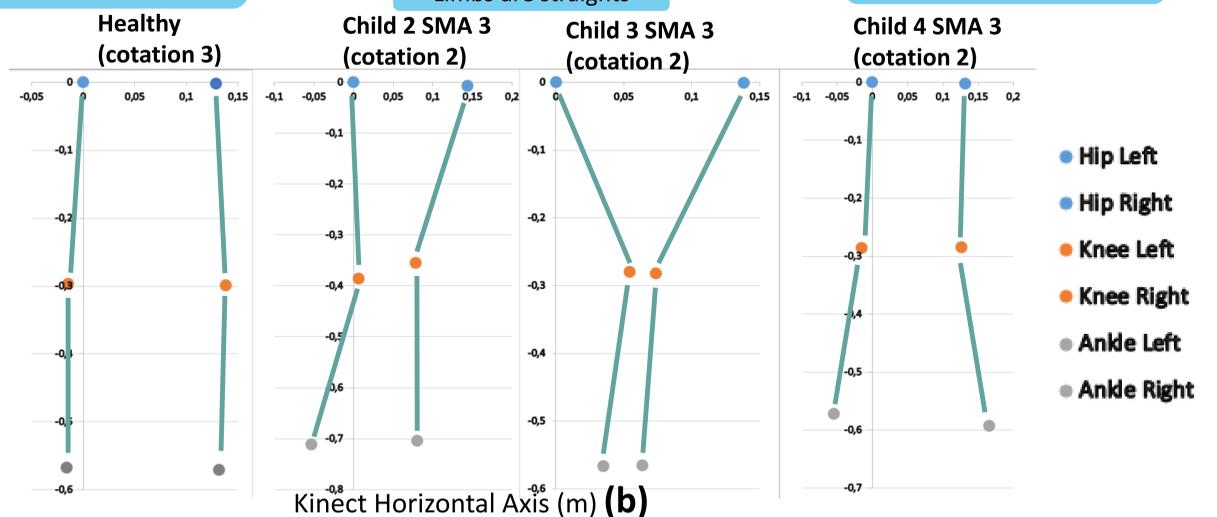
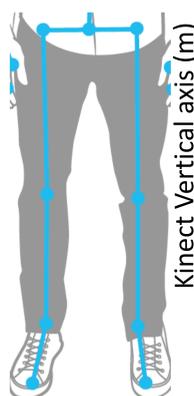
Child 2  
SMA 3

limb joints gap > 2 cm  
(b)

Stand 5s ✓  
Limbs are straights ✗

2

Stand for 5s  
Lower limbs abduction



## CONCLUSION

This research propose the following contribution:

- A tool to evaluate MFM items with a Microsoft Kinect by providing argumentation based on medical criteria and observables
- Trials on SMA patients to calibrate and evaluate the tool

Work are in progress to provide automatic advices for therapists during evaluation and to be incorporated into a serious game for children

## REFERENCES

- [1] Iannaccone ST, American Spinal Muscular Atrophy Randomized Trials (AmSMART) Group. Outcome measures for pediatric spinal muscular atrophy. Arch Neurol. sept 2002;59(9):1445-50.
- [2] Da Gama A, Fallavollita P, Teichrieb V, Navab N. Motor Rehabilitation Using Kinect: A Systematic Review. Games Health J. avr 2015;4(2):123-35.
- [3] Han JJ et al. Reachable Workspace and Performance of Upper Limb (PUL) in Duchene muscular dystrophy. Muscle Nerve sept 2015