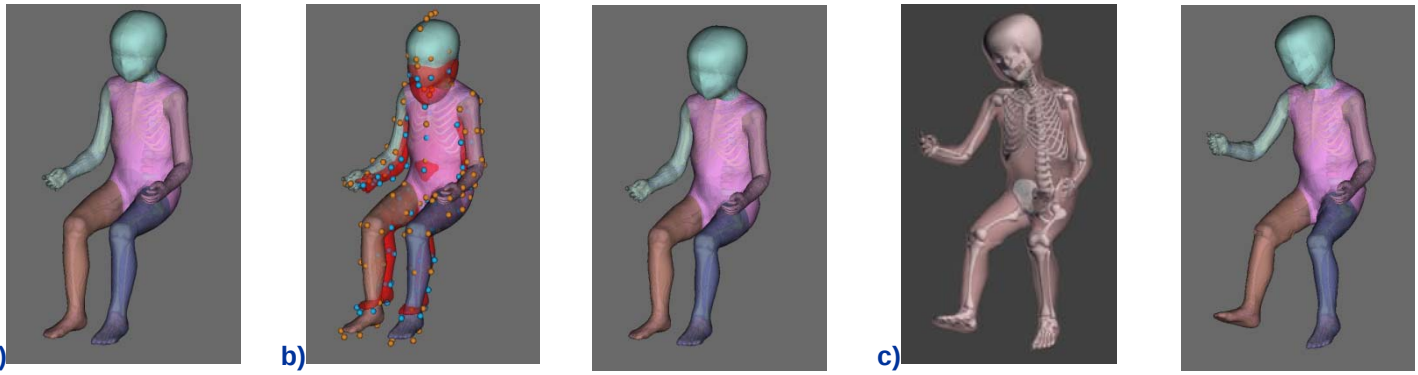
Position and Personalize Advanced Human Body Models for Injury Prediction

NEWSLETTER 3

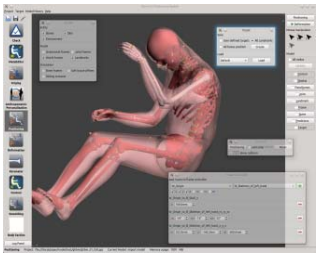
PIPER Child model nearing finalization

The continuously scalable PIPER child model is nearing finalization. The mesh development phase is completed and the verification of the model response is ongoing. All body regions, as well as the assembled model, have already been checked against numerous impact conditions (Presentation at the Conference on the Protection of Children in Cars, Munich, Dec. 8-9, 2016). The model is already well integrated in the PIPER tool to perform age scaling based on anthropometric dimension and positioning.



Personalization and positioning workflows on the PIPER child model: the baseline 6 years old model (a) can be scaled to a 3 years old child (b) using Kriging and then positioned (c) using a lightweight physics simulation.

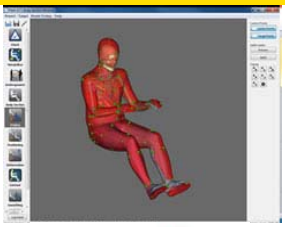
Beta testing phase in progress



A testing phase has started. It will allow users selected outside the project to get a first preview of the PIPER tool. The current version includes many modules and possible workflows to position or personalize leading models. Executables (Windows or Linux) are provided (under NDA) with illustrations showing the use with the GHBMC Male, the PIPER Child model or the Thums.

The objective is to identify possible gaps between user expectations and current functionalities, and to collect information about possible stability and usability issues. This information will be useful to define priorities for the upcoming months and prepare for the final release (which will differ significantly from the current version). Beta testers were selected and are contacted in three phases.

Licensing plan adopted



The PIPER consortium has now selected licenses for the final deliverables. All deliverables will be released under Open Source licenses at the end of the project (April 30, 2017). The licenses selected ensure that the software and models will remain Open and freely accessible for all (including academic and commercial users). They will allow contributions by anyone such that the software and models can keep evolving. The licenses are also compatible with a commercial service business model. More specifically:

- All **software** (PIPER framework and modules) will be released under the Open Source license GPLv2 or later (https://www.gnu.org/licenses/old-licenses/gpl-2.0.en.html).
- **PIPER Child models** will be released under the Open Source license **GPLv3** (full text here: https://www.gnu.org/licenses/gpl-3.0.en.html) with additional clauses to promote **Open Science**.
- **Data** (e.g. segmentations) will be released under the Creative Commons **CC-BY** Version 4 (https://creativecommons.org/licenses/by-sa/4.0/)

- Some specific libraries (e.g. AnatomyDB) will be released under the more liberal LGPLv2 to facilitate use in other software (Full text of license: https://www.gnu.org/licenses/old-licenses/lgpl-2.1.en.html)
- Documentation will be released under the Free Documentation License Version 1.3 (GNU FDL V1.3, https://www.gnu.org/licenses/fdl-1.3.en.html)

Discussions are ongoing with commercial models owners regarding the distribution of the metadata required to import their models in the software framework. Prior to the final release, previews will be available in beta testing under non-disclosure agreement.

Project overview: motivation, objectives and main steps

*In passive safety, **advanced Human Body Models (HBM) for injury prediction** based on the Finite Element method have the potential to represent the population variability and to provide more accurate injury predictions than alternatives using global injury criteria. However, these advanced HBM are underutilized in industrial R&D. Reasons include difficulties to position the models – which are typically only available in one posture – in actual vehicle environments, and the limited representation of the population variability (size, weight, etc.).*

*The main objective of the PIPER project is to **develop "user friendly" tools to position and personalize these advanced HBMs.** By facilitating the generation of population and subject-specific HBMs and their usage in production environments, the tools will enable new applications in industrial R&D for the design of restraint systems as well as in research. The main steps for the implementation include:*

- *Definition of the specifications for the personalizing and positioning tools. Improvement of child human models and accident reconstruction environments; evaluation of the tools in actual applications including adult and child biomechanics; definition of guidelines for use of the tools (WP1).*
- *Development of predictors of posture and shape to help drive the personalisation and positioning tools based on imaging and postural data (WP2).*
- *Development of a modular framework to position and personalize HBM (WP3).*
- *Dissemination of results, facilitation of test by potential user (WP4). A final workshop will be held in Paris on April 25, 2017.*

Key points and deliverables

The tools will be shared with the community using an Open Source License. It will ensure easy access and allow future evolutions and contributions from the community. The tools aim to be model neutral. Predictors of posture and shape are based on statistical databases (e.g. geometrical) that will be released under a similar license. You are welcome to contact us if you think you have data that could be useful for these databases. The needs and priorities of the community are synthesized based on end users requests.

Key figures

4 M€ Budget

3 M€ EC Funding

42 months, from 1st Nov. 2013

Final dissemination workshop to be held on 25th April 2017 in Paris

Project participants

Université Claude Bernard Lyon 1 *Project Coordinator*		Centre Européen d'Etudes de Sécurite et d'Analyse des Risques	
GIE de Recherches et d'Etudes PSA Renault		Institut National de Recherche en Informatique et en Automatique	
Kungliga Tekniska Hoegskolan		Partnership for Dummy Technology and Biomechanics	
Technische Universität Berlin		University of Southampton	
Foundation for Innovation and Technology Transfer - Delhi		Lyon Ingénierie Projets	

Contact: contact@piper-project.eu **www.piper-project.eu**

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