



## **PhD Grants from the China Scholarship Council: Co-operation Program with the UTs and INSAs (France), Program 2022**

### **Thesis subject:**

Integration of human factor for car interior design: new user needs of the future cars.

### **Keywords:**

Car design, User, Ergonomics, Occupant packaging, Automotive engineering, CAD

### **Description:**

The automobile industry is currently facing a milestone in its development. What will the automobile look like in ten years? Will it be ultra-compact, low-tech, and sustainable, or ultra-high tech? Today, cars are undergoing significant changes: firstly because of developing Connected and Autonomous Vehicles (CAV), secondly, because of the immediate need to switch back to reasonably sized vehicles to continue the drastic reduction in energy consumption. Such developments will put ergonomics at the core of the architecture of these future vehicles: The new electric and hybrid propulsion systems create new architectural potential with a positive impact on the passenger cabin. Flat floors and elimination of the engine compartment might require rearranging onboard functions. Autonomous driving will offer new onboard activities, mainly for the "driver," who must sometimes take over control of the car rapidly, when for example the car leaves the highway. The "driving position" and seating functions will change radically, switching also from the autonomous position to the control position. Furthermore, energy-efficient vehicles will be more compact and lighter but will still have to accommodate their passengers comfortably and efficiently. Consequently, ergonomics and vehicle architecture will be the core of new vehicle development to find the best compromise to achieve user comfort and performance. It will be crucial to work on the comfort, physical, and cognitive ergonomics of future driving positions, allowing to switch securely and efficiently from the autonomous position to the control position.

In this context, the process of new vehicle design needs to integrate early the ergonomics package, from the architectural step. These new aspects of UX are also crucial for the position of industrial companies, from the SME to big companies, on the market. The quality of a UX is defined by the ability to answer the requirements (needs to interact with the product) and the ergonomics (mapping between the physical and cognitive aspects). The main objective of the automotive industry is to supply a product that provides the user a good feeling without the rigors of the journey. A tired driver can be the cause of an accident, but tiredness is also a big source of negative UX. This objective to provide a better UX will put the industrial company in a better marketplace.

To answer this objective, new digital tools (DHM) are used by the design engineer in the architectural design step, these tools allow to evaluate different ergonomics aspects and the UX of occupant packaging. The research question is: How can we integrate human factors and ergonomics into the interior design process of future car? This Ph.D. thesis focuses on the methodologies to design the occupant packaging of future vehicles with the considering of user needs and human factors. The Ph.D. candidate, at the first stage, must study various projects of future car development and provide a panoramic vision of tomorrow's vehicles



regarding occupant packaging. This step is mainly dedicated to a literature review and knowing/digging the actors and manufacturers' car design in the world. The second step is assigned to perform the user experiences of proposed occupant packaging on the simulators (physical and virtual). In the third stage, the experimental study must be conducted to investigate the effectiveness/weakness of the human factor integration into occupant packaging. Finally, a heuristic/guideline should be developed for the use of engineers for the ergonomic design of the interior car which would allow developers and designers to create a digital model of a vehicle adapted to users' needs.

### **Expected background of the Ph.D. candidate:**

The applicant should have a master's degree in: engineering design, mechanical engineering, product design, industrial and system engineering. Competences in Computer Aided Design, Automotive Engineering, Ergonomics and human factors will be appreciated.

### **Supervision of the research works :**

Supervisor:

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