[PhD Thesis TIS-DTIS-2020-11] Tactile and haptic interaction for piloting assistance

The main objective of this research project is to study a dual function of tactile assistance (in the broad sense) to the perception and control of piloting in complex and degraded situations. It is based on the combination of a vibro-tactile interface for the perceptual aspects and a force feedback interface for the motor regulation aspects.

The scientific and technological orientations of the concept considered are based on the principle of perceptual supply, which makes it possible to complete or even replace one or more functions of a sensory channel using another sensory channel (Bach-y-Rita, Collins , Saunders, White, & Scadden, 1969). In this context, the tactile mode appears to be particularly interesting when the visual and / or auditory information is missing, degraded or even too much. From a fundamental point of view, these perceptual support devices, at the origin of a new form of perception, require a detailed understanding of the sensorimotor and cognitive mechanisms involved in the perception and optimal control of steering actions. From an applied point of view, the development of these devices must take into account useful information and the usage contexts associated with piloting in order to exceed the limits of existing interfaces and effectively improve the safety and performance of pilots in complex environments. and / or degraded on the informational level.

To achieve this objective, the approach proposed in this project will consist of identifying the assistance needs of helicopter pilots in this type of situation and formalizing the information used by pilots to perform the maneuvers. This preliminary step will identify the information that it will be useful to transmit in the form of vibrotactile messages and that requiring the development of haptic control laws transmitted through the control organs. Spatially distributed but resolutely complementary in terms of useful information for the pilot, this system of tactile interfaces will thus constitute an augmented perception-action loop to optimize piloting in situations of interest.

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