Tunnel junctions are interface-dominated devices. By combining ferroelectric or multiferroic tunnel barriers with ferromagnetic and/or superconducting electrodes novel tunnel junctions can be investigated, which is challenging from the experimental and theoretical point of view. At oxide interfaces the subtle balance of Coulomb interaction and crystal field splitting is altered and leads to novel physics and advanced device functionalities, such as non-volatile multiple state memory cells. To study the size effect on ferroelectricity in heteroepitaxial SrRuO$_3$/BaTiO$_3$/SrRuO$_3$ capacitors, ultrathin BaTiO$_3$ layers were deposited in form of wedges across SrTiO$_3$ substrates. The electrical measurements performed at 77 K showed that, despite progressive reduction of remnant polarization with decreasing film thickness, even the 3.5-nm-thick BaTiO$_3$ film retains a large polarization of 28 µC/cm$^2$. Moreover experimental results on entirely complex oxide ferromagnetic-ferroelectric tunnel junctions will be presented. As ferroelectric barriers BiFeO$_3$ was chosen because it possesses high remnant polarization and it is expected to remain ferroelectric even down to few nm thickness. La$_{0.67}$Sr$_{0.33}$MnO$_3$ and SrRuO$_3$ were used as ferromagnetic electrodes due to their compatibility for epitaxial film growth. The Curie temperature of the La$_{0.67}$Sr$_{0.33}$MnO$_3$ film was above room temperature and of the SrRuO$_3$ film was about 140 K. The entire tri-layer heterostructures like La$_{0.67}$Sr$_{0.33}$MnO$_3$/BiFeO$_3$/La$_{0.67}$Sr$_{0.33}$MnO$_3$, La$_{0.67}$Sr$_{0.33}$MnO$_3$/PbZr$_{0.2}$Ti$_{0.8}$O$_3$/ La$_{0.67}$Sr$_{0.33}$MnO$_3$ deposited on SrTiO$_3$ or NdGaO$_3$ crystalline substrates using pulsed laser deposition and monitored via Reflection High Energy Electron Diffraction. Ferroelectric switching of the ultra-thin barrier films was confirmed by Piezoresponse Force Microscopy (PFM). DC strain loops were also obtained using a modified PFM setup. Tunnel junctions were fabricated using optical lithography and ion beam etching. We show that our devices posses a positive Tunneling Magnetoresistance (TMR) ratio up to ~80%, measured at a temperature of 80 K. Moreover, by inducing ferroelectric switching via an applied electric field of about 770 kV/cm, we can modulate the anti-parallel state resistance state as well as the TMR ratio. The results are discussed in the framework of the predicted magnetoelectric interface effect and may lead to novel multistate memory devices. The experiments indicate a possible tuneable orbital reconstruction at ferromagnetic-ferroelectric interfaces via the remnant charge of the ferroelectric.