ABSTRACT

We present a study of the links between star formation history and structural disturbance for a large mass-selected galaxy sample taken from the STAGES survey. Our sample contains galaxies of all morphologies inhabiting a very broad range of environments, from field galaxies to galaxies living in dense cluster regions. The galaxies' structure is quantified using Hubble Space Telescsope (HST) images (Thisisme et al. 2012), allowing us to divide the sample into undisturbed galaxies, disturbed but non-merging galaxies, and disturbed galaxies which are mergers. Moreover, a quantitative measurement of the degree of disturbance is calculated for each galaxy. As expected, we find that the vast majority of Elliptical and S0 galaxies in all environments probed have relaxed structure and show no signs of ongoing or recent star formation. We also find that structurally-disturbed galaxies have higher star-formation activity and younger stellar populations than their relaxed counterparts. These galaxies tend to avoid the lowest density regions. Conversely, cluster spiral galaxies with reduced/quenched star formation have significantly less disturbed (smoother) morphologies than spirals with "normal" star-formation activity. This is independent on whether these spirals are experiencing mergers or not. This finding suggests that these "passive" spirals have started their morphological transformation towards becoming lenticulars. Surprisingly, we also find that merging galaxies and equally-disturbed (but non-merging) galaxies have very similar specific star-formation rates and stellar ages. The degree of enhanced star formation in galaxies is thus linked to the degree of structural disturbance, regardless on its physical cause. Specifically, galaxies with equivalent degrees of "roughness" (i.e., equivalent deviations from a smooth profile) will have equivalent degrees of enhanced star formation, whether they are merging or not. This indicates that merging galaxies are not special in terms of their higher-than-normal star-formation activity. Any other physical process that produces "roughness", or, in other words, regions of enhanced density, will increase the star-formation activity in the galaxy with similar efficiency.