INAF

ISTITUTO NAZIONALE DI ASTROFISICA
OSSERVATORIO ASTROFISICO DI ARCETRI

UNIVERSITÀ DEGLI STUDI FIRENZE

Lecture XIII: A brief excursus on the evolution of galaxy properties

Astrophysics of Galaxies 2019-2020

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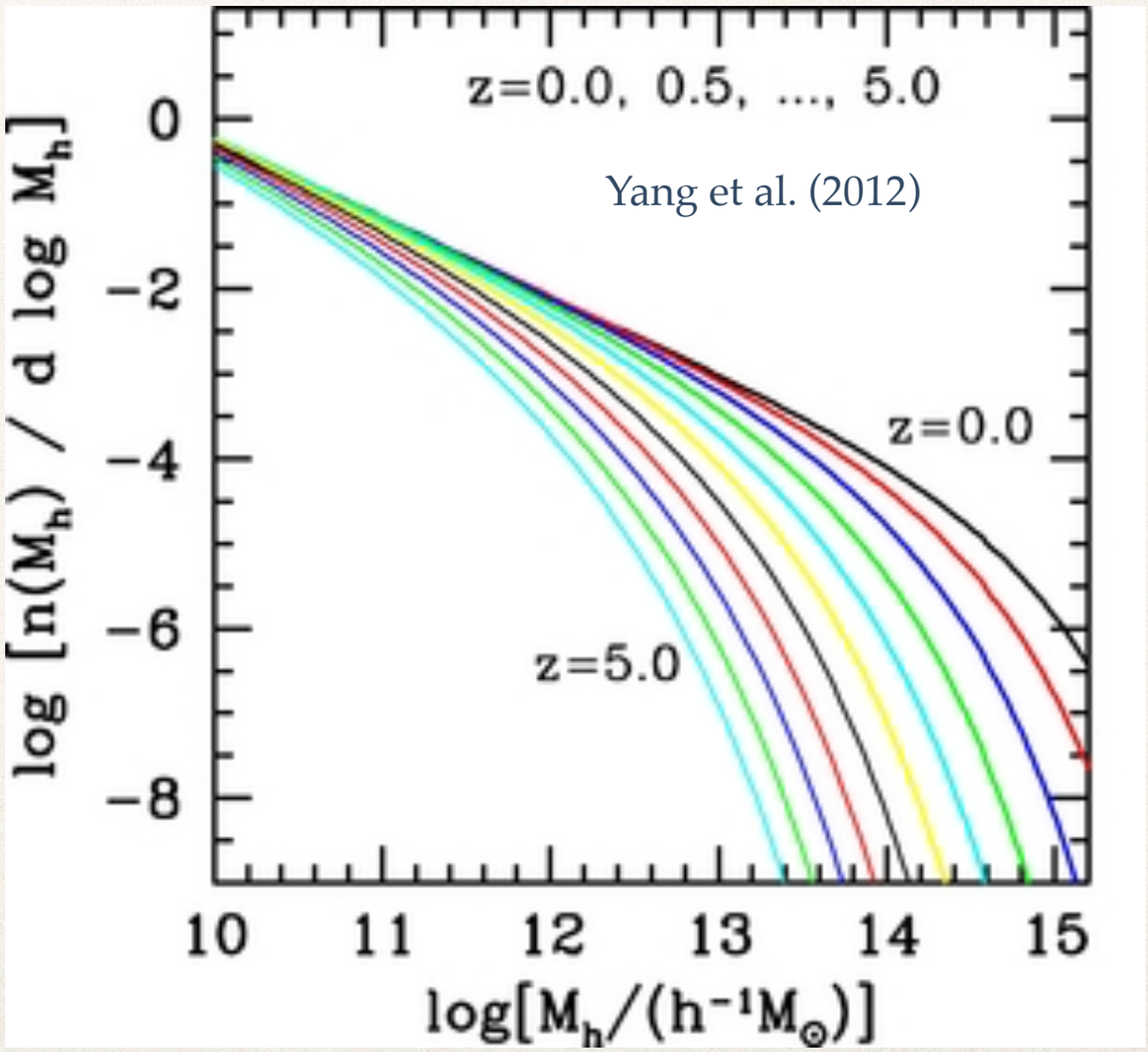
Lecture XIII

Galaxy evolution

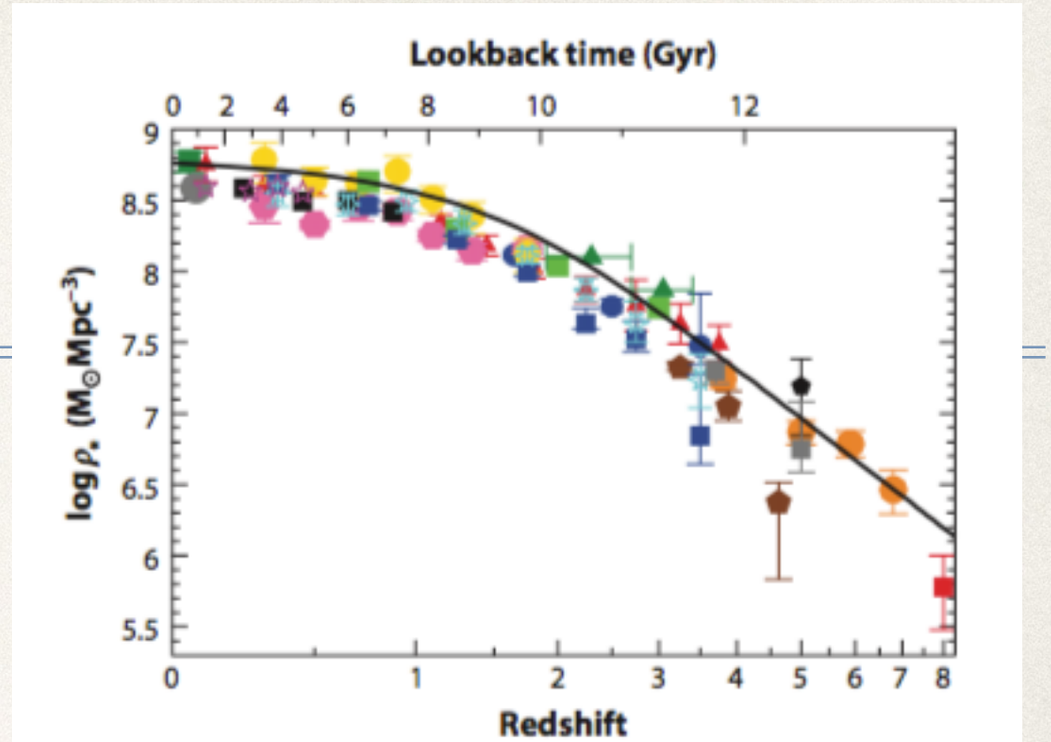
- **Growth of structure (DM halos)**



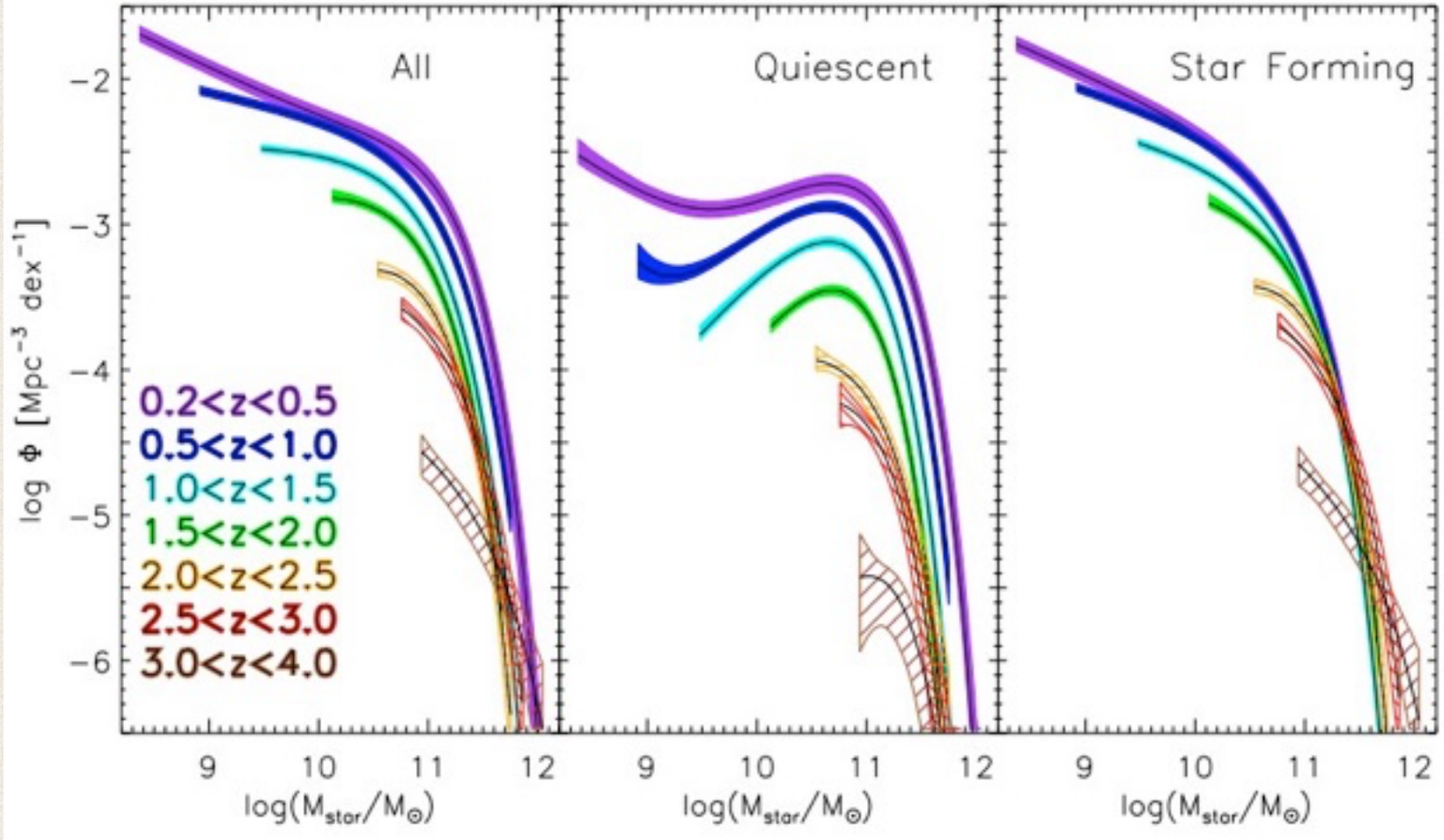
Yang et al. (2012)

Galaxy evolution

- **Star formation, i.e. transformation of gas into stars**



Madau & Dickinson (2014)

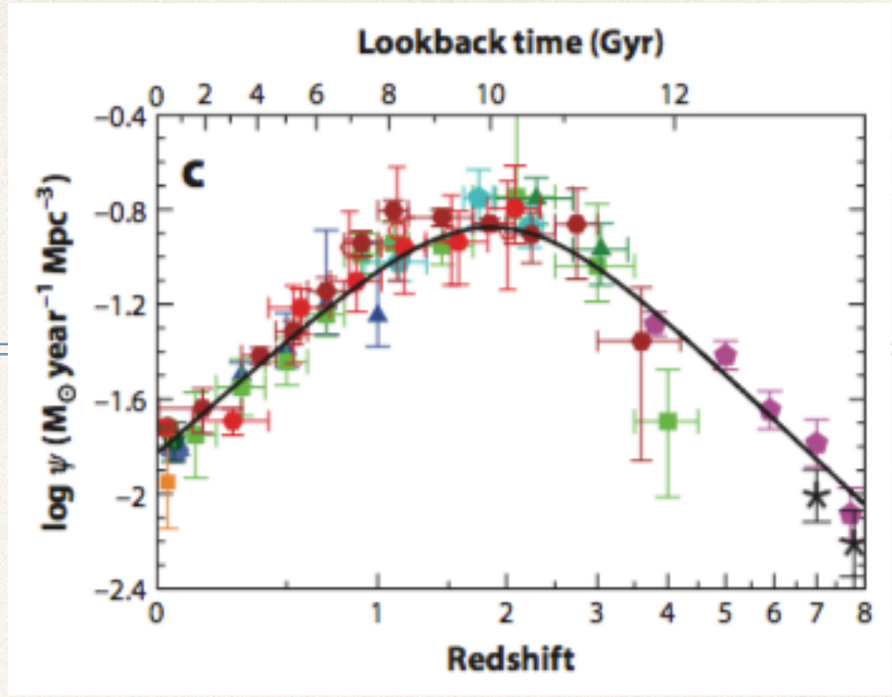


Muzzin et al. (2013)

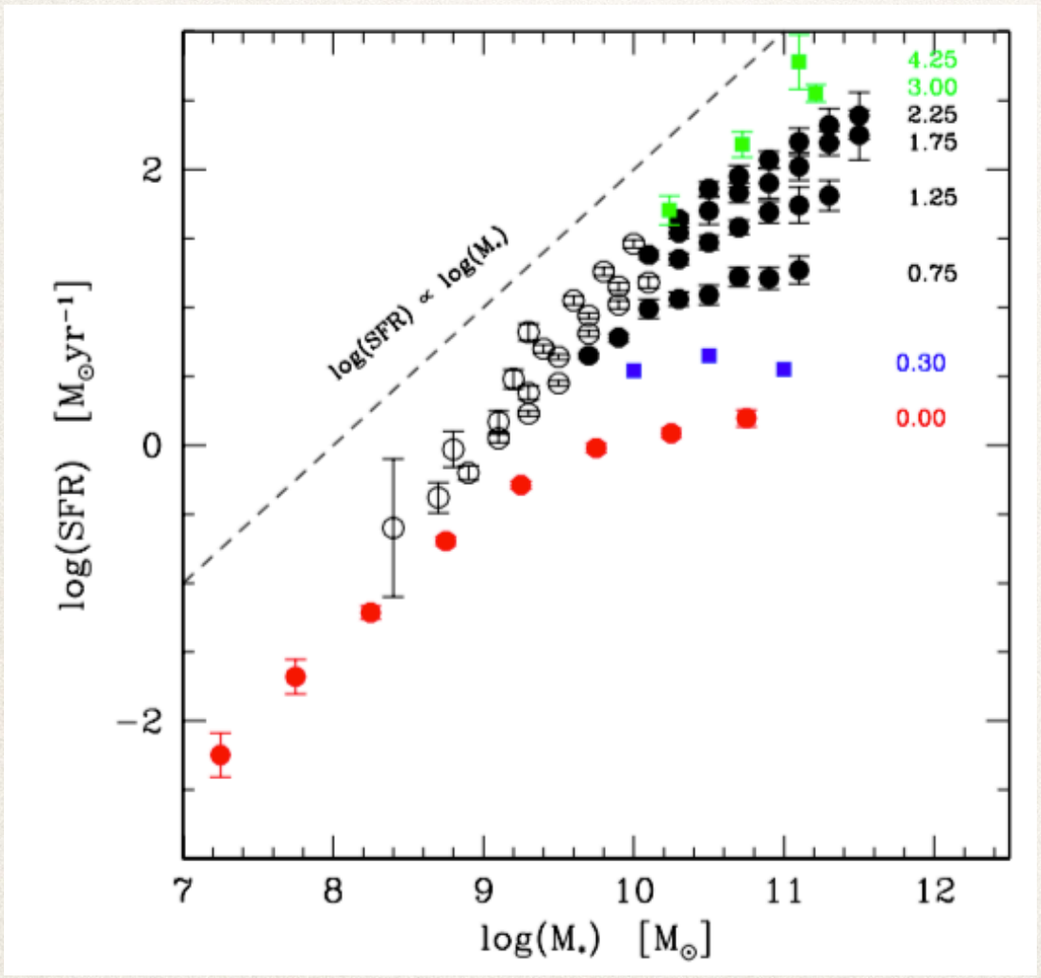
- The stellar content of the Universe grows
- At late times, most of the stellar mass growth goes into quiescent galaxies

Galaxy evolution

- **Star formation, i.e. transformation of gas into stars**



Madau & Dickinson (2014)



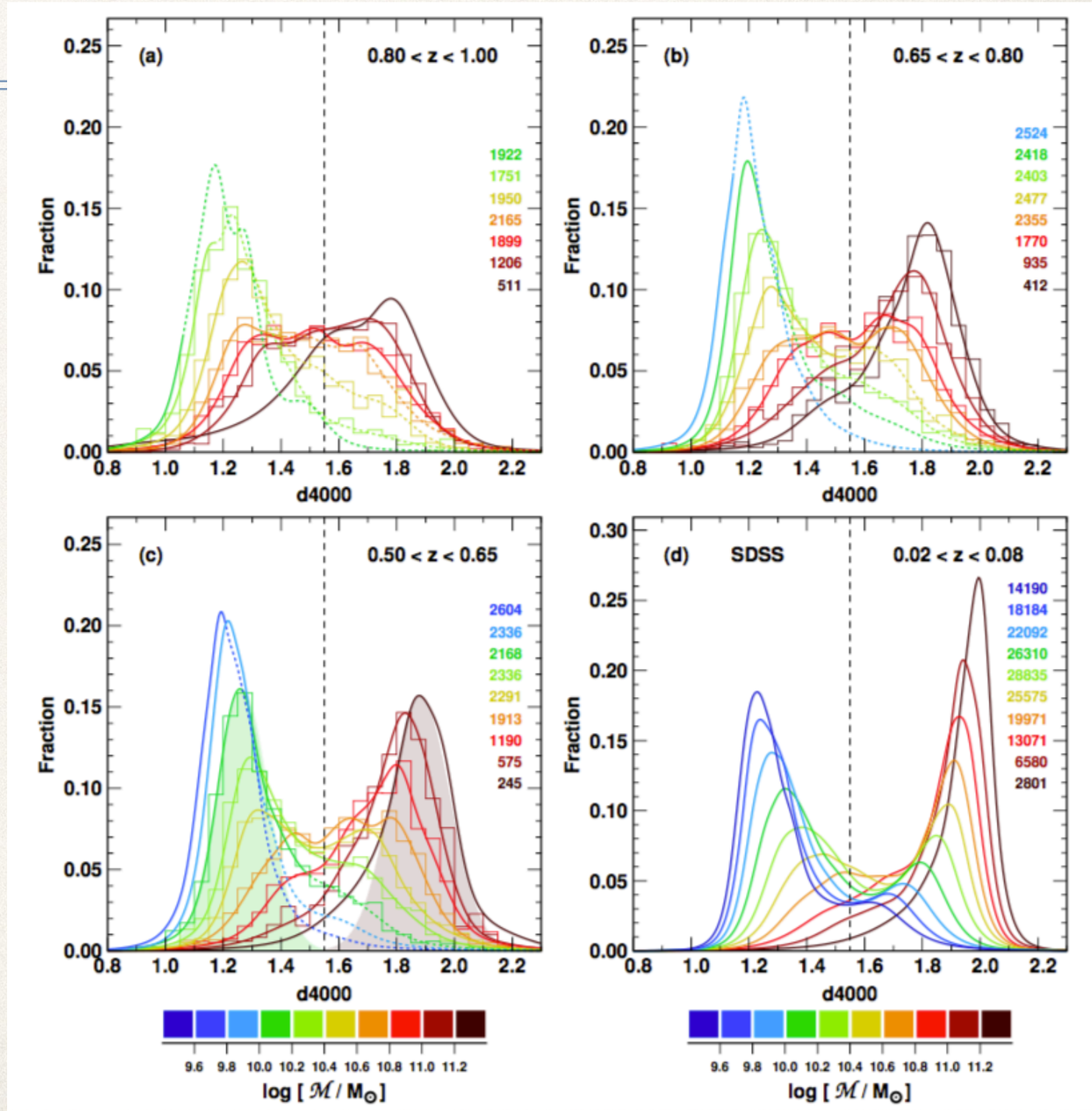
Compilation by Gavazzi et al. (2015)

- Evolution of global SFR with time
- Not only star-forming galaxies change in number density, but also change their activity (i.e. sSFR)

Galaxy evolution

- **Quenching**
- **Downsizing**
- SFing galaxies shut down star formation and transform into quiescent galaxies
- This happens at earlier times for more massive galaxies, such that the galaxies responsible for the bulk of star-formation get smaller with time

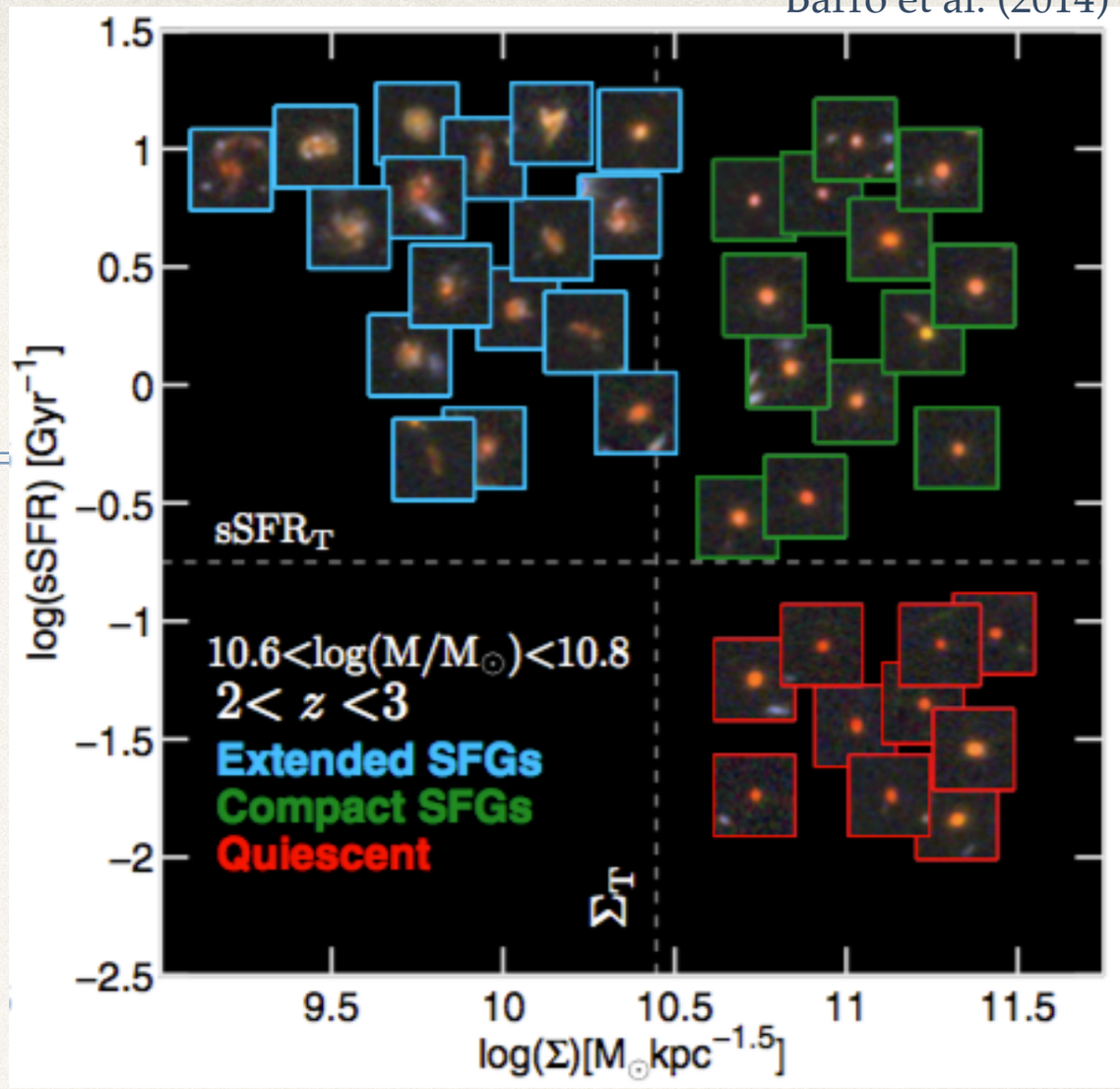
Haines et al. (2017)

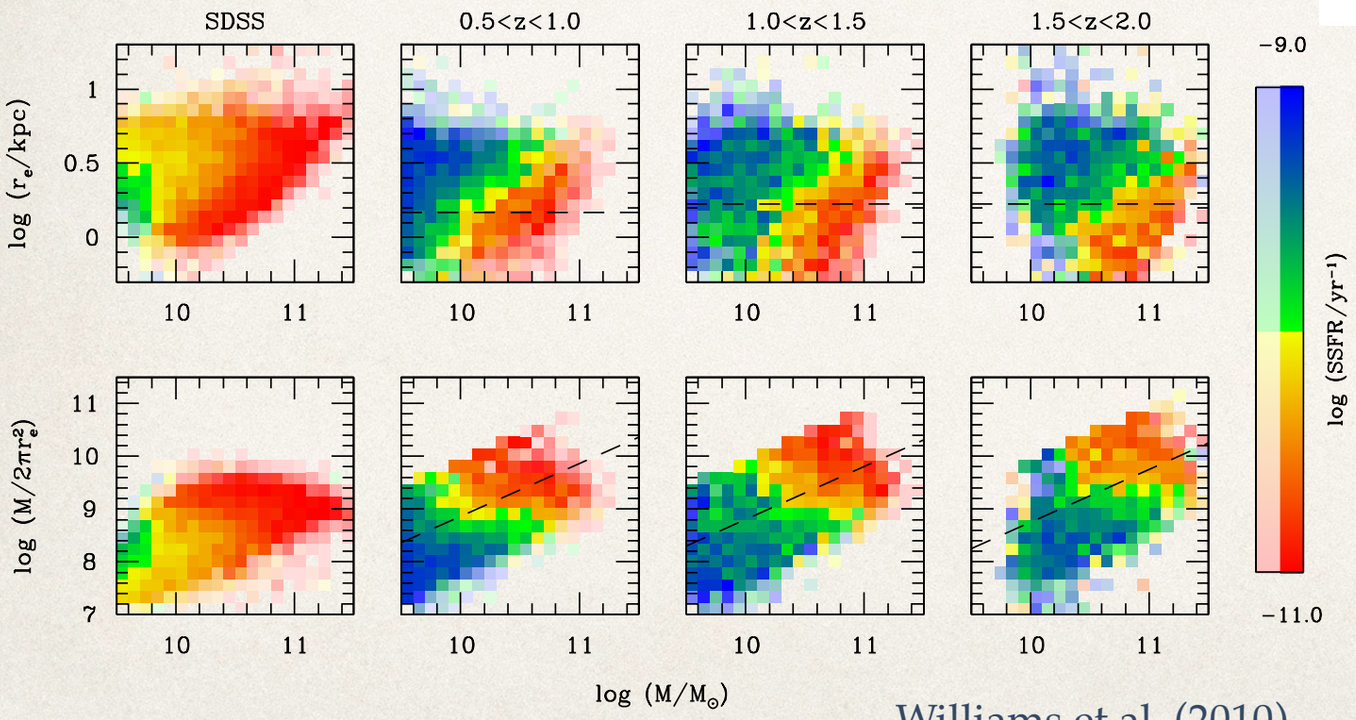


Galaxy evolution

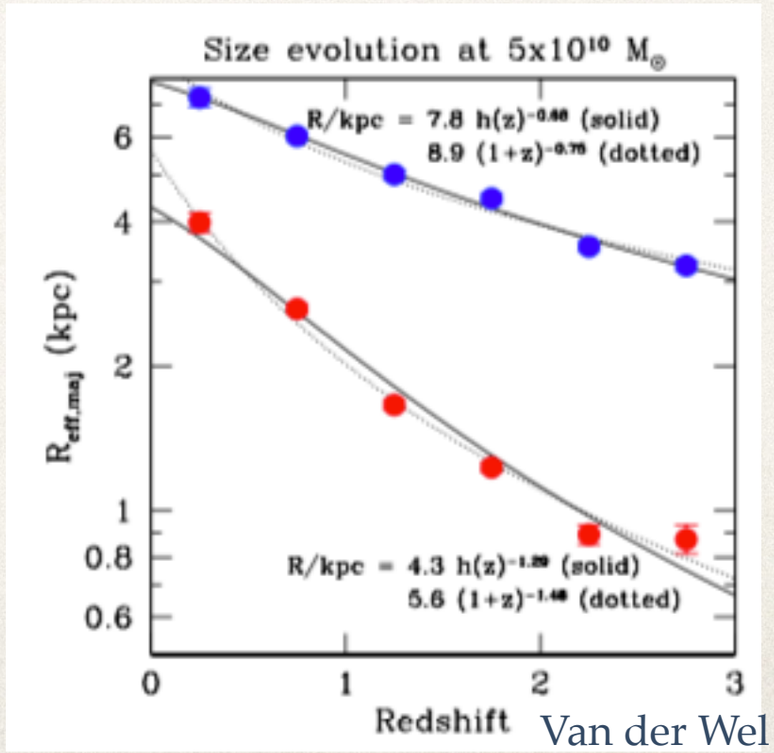
- **Structural transformations**
  - Induced by internal (secular evolution, stellar/AGN feedback) or external processes (mergers, environment)
  - Linked to changes in SFR

Barro et al. (2014)





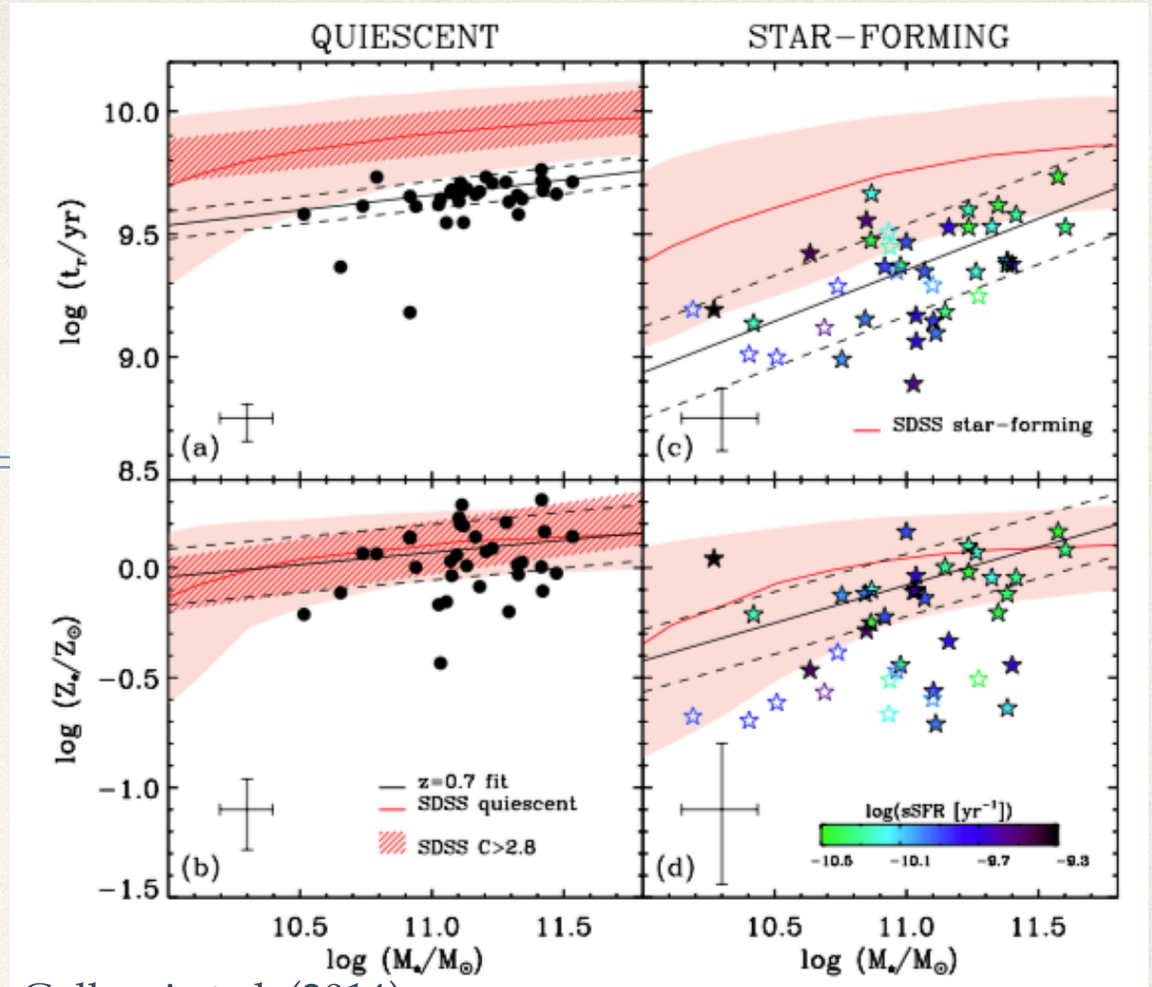
Williams et al. (2010)



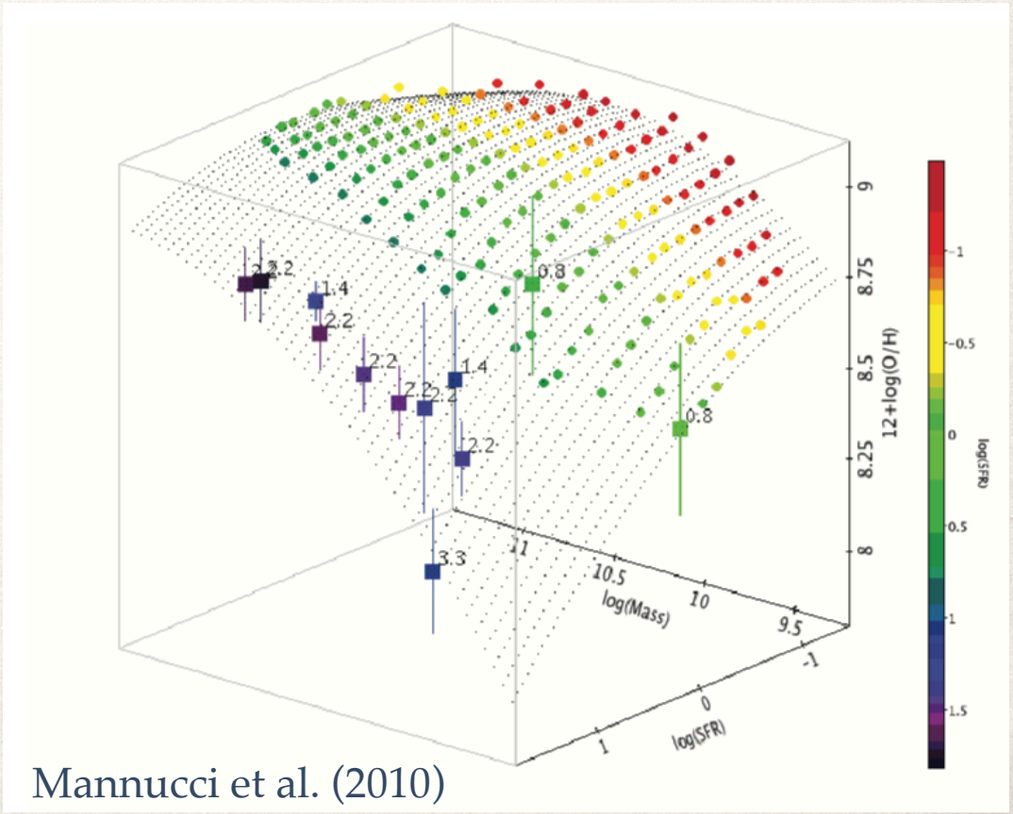
Van der Wel et al. (2014)

Galaxy evolution: tools

- Galaxy properties and scaling relations in the local Universe: Archaeological approach — boost from IFS
- Trace back in time the properties and the scaling relations: new surveys coming online
- Direct study of specific evolutionary processes — boost from IFS
- Modelling in a cosmological framework, e.g. semi-analytic modelling: check how different physical hypothesis impact on the properties of galaxies



Gallazzi et al. (2014)



Mannucci et al. (2010)