Minor corrections

Rebecca Smethurst DPhil thesis viva : Minor Corrections

The influence of morphology, AGN and environment on the quenching histories of galaxies.

Preamble: Statement of Originality.
Please indicate a rough percentage contribution to each published work in the declaration.

A percentage contribution has been added to the Statement of Originality, along with a statement clarifying this percentage.

Introduction : Page 6. and elsewhere
`This transition was theorised to occur……' please re-word without the use of `was theorised' e.g. `It has been proposed that this transition ……'
See also 1.1 ; 1.1.1.3.

p.6 : Statement reworded
p. 7 : "There are many theorised mechanisms which can cause quenching" -> reworded to -> "There are many mechanisms proposed to cause quenching."
p.10: "The former is theorised" -> reworded to -> "The former is thought" and "The latter mechanism is theorised" -> reworded to "The latter mechanism is thought"
And other highlighted changes thoughout Sections 2 - 6

Page 7. `accreton disk of cold material'-> `accreton disk of hot material'

p.7 : wording changed

Page 15. Indicate that aperture bias is (is not) an issue for the thesis, supported by an appropriate calculation of the physical scale at the low and highest z range probed by the sample.

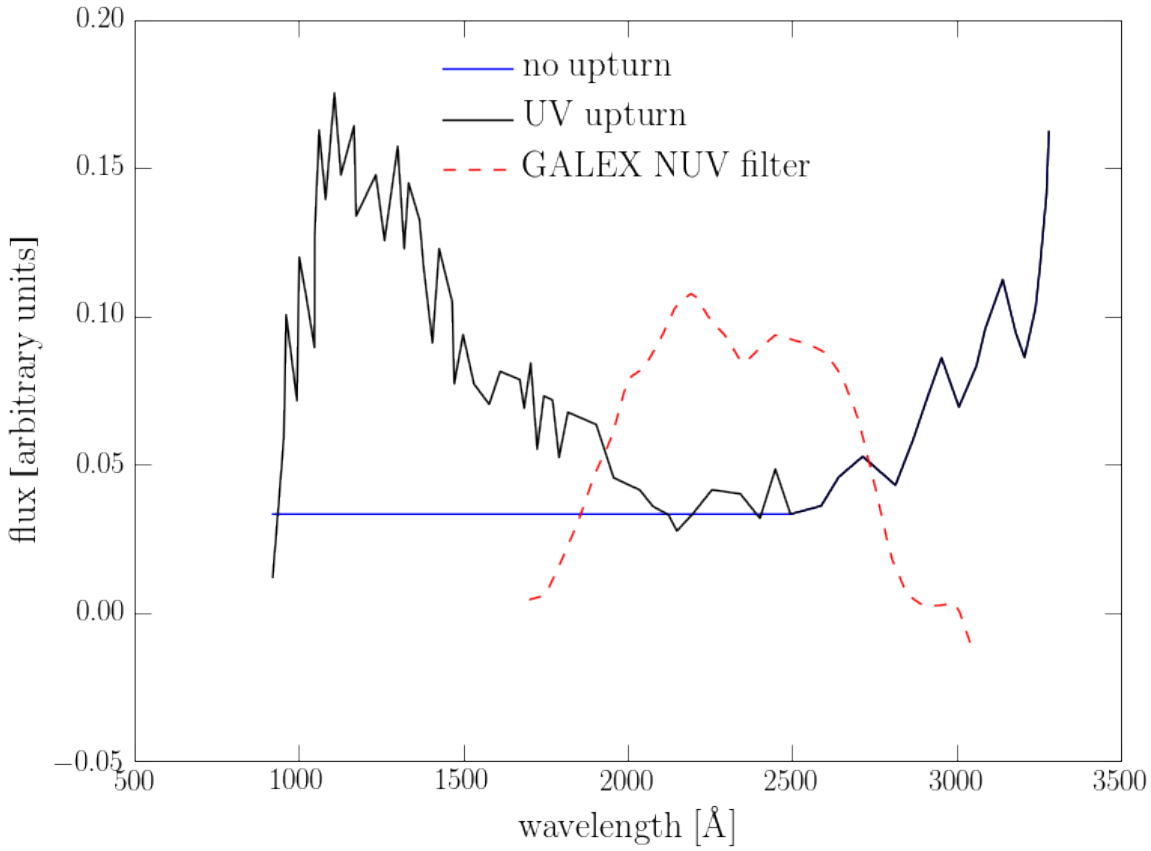
p. 15: A sentence has been added discussing the physical scale across the redshift ranged probed by the sample as justification for using the Petrosian magnitudes used in this study.

Page 16. The outer portions (beyond 1.1deg from the axis) of GALEX observations have poor astrometry and FWHM of the PSF (e.g., Morrissey et al. 2007; Drinkwater et al. 2010). Please indicate if these regions have been used in the work, or if the latest GALEX data release does not include these poor astrometry regions. Spell out clearly the source of the GALEX data (which data release, and how the data was accessed – presumably from the public web site?). If these regions have been included to match to SDSS photometry, the galaxies will need to be removed from the subsequent analysis, as the NUV-optical colours will likely be wrong.

p. 16 : The source of the GALEX data was the Bianchi et al. (2011) DR5 catalog accessed using the VO through the TOPCAT application. This has been stated in Section 1.3.2. Concern was raised over the outer portions of the GALEX field of view which have poor astrometry. We have investigated the positions of the galaxies in the GZ2-GALEX sample within the GALEX field of view and have found that all sources have a field radius, $R_{fov} < 0.5°$ (i.e. are within 0.5° of the field centre). Morrissey et al. (2007) confirm that sources within $R_{fov} < 0.6°$ can be accurately cross matched with SDSS data, as long a cross match radius of < 3" is used. In this study I have used a cross match radius of 1" and so am confident in the accuracy of the NUV-optical colours.

Add a caveat to allow for the possibility that the NUV flux could come from horizontal branch stars, as opposed to young star (O and B class) and therefore would not be due to star formation (i.e. the “UV upturn” phenomenon).

p.22 : A paragraph discussing this caveat and the effect of the UV upturn on the NUV-u colours has been added to Section 1.3.4. Since the UV upturn is still not fully understood and stellar population models of horizontal branch stars are highly uncertain, I have taken an empirical approach to quantify the impact that the UV upturn may have on the NUV magnitudes. Taking the composite spectrum of a typical strong-UV upturn galaxy, NGC 4552 (M89), which is provided in Figure 1 of Yi et al. (1998) I have convolved it with the GALEX NUV filter when the NUV upturn is present and when it is absent. The absent case was determined by assigning the flux measured at 2500Å, the typical edge of the NUV upturn region, to all wavelengths blueward of this point. This is shown in the plot below:



I find that in this worse case scenario the change in the NUV magnitude from the spectrum with no UV upturn is ~ 0.13, which is well within the median error on NUV-u quoted on p.22 (see below).

Page 21 & Throughout ensure that the contour levels given on all contour plots.

Contour levels have been included on all plots where possible and in a few cases, where this would result in crowded plots, levels are instead specified in the caption.

Page 21. Give the uncertainty on the colours for the galaxies (especially u-r).

p.22 : Median uncertainties on both u-r and NUV-u colours have been stated to 2sf.

Chapter 2.
Early in the chapter, make it clear what the inputs and outputs to starpy are used (e.g., u-r and its uncertainty, NUV-u and its uncertainty and redshift and its uncertainty plus age result in t and Tau outputs).

p.35 : This has been stated at the end of section 2.2.2

Section 2.2.1
In this section (and unlike the rest of the thesis), the phrasing changes to say “allows you”; “represents your”; etc. Please remove the word “you” and “your” wherever possible here and replace with more appropriate wording.

All wording changed to be passive, “you” and “your” removed in all cases throughout section 2.2.1

Page 40. Are there any galaxies that might plausibly be systematically discarded? In particular, comment about the location of post star bursts / E+As in the figure caption.

p. 40 : A paragraph has been added to Section 2.5 discussing the possibility that galaxies may be systematically discarded, referring particularly to PSB galaxies.
p.41 : A sentence has been added to the caption of Figure 2.7 referring to the locations of E+A galaxies.

Page 43. Definition of “Inactive” is required in the figure caption.

p.44 - 45 : Definition of INACTIVE sample added to captions of Figures 2.8 & 2.9

Chapter 3
Page 48. “For a more complete sample” – quantify completeness here.

p.49 : Wording changed to a “complete sample” and completeness now quantified later in the same sentence.

Page 51. Fourth line of Table 3.1. The p_S>=0.8 is incorrect.

p.52 : Table 3.1, typo corrected so that “Late-type (p_s >=0.8)” now reads “Late-type (p_d >=0.8)"

Section 3.2.1 Cite Jacob Crossett’s work that complements the present arguments.

p. 57 : A sentence discussing the agreement with Crossett et al. (2014) has been added to Section 3.2.1.

Page 57. Comment on the “unusual” shapes of the upper curves – are they real or artifacts of the particular model chosen?

p.59 : A discussion has been added to Section 3.2.2 about the shape of the upper curves. The captions of Figures 3.4, 3.5, 3.7 have also been updated to state the normalisation of the upper histograms is between 0 and 1.

Page 59. Is there a slow channel and a fast channel to red sprials? Please comment.

p. 61 : A comment has been made that red spirals are more likely to be produced by a slower quench since spiral structure is often retained in secular processes, however may also be triggered by interactions which could be attributed to the rapid quench seen in Figure 3.5.

Also on this page, the 31.2% change requires a fuller explaination.

p.61 : The calculation of 31.2% has been laid out in a footnote to show how this was obtained.

Page 69. Bullet point (ii): “elliptical” is wrong. Should be `early-type’, or `smooth’. Check every occurrance of “elliptical” and consider whether you need to change this.

All occurrences of “elliptical” throughout the thesis have been considered and changed to early-type or smooth where appropriate, including the bullet conclusion on p.71.

Chapter 4
Page 71. Add a note of the relative timescales of AGN triggering and visibility versus quenching mechanisms.

p.73 : A discussion of the typical AGN visibility timescale ~ 0.01 Gyr in comparison to the time taken to drop below the SFS in a set of models with rapid quenching rates has been added.

Page 72. How have the emission lines been measured?
Give the definition of S/N in use here? (i.e. line or continuum?).
p. 74 : A sentence stating how the emission lines have been measured has been added.
p. 75 : The definitions of the variables used to calculate S/N have been stated.

Page 73. Compare the typical (u-r) uncertainty to Delta(u-r)=0.09 to demonstrate it is negligible.

p.75-76 : The two values have been compared along with a reference to Section 1.3.4 where the median uncertainty on u-r colours was originally stated.

Page 75. Fig 4.3. Some of the images look asymmetric. Comment on this in the figure caption in relation to recent merger activity.

p. 79 : Caption of Figure 4.3 updated to highlight the asymmetry of some of the galaxies shown along with a comment on the connection between this and merger triggered AGN activity.

Page 79. Fig 4.6 (and similar figures on subsequent pages).
Make a clear statement about the normalization of the y-axis of these plots.

p.82-84 : The captions of Figures 4.6-4.8 have been updated to state that the curves are normalised so that the areas underneath the curves in a single panel are equal.

Page 82. Tab 4.3. AGN-Hosts with Tau<1Gyr – for 10.25<M_solar<10.75 the
numbers 33 & 69 look the wrong way around. Please correct this in the table caption or main body of the text.

p.85 : The numbers quoted in Table 4.3 have been double checked and are all correct. The 33% and 69% quoted for the disc and smooth 10.25<M_solar<10.75 populations with tau < 1 Gyr are

calculated from the curves shown in the left, middle panel of Figure 4.8. The dashed line, showing the smooth weighted population contains over double the area bounded by the solid line, showing the disc weighted population, in the tau < 1 Gyr region.

Also `three mass bins' -> `three bins in stellar mass'

p. 85 : Caption of Table 4.3 updated to reflect that these are bins in stellar mass.

Page 86. `This suggest that AGN……' -> `This suggests that AGN……'

p.89 : Typo corrected

What fiducial level do Sparre & Springel (2016) use?

p.88-89 : The fiducial level of Sparre & Springel (2016) has been stated along with the level of the strongest AGN feedback. This is defined in terms of the metallicity input into the cooling function of the gas. Spare & Springel (2016) do not state how these modes of feedback compare in terms of energy output.

Page 92. Fig. 4.10 In the figure caption Note the change in linear scale (in kpc) from top left to bottom right.

p. 95 : The caption of Figure 4.10 has been changed to note the change in linear scale in kpc/`` from the top left to bottom right with redshift.

Page 93. Fig 4.11. Add a note in the figure caption that the 4th galaxy from the left has a bar.

p.96 : Note added to caption of Figure 4.11 to highlight the bar in galaxy J115338.14+72515.36

Spelling `debiase' -> debias

p.96 : 'debiase' typo corrected

Page 96. Spelling: "catalogueue" -> catalogue - run a spell check on this chapter prior to re-submission.

p. 98 : spelling of catalogue corrected here and throughout chapter. Spell check run and changes made.

Page 106. LIMMIX -> LINMIX

p. 108 : typo corrected

Page 110. Fig.4.20. The figure is missing the open circle points from Simmons.

p. 113 : Simmons et al. (2013) open circles added to the plot as requested.

Page 112. Fig 4.22. Either the distribution of points is strongly affected by systematics, or something very interesting is indicated. Explain why there might be excess points (i) at the very bright end of the blue cloud, and (ii) redder than the red sequence. Are any of the really red galaxies related to the work of Shearman & Pimbblet (2014) or is the cause of their colours

different altogether?

p.114 : The excess points at the bright end of the blue cloud and above the red sequence have been discussed as possible under and over subtractions of the AGN contribution to the galaxy photometry respectively. The anomalously red galaxies of Shearman & Pimbblet (2014) are also discussed here in reference to those galaxies which appear redder than the red sequence.

Conclusions of Chapter 4. Where possible, quantify all conclusions.

p.122 - 124 : Where possible, conclusions have been quantified.

Chapter 5
Page 123. The fact that the Yang catalogue search results in only 38 galaxies found looks incorrect. Please consider whether this number is wrong.

p.127 : This number originally quoted was indeed wrong and has been changed in the text. A statement has been made as to why the Berlind et al. (2006) sample was used instead.

How valid is it to assign the status of “central” to the most massive galaxy? Add plausible alternatives, and state why this route has been taken.

p.127 : A paragraph has been added discussion the alternative of assigning the brightest galaxy as the central. A statement has been made about the number of central galaxies which change their designation when using stellar mass rather than brightness.

Page 132
halo mass -> proxy for halo mass

p. 137 : wording changed to proxy for halo mass

In figure 5.9b the trend is absent, not `less apparent' !

p.136 - 141 : wording has been changed when referring to absent trends in tau with R/R_200.

[Page 133. Fig 5.9 and similar plots on subsequent pages.
We do not require this but the conclusions would be clearer if a line was fitted to quantify the significance of any trend present.]

p. 142 : Lines have been fit to each of the central bins of Figures 5.9-5.11 the slopes for which are quoted in Table 5.1 in order to quantify the significance of the trends.

Fig 5.11 What is the lowest sigma that can be measured? Adjust caption accordingly.
[We do not require this however, you might consider whether there are effects here over-and-above the influence of mass e.g. can a statement be made that environment is one-third as much of an influence as mass?]

p. 140 : The caption of Fig 5.11 has been updated with the lowest sigma that can be measured from SDSS spectra due to the instrument dispersion of 69 km/s.

Page 137. Table 5.1. What is the significance of the trends? (see comments above).

p.142 : Table 5.1 updated to quantify the slopes of a fit to the central bin data shown in the Figures 5.9-5.11 for both Δt and τ variables. The values quoted are determined from the median values from the walker chain of a linear regression fit (along with ±1sigma values). These values confirm that the strongest trends in Δt are seen when the satellite galaxies are split by the mass of the central and their mass ratio, μ* and that the weakest trends are seen when split by N_group and |Δv|, as concluded in the text. The slopes found for the τ variable confirm that the trend is absent in the rate that quenching happens.

Chapter 6
Page 150 – last para – you have not used the `simplest possible SFH', that would be a single burst.

p. 155 : This sentence has been clarified by stating instead that the SFH used is the "simplest plausible SFH for galaxies undergoing a decline in star formation."

Page 152 – would there be enough Ty1 AGN to make this a significant addition?

p. 157 : A discussion has been added about the ratio of Type 1 : Type 2 AGN and the size of sample that could be built.

Bibliography.
Please update any citations that were "in press", "submitted" and so forth with an up-to-date status where relevant.

All references updated accordingly from arXiv to journal citation. Kruk et al. (in prep) has been altered to Kruk et al. (submitted to MNRAS).