



Galaxy Zoo CANDELS:



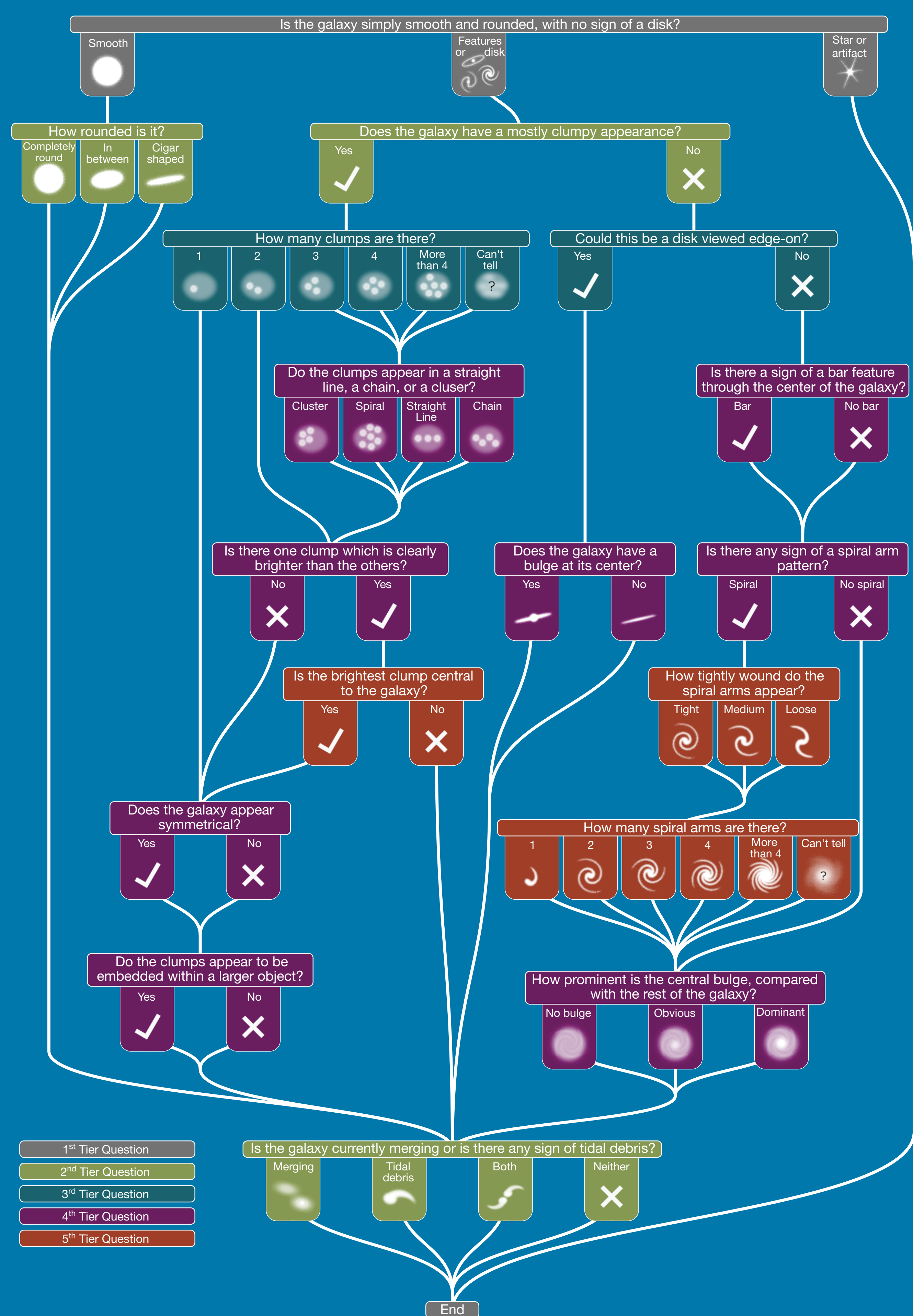
Morphologies of 50,000 $z \lesssim 4$ Galaxies

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and the Galaxy Zoo and CANDELS science teams

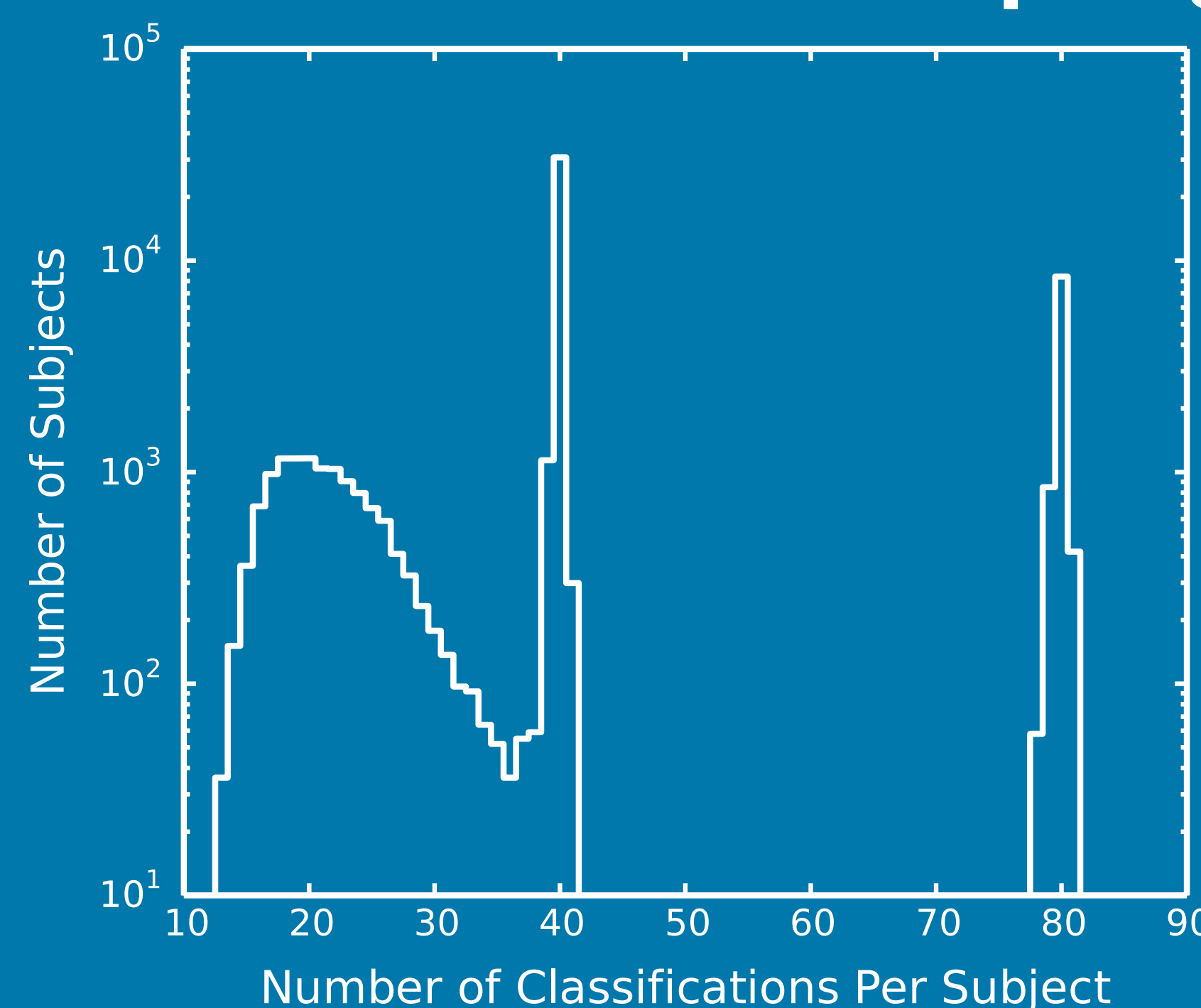
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Over 95,000 Galaxy Zoo volunteers contributed over 2,000,000 independent visual classifications of 49,555 *I**H* images (selected to have $H < 25.5$) from three CANDELS fields: GOODS-South, COSMOS, and UDS. The classifications have been analyzed and a public data release is planned for early 2016.

Classification of Detailed Features

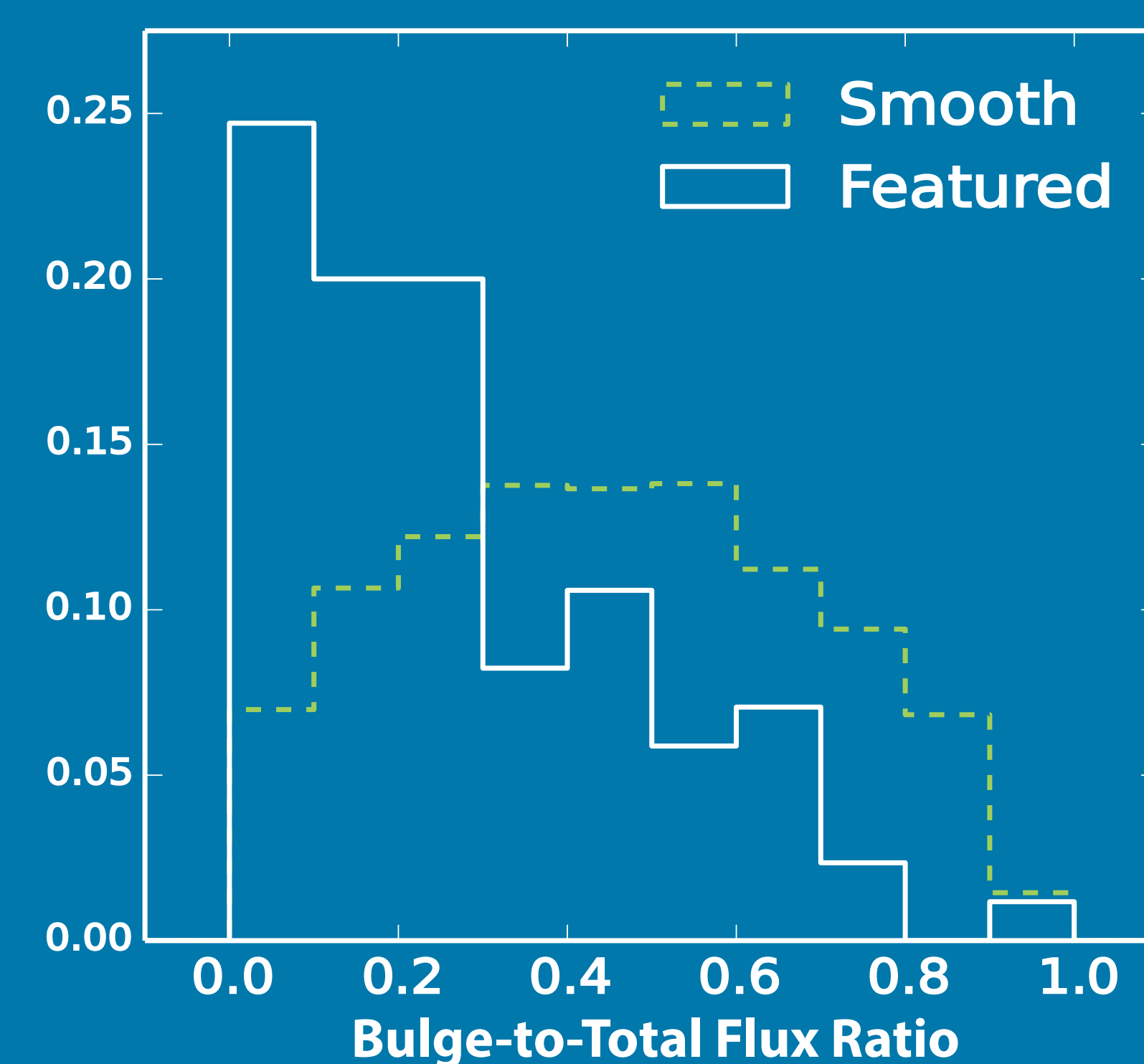


Typical: 40 classifications per galaxy



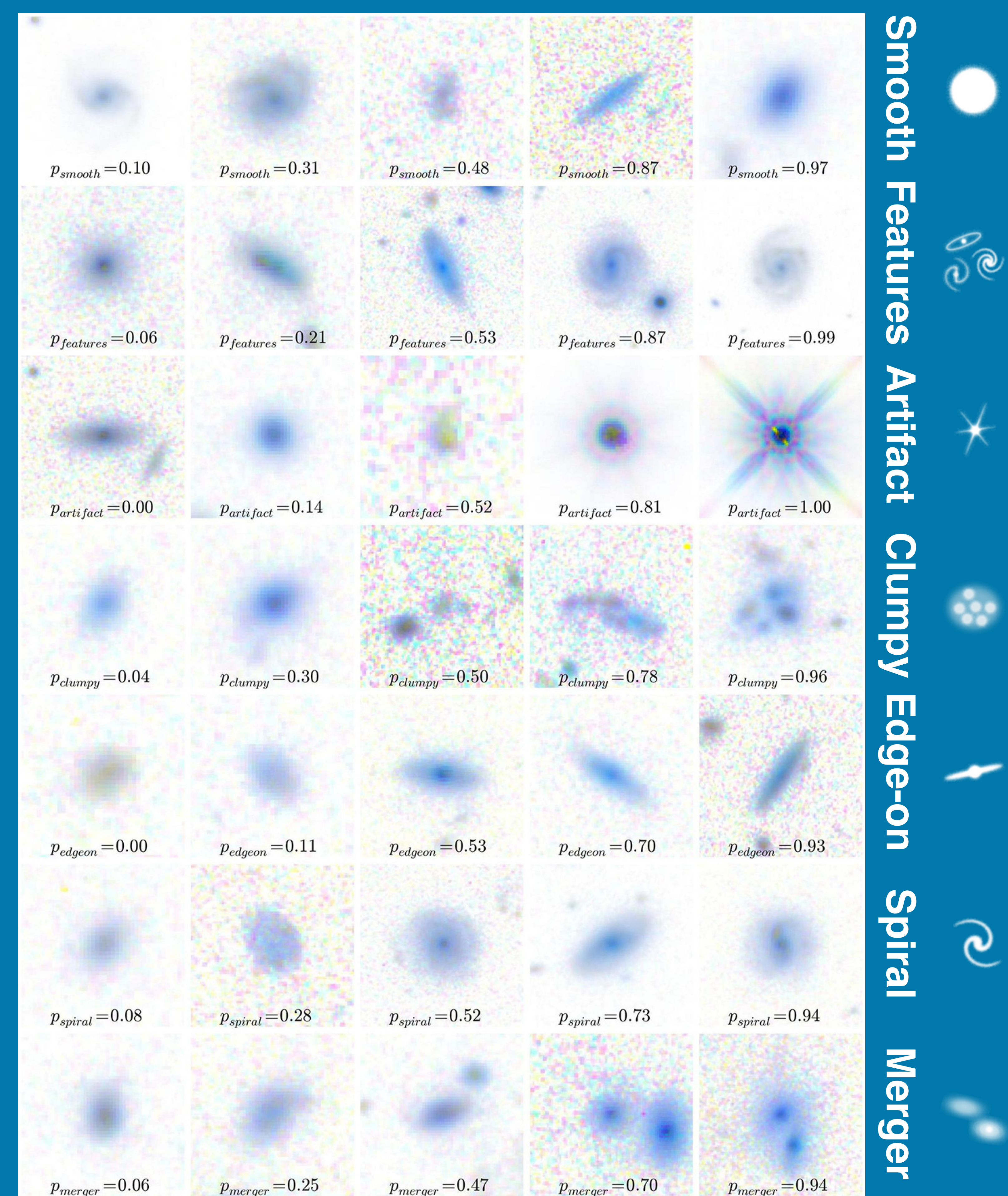
The majority of subjects received 40 classifications. Following initial analysis, some subjects were retired early. Subjects with vote percentage $p_{\text{features}} > 0.2$ were retired after 80 classifications each.

Featureless disk galaxies at $z > 1$



Comparison of bulge-to-total ratios (Häußler et al., in preparation) with “smooth” vs “featured” galaxies at $1 < z < 3$ reveals a substantial population of disk-dominated galaxies lacking any features typically associated with disks.

Less → More

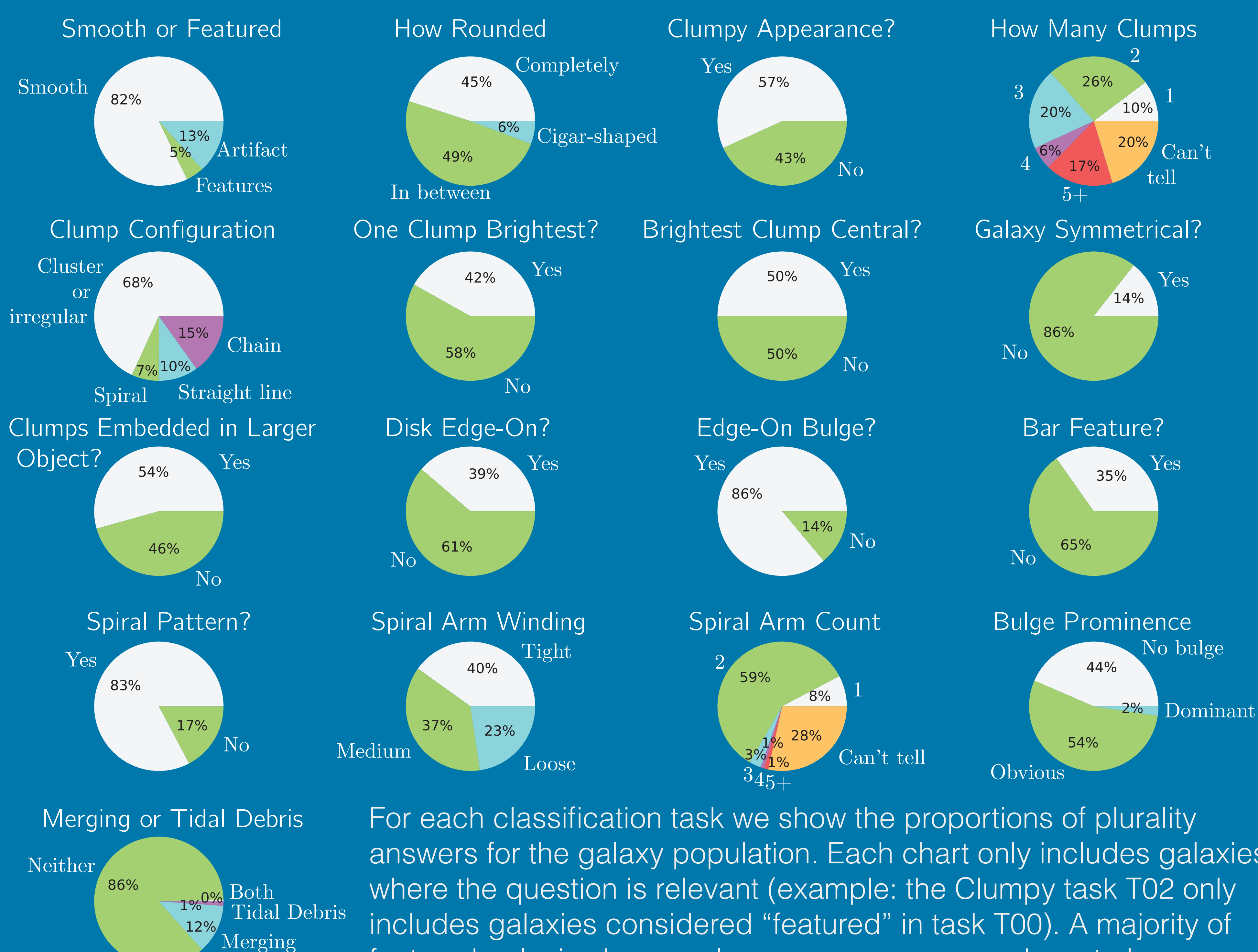


Smooth Features Artifact Clumpy Edge-on Spiral Merger

A single classification in Galaxy Zoo CANDELS consists of 17 separate tasks, each answering a question about the subject. Morphological measurements include details of clump structures, bar features, spiral arm counts, bulge strength in disks, and merger/tidal features.

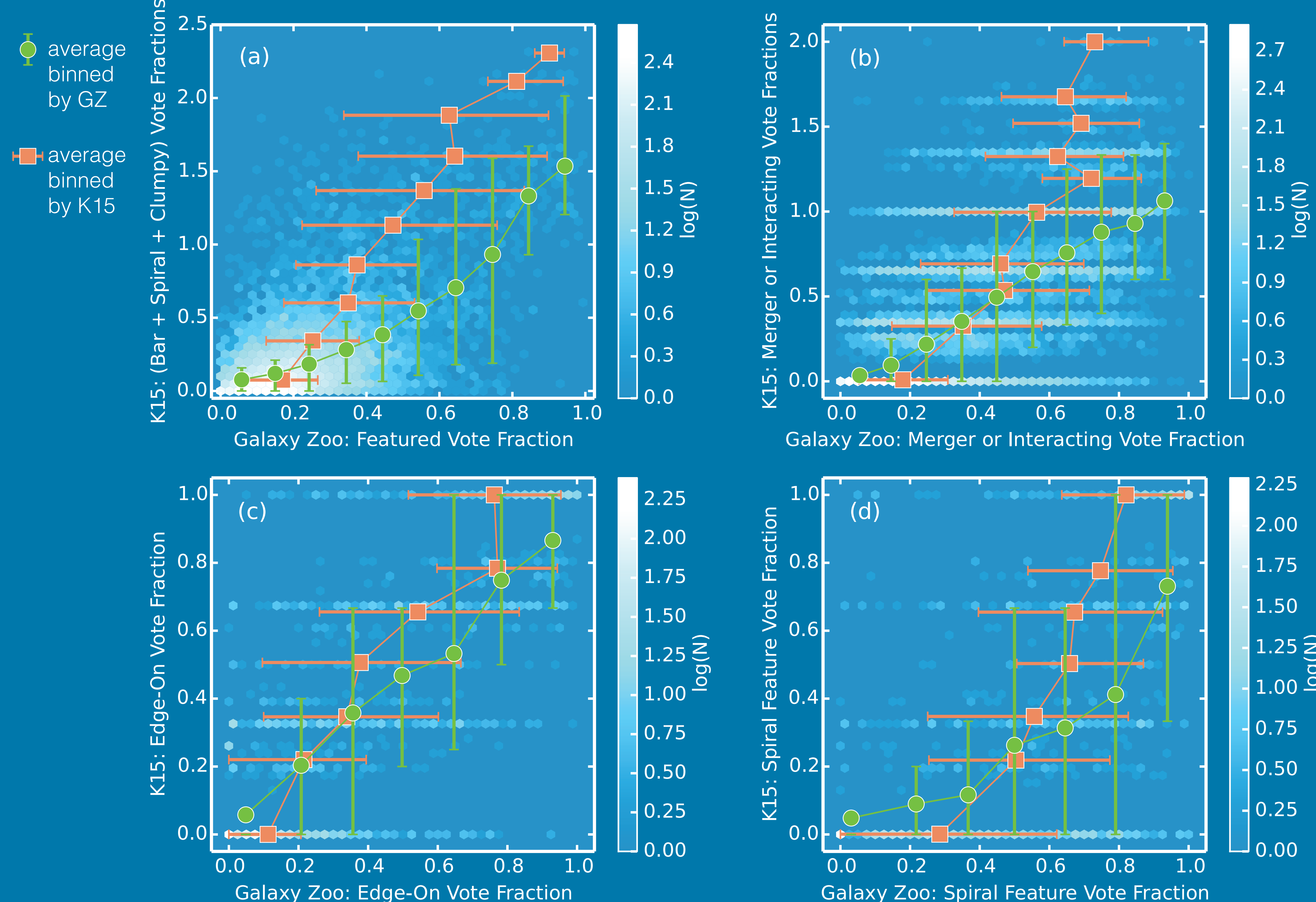
We weight classifier inputs and combine them into vote percentages p for each galaxy and feature, including mergers, bars, edge-on likelihood, and clumpiness. Each row of inverted *I**H* images shows examples spanning different morphological categories. (0."06 / pixel)

Demographics of galaxies by morphological feature



For each classification task we show the proportions of plurality answers for the galaxy population. Each chart only includes galaxies where the question is relevant (example: the Clumpy task T02 only includes galaxies considered “featured” in task T00). A majority of featured galaxies have a clumpy appearance, and most clumpy galaxies are asymmetric with a mix of clump counts. Among spiral galaxies, 2 arms are typical. These charts include galaxies at all redshifts and luminosities.

Comparison with professional visual classifications



Galaxy Zoo (typically ≈ 40 classifications per galaxy) and CANDELS team visual classifications (typically 3 per galaxy; Kartaltepe et al. 2015, K15) correlate strongly over a range of features.