The part of the work devoted to Tycho’s priority dispute with Ursus builds on earlier studies by Schofield, Jardine and Rosen. Drawing on the ample materials contained in these four studies, let us reflect on the strategies through which Tycho secured ownership of a world system — strategies deployed at a time when, as I have emphasised, there were few, if any, established conventions for the acquisition of priority on theoretical claims in the sciences.

Tycho’s manifest strategy in attacking Ursus was, at both the literal and the metaphorical levels, legal. However, the legal cause and the legal terminology were not here modelled as in many of the seventeenth-century priority disputes on legal actions relating specifically to rights over what we would now call ‘intellectual property’: copyright in books, patents on inventions, etc. Rather, in Tycho’s initial public attack in his Letters of the astronomers of 1596 Ursus was charged with theft, a theft later specified by Tycho as the purloining by Ursus of an unauthorised copy of a defective diagram of a geoheliocentric system whilst visiting Hven in a nobleman’s retinue in 1584. After the publication of Ursus’s counterattack, the scurrilous unlicensed and privately printed De astronomicis hypothesibus tractatus of 1597, Tycho added the charge of defamation of the character of himself and his family. In 1598–1600 Tycho furiously pursued his quarry, soliciting testimonials to Ursus’s bad character and suspicious behaviour at Hven. On his arrival in Prague in 1600 Tycho instituted legal proceedings against Ursus and his book. The action against the book secured an Imperial Annullment and the seizure and burning of the author’s stock. It is unclear whether the action against Ursus before a tribunal of noblemen and doctors of law appointed by the Emperor, took place or was abandoned after Ursus’s death. Tycho planned to publish the entire proceedings of the trial alongside Kepler’s Defence of Tycho against Ursus, which dealt with “the matters which are mathematical and concern hypotheses”. Ursus had attacked Tycho in a legalistic vein, casting his Tractatus in the form of a petition to Moritz, Landgrave of Cassel, to act as impartial judge in the dispute over priority. Kepler followed suit in his Defence of Tycho, calling on the reader as judge and cleverly combining the themes of theft and defamation by presenting a refutatio of Ursus’s attack on Tycho’s originality and of his defamation of astronomical hypotheses.

In this legal and quasi-legal confrontation, printed publication was treated as an important issue, but not as the primary arbiter of priority. Instead, there was constant concern by both parties with other forms of disclosure: notably the display and communication of diagrams and models. There was, however, a significant strategic difference between Tycho and Kepler, on the one hand, and Ursus, on the other, over the crucial issue of competence to bear witness to and judge the matters in dispute. In his Letters of the astronomers of 1596 Tycho presented himself as an independent philosopher and astronomer addressing astronomers concerned with the nature and disposition of the cosmos. Ursus, by contrast, wrote as Imperial mathematicus appealing to other mathematicians and their patrons concerned with contrivance of formulae for the solution of technical problems. In his Defence of Tycho Kepler brilliantly exploited this difference of stance, contrasting the architects of world systems, philosopher-
astronomers such as Copernicus and Tycho, with their socially inferior dependents, mere mathematical artisans and technicians such as Ursus.

The difference in roles assumed by Tycho and Ursus in the conflict correlates with a marked difference in the attitudes that they held and promoted towards the issue of priority. Tycho presented the issue as one concerning the nature of the cosmos with absolute priority in the discovery of the true form of the cosmos as a great prize. Ursus made the stakes more modest. For him, as for many other mathematical astronomers of the period, construction of planetary models was aimed not at portrayal of the form of the cosmos but at the derivation of a calculus adequate for prediction and retrodiction of celestial phenomena. Moreover, since he held that geoheliocentric models had been constructed in Antiquity by Apollonius of Perga, the question was for him not one of absolute but of relative priority.

As Gingerich and Westman rightly emphasise, the whole issue was for Tycho, a nobleman grossly and obscenely insulted by a swineherd’s son, above all a matter of honour; and throughout the controversy a crucial role was played by the challenges and counter-challenges appropriate to affairs of honour. Thus, in correspondence with third parties Tycho implicitly challenged Ursus, both by charging him with inability to resolve the question of the intersection of the orbs of Mars and the Sun and by denying his competence to substantiate the “new supposition” through construction of observationally adequate geoheliocentric planetary models, especially for the “difficult case” of the superior planets. In his Tractatus Ursus responded with a mocking challenge to Tycho to solve a series of ‘prosthaphaeretic’ (i.e., trigonometrical) problems of importance for practical astronomy. He also hit back in a more subtle way, disarming the demand for observational demonstration of world systems by arguing for the observational equivalence of world systems and hence the impossibility of such a demonstration. In his Defence of Tycho Kepler countered Ursus’s argument from aequipollentia, observational equivalence, in a way which further escalated the demand for proof, by insisting that the issue between observationally equivalent world systems be settled by appeal to natural philosophical considerations.

In these challenges and counter-challenges we find, I believe, a key to Tycho’s achievement. By demanding observational substantiation of specific geoheliocentric planetary models Tycho issued a challenge that Ursus manifestly could not meet for lack of financial, instrumental and technical resources. No matter that, as recent historians have shown, it was a challenge that Tycho himself had not in fact met. Given his standing as architect of Uraniborg and Stjerneborg with their armies of assistants, armories of mighty instruments and jealously guarded treasuries of observations, all vaunted in his de luxe Astronomiae instauratae mechanica of 1598, who dare question his capacity to build a new world system? By contrast Ursus had only the resources of his wit and mathematical competence. His ripostes were shrewd. He evidently knew of Tycho’s dependence on others’ mathematical expertise (perhaps from his contacts with Wittich and his own visit to Hven). And the sceptical argument from observational equivalence could be expected to have considerable persua-
sive force amongst the many mathematical astronomers committed to a view of astronomy as a practical discipline unconcerned with and sceptical about physical questions about the cosmos. These counter-challenges may have embarrassed Tycho. But the demands they posed were ones that he could hope to meet by calling on the services of others, as in fact he did in seeking help from Daniel Cramer with the trigonometrical problems posed by Ursus and in persuading Kepler to reply to Ursus's arguments about the status of astronomical hypotheses. Here we see in operation a machinery of intellectual contest through escalation of demands for the proof of claims, a machinery of the type that Bruno Latour has called, by analogy with the arms race, "the proof race".8

In Tycho's challenges to Ursus we have a partial explanation of his establishment of entire world systems, cosmological arrangements complete with detailed planetary models and derived and confirmed planetary tables, as proper objects for priority claims. By insisting on mathematical specification and observational confirmation of a world picture Tycho defined the priority issue in his own favour, in terms of achievements that he could in contrast to his opponents credibly claim to have performed.9 And in so doing he differentiated his priority claim for those of Ursus and other rivals: he assumed rights over an entire world system; they were left as claimants to mere sketches of world systems.10

There is a second fundamental mechanism at work in the definition and enforcement of Tycho's priority claim, that of retrospective legitimation. When was the Tychonic system in fact invented/discovered? Given the terms in which Tycho successfully defined the issue, the answer must be: long after his death. It was only with his pupil Longomontanus's Astronomia Danica of 1617 and his erstwhile assistant Kepler's Tabulae Rudolphinae of 1627 that geoheliocentric world systems complete with detailed and observationally confirmed planetary models were made public. Tycho had bluffed — with his formidable social, instrumental and technical resources he could afford to do so. The bulk of the assertions on which he rested his claim that the cosmological sketch he published in 1588 represented a complete or near-complete world system appear to have been retrospective fabrications, fabrications that he and his allies, Kepler, Longomontanus and Riccioli, amongst others, succeeded in so writing into the historical record that it is only recently that historical scholarship has been able to unmask them. Where it was through his escalation of the demand for proof that Tycho defined his priority claim and defeated his rivals, it was through the mechanism of retrospective legitimation that his claim to priority was stabilized and entrenched in the memory of astronomy.

Since the sixteenth century the manifest conventions of priority dispute and its resolution have changed out of all recognition. But these more fundamental mechanisms, proof escalation and retrospective legitimation, surely remain in force. It is my hunch that they will continue to govern issues of priority despite the present transformation of the official conventions of priority at the hands of the electronic revolution and the economic war of all against all.

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