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Proverbial economies of STS

Ranjit Singh[1] and Michael Lynch[2]

Abstract

This article discusses examples from an extended family of aphorisms, stories, and themes that have circulated widely in STS and remain associated with the formation and integration of the field. Drawing upon Harvey Sacks's insightful remarks about features of everyday conversation, which he related to ancient practices in oral culture, we argue that familiar citation magnets in STS operate in many respects like proverbs, parables, and an extended family of neatly and memorably packaged viral articulations in ordinary language. After discussing the contingent production of proverbial truth, the article focuses on three well-known examples that combine memorable proverbs and themes with parables: Winner's account of the low parkway bridges designed by city planner Robert Moses to show that technology *has* politics; Pinch and Bijker's concise history of the bicycle to illustrate the social construction of technology, and Star and Griesemer's viral two-word theme of 'boundary objects' as artifacts that sustain collaboration across organizational contexts. The discussion of these cases suggests that different elements of these examples become the focus of subsequent citations and applications, and that ambiguities about the origins and meanings of the cited items opens new avenues for critical reflection on practicing citational justice and the nature of STS as an affiliative discipline.

Keywords

proverbs, history of STS, parables, viral themes, citational justice

While co-organizing a storytelling workshop in 2021 for mostly early career academics working at the intersection of science and technology studies (STS) and information science, Singh was involved in scheduling an hour-long orienting conversation with each selected storyteller assuming that it would be about discussing workshop logistics. Much to the organizers' surprise, however, the participants often asked: 'What do you mean by

[1]Data & Society Research Institute, New York, NY, USA
[2]Department of Science & Technology Studies, Cornell University, Ithaca, NY, USA

Correspondence to:
Ranjit Singh, Data & Society Research Institute, 228 Park Ave S, PMB 83075, New York, NY 10003, USA.
Email: ranjit@datasociety.net

a story?' Hidden within this question is the presumption that academics write papers rather than tell stories. The organizers spent the rest of the hour convincing each participant that they were, indeed, looking for a story: a vignette from field research, an account of an everyday experience, an articulation of an incident that a reader/listener could remember and use to illustrate a shared understanding of the participant's research topic. This incident revived a longstanding and ongoing conversation between the authors of this article on the question: How do characteristic orders of ordinary language, such as proverbs, aphorisms, and parables, feature in the circulation and citation of academic writings? We address this question with reference to the field we know best: STS.

Although some can be traced to pre-literate usage, as Shapin (2001) points out parables, vignettes, proverbs, aphorisms, dicta, and slogans are abundant in literature, including the sciences and humanities. At least some of these discursive forms become citation magnets, invoked in academic articles, often without further explication. In this article, we explore a loosely affiliated, extended family of well-known and widely cited stories, phrases, and themes that have become emblematic of STS. While conducting this exploration, we aim to tread a fine line between dismissing the examples we discuss for being widely cited *despite* a lack of substantiation, and attributing their circulation to intrinsic qualities of the ideas or meanings that they index. To put this another way, we aim neither to *explain* nor *explain away* why some items have become nodes in a citation network, while many other candidates remain largely ignored. Our intervention is largely descriptive: we focus on *how* these items are used as communal resources, though we make some suggestions in the end about implications for current interests in citational justice and STS as an affiliative discipline.

Proverbs, parables, and other vehicles of STS travel

Summary formulations and memorable examples in the social sciences clearly have pedagogical value, and they also help to integrate research practices within and across disciplines, subdisciplines, and transdisciplinary networks. They often are presented to illustrate fundamental principles, models, and even theorems, but they also can be placed in the humble company of vernacular anecdotes and aphorisms, sayings, shibboleths, epigrams, mottos, maxims, adages, commonplaces, truisms, platitudes, urban legends, clichés, chestnuts, bromides, and old saws. While there is overlap and interchangeability between this ever-growing list of cultural objects, there are crucial differences too.[1] Some items consist of words or short phrases that promote a theme or perspective, others are brief formulations that are widely recognized and repeated verbatim in the manner of proverbs, dicta, and slogans, and still others take the form of parables that are sometimes, but not always, referenced to the historical record and specific authors. Parables do not often count as *evidence*, or even 'mere anecdotal' evidence. It is not even *appropriate* in many cases to demand historical evidence for a parable, or to validate proverbial truisms such as 'blood is thicker than water', or 'Rome wasn't built in a day'.[2]

Like epic poems, parables and proverbs have ancient roots as oral repositories of history and culture. Proverbs are *memorable*, as brief sentences and phrases, often with poetic qualities such as rhyming, cadence, and alliteration. Sacks (1992, Vol. 1, p. 111) characterizes them as 'atopical' in the way they can be made relevant to an open variety

of topics and contexts. Though associated with oral transmission of epic poems and folk tales, they live on as integrative elements of literary culture.[3] Shapin suggests they are constituents in a 'proverbial economy',[4] which he defines as 'a network of speech, judgement and action in which proverbial utterances are considered legitimate and valuable, in which judgement is shaped, and action prompted, by proverbs competently uttered in pertinent ways and settings: that is to say, a cultural system in which proverbial speech has the capacity of making a difference to judgement and action' (Shapin, 2001, p. 735).

Regardless of any consensus over their truth-value, constitutive elements of a proverbial economy are repeatedly mentioned and recited, thereby enhancing the 'impact' of the source publications and drawing further attention to them. Whether or not they are correctly sourced or literally true, parables, proverbs, and slogans are robust means for disseminating 'knowledge',[5] not only in ordinary language but also in more restricted technical and academic fields. They lend coherence to the literature of a field. A crucial feature of the proverbial economies of academic fields is that citations and quotations become gestures of tribute in economies of credit. These proverbial economies take on a moral character as the intangibility of credit becomes fungible and increasingly subject to measurement, evaluation, and reward.

Although members of the extended family of truisms, stories, and sayings are sometimes treated as unwelcome commoners crashing the gates of science, this motley assemblage of discursive items has done important work for the natural and human sciences, as well as many other academic and ordinary fields. In academic fields, selected members of the family can be credited with establishing both professional and popular interest in specific theories, experiments, and observations. An important feature of academic proverbs, parables, and aphorisms is that, while they include citations to authors, such citations are often ambiguous. Take, for example, a proverbial expression in sociology that is sometimes dubbed 'Thomas's theorem': 'If men define situations as real, they are real in their consequences'. Sometimes it is called a 'dictum', and less commonly an 'apothegm' or even a 'shibboleth' (Garfinkel, 1956, p. 185n, 2022, p. 157). This 'theorem' is attributed William I. Thomas, often without citing his co-author and spouse Dorothy,[6] and is sometimes linked to an antecedent and more concise (if less eponymous) formulation, 'definition of the situation', which became a key concept in symbolic interactionist sociology.[7] Thomas's theorem has had a long career in sociology and can still be found in textbooks. Although the term 'theorem' may suggest that the proposition can be proved or disproved, its persistence has more to do with its provocative and memorable phrasing than with the possibility of a final reckoning with empirical evidence.

As in the case of Thomas's theorem, authorship can be a source of uncertainty and contention, though such contention rarely rises to the level of a formal priority dispute. The complexity involved in attributing authorship is nicely illustrated with a familiar one-liner that is commonly attributed to Mary Douglas: 'Dirt is matter out of place'. In a brief and entertaining commentary on this aphorism and its 'viral' career, before as well as after Douglas famously recited it, Fardon (2013) attempts to pursue the aphorism to its source. According to Fardon (p. 25), Douglas (1966) inscribed a version of the aphorism in a 1953 fieldnote, before publishing it in *Purity and Danger* (p. 165). Douglas credited Lord Chesterfield as its original author. Fardon was able to find only approximate and less pithy lines in Chesterfield's letters, but he credits another scholar

(Steven Connor) with having located a closer version recited by Lord Palmerston in an 1852 address to the Royal Agricultural Society: 'I have heard it said that dirt is nothing but a thing in a wrong place' (Fardon, 2013, p. 25). Lord Palmerston did not claim credit for the aphorism or provide a specific citation. Fardon also points out that Douglas's version was more abstract (and, we would add, 'catchier') than Lord Palmerston's, but he traces further recitations through the 19th and 20th centuries that modify the aphorism by replacing 'thing' with 'matter' and 'wrong place' with 'out of place'. The conclusion from this scholarly exercise is that Douglas appropriated a commonplace that subsequently became emblematic of her legacy. Fardon does not reproach Douglas for this achievement, nor does he suggest that the ambiguous origin of the aphorism counts against its truth. Indeed, in addition to Douglas, many others continue to find creative uses for it beyond the original associations with excrement and other forms of filth and rubbish (e.g. Mody, 2001).

Although, as we argue in this paper, the question of truth is pertinent to proverbs and parables, just how it is pertinent is a key issue. To clarify this point, we can consider another instance of scholarly attempt to locate the source of a citation. This pursuit was presented in an article published in *Social Studies of Science* on 'academic urban legends' (Rekdal, 2014). For years following its publication, Rekdal's article was the most 'read' (i.e., downloaded) article published in the journal. Part of the appeal of the article is its use of what might be called double irony.[8] The initial irony concerns the widely promoted 'fact' that spinach is an excellent source of iron. That 'fact' was famously promoted in the United States by Popeye cartoons during and after World War II, but it also proved to be an excellent source of irony. Following the popular establishment of this taken-for-granted truism, it was supposedly debunked for being based on a decimal point error in an early 20th century measurement of digestible iron content in spinach. The second irony arose from efforts by Rekdal and others to trace back through a chain of citations to locate the original source of the decimal point error. Such efforts failed to locate a specific source, leading Rekdal (2014, p. 644) to conclude that no such source ever existed. For Rekdal, the *academic* urban legend was not the popular belief that spinach is an excellent source of iron; instead, it was the story that the popular legend arose from a decimal point error. Rekdal noted that other scholars had preceded him in raising strong doubts about the allegation of a decimal point error, but that like other urban legends the decimal point story continued to circulate for long afterwards.

When we compare Fardon's and Rekdal's laborious efforts to trace a citation to an original source, a difference stands out. As we understand it, the difference arises from contrary epistemic conceptions of the dicta in question. Rekdal pursued the historical origin of a claimed factual error, whereas Fardon pursued the origin of a colloquial aphorism that Douglas recited to good effect in her analysis of cultural beliefs and practices. Although both investigations did not find clear origins for the citations in question, Rekdal raised doubt about the historical fact of the decimal-point error and chided the authors who cited it without undertaking more diligent scholarship, whereas Fardon did not suggest that Douglas's aphorism is erroneous or fraudulent. A lack of concern about historical fact is, we argue, characteristic of well-traveled aphorisms, parables, and themes: *their appeal and resiliency does not depend upon a subscription to their factual status.* Nevertheless, the conventional citation, with its concise tribute

to an author and repetition of key words and lines, is an important currency and form of intellectual property in academic fields. As such, the proverbial economy is a key topic as well as an organizational and communicative resource for these fields generally, and STS specifically.

In this article, we focus on a few commonplace parables, proverbs, and themes featured in the STS literature. There are many other examples. To recite a few that have circulated for decades, we can mention *parables* such as Winner's (1980) recounting of Robert Moses' low parkway bridges, Pinch and Bijker's (1984) summary account of the history of the bicycle, Haraway's (1984/1985) account of the gorilla diorama in the American Museum of Natural History, and Wynne's (1992) story of a confrontation between government ministry scientists and Cumbrian sheep farmers in the aftermath of the Chernobyl disaster. Proverbial statements are illustrated by Shapin and Schaffer's (1985, p. 332) memorable line, 'solutions to the problem of knowledge are solutions to the problem of social order', and Latour's (1990) pronouncement that 'technology is society made durable'. Themes include such two-word items as 'boundary work' (Gieryn, 1983),[9] 'virtual witnessing' (Shapin & Schaffer, 1985), 'experimenter's regress' (Collins, 1985), 'immutable mobile' (Latour, 1986), 'situated knowledges' (Haraway, 1988), 'boundary object' (Star & Griesemer, 1989), and 'technoscience/sociotechnical imaginaries' (Jasanoff & Kim, 2009; Marcus, 1995). Often, the cited source presents a theme together with one or more exemplary cases, notable maxims, or proverbial phrases. For example, Collins (1985) recites the common proverb 'distance lends enchantment' to complement his two-word theme 'core set', which is further illustrated with a concentric circle diagram and exemplified with his case study of gravity wave research.[10] Star and Griesemer's (1989) viral theme of 'boundary object' is illustrated with a capsule history of the Berkeley Museum of Vertebrate Zoology, and Pinch and Bijker's 'model' of the social construction of technology (SCOT)[11] is exemplified with the theme 'interpretative flexibility' and a potted history of the bicycle. In some cases, a theme or proverbial phrase becomes the memorable index for citations, while in others the illustrative case is memorialized.

Proverbial economies are alive and well in the natural sciences, as Shapin (2001) demonstrated. Rather than focusing on other fields, however, we are focusing closer to home. We have several reasons doing so: (1) we (and, we assume, many of our readers) have first-hand familiarity with the literature and idioms in STS; (2) STS (in common with other social science fields) exhibits ambivalence about the epistemic value of anecdotes, platitudes, and urban legends; (3) the topic relates to a persisting question in STS of how knowledge travels and how disciplines take shape; and (4) the prominence and persistence of these discursive forms suggests they are used to produce and integrate the field's communicative existence as literature.

Proverbial truth

Our thematic focus is on how proverbs, parables, and themes provide integrative nodes in the STS literature. We shall discuss a few cases, but before presenting them, we are compelled to address the question of proverbial *truth*. Murray Davis, in an article on widely circulating theoretical formulations in sociology, provides an authoritative

starting point: 'the truth of a theory has very little to do with its impact, for a theory can continue to be found interesting even though its truth is disputed—even refuted!' (Davis, 1971, p. 309). To put it affirmatively, successful social theories catch on and circulate for reasons other than that they are true. In cases of what he calls 'aphorisms', Davis (1999, p. 250) observes that successful instances are 'modular', 'quotable', and 'felicitous'. They easily 'slip into' what one says, and like proverbs they can support virtually any opinion.

What holds for aphorisms also can apply to experiments. In a withering review of social psychology experiments produced in the postwar decades of the 20th century, Brannigan (1997, 2021) suggests that cases such as Milgram's obedience experiments, Sherif's autokinetic effect, Asch's experimental 'paradigm', and Zimbardo's prison experiment enjoyed lasting appeal in popular culture and introductory psychology lectures, despite the methodological and ethical problems that were identified and reiterated over the years. Brannigan further suggests that the 'phenomenal popularity' of these experiments derived from their 'prophetic role in secular society' as parables relevant to 'pressing issues of the day' and 'matters of public concern'. They continue to provide dramatic examples couched within the 'idiom' of empiricist experimentation which furnish 'leverage over common knowledge' (Brannigan, 1997, p. 596).

Arguments such as Davis's and Brannigan's may seem to encourage skepticism, or even outright disbelief in the validity of the social science 'knowledge' that is recited so 'shrewdly' and matter-of-factly, and while we also have reason to doubt many of the theoretical principles and experimental findings in question, we encourage another view of their pragmatic value. *If* one is willing to abandon the supposition that knowledge must demonstrably correspond to independently verifiable features of objective reality, then we can begin to entertain the possibility that knowledge expressed in the form of proverbs, parables, maxims, and other sayings exhibits truth *of a sort*. Accordingly, dictums, truisms, and proverbs depend on their context and contingent aptness; persuasiveness of their use does not count towards or against their validity. Instead, they invite a different sensibility towards how they are true when compared to factual statements that are subject to disproof.[12] With their malleability, as well as mnemonic and poetic appeal, proverbs tend to be in a stronger position to outlast debunking than are statements presented and recited as historical, scientific, or experimental facts.

In posthumously published transcripts of lectures delivered in the 1960s and early 1970s, Sacks (1992, Vol. 1, pp. 104–112; Vol. 2, pp. 419–424) articulates such a sense of proverbial truth. In those lectures, he accepts the idea that the resiliency of proverbs does not depend upon a generalized referential accuracy, but he also argues that truth and correctness *are* relevant to their use. Sacks observes that prominent social scientists (he mentions sociologist George Homans and social psychologist Jerome Bruner) often draw invidious comparisons between scientific propositions and traditional proverbs. Proverbs, according to these authorities, tend to be inconsistent with one another and yet resistant to disproof. However, rather than dismissing proverbs as dubious assertions and unfalsifiable folk tales, Sacks considers why they are highly resilient, in some instances persisting through millennia and across differences in language, and proposes that their persistence is tied to the fact that they are 'true for something'. He adds that what they are true *for*, and *how* they are true, is established analogically in the context of use. Their

contextual and analogical 'truth for something' provides proverbs not only with 'interpretive flexibility', but also with strong utility as multi-purpose linguistic tools to be adapted to emergent circumstances. The combination of their formal stability, situated utility, and memorability lends a kind of universality to them: they are ready to hand (and tongue) when suitable occasions arise. Not only can an aptly used proverb fit a well-chosen occasion, it also can link that occasion to others which, at first glance, may seem to have little in common with it.

Parables take the form of stories rather than aphorisms or assertions, but like proverbs they are not typically cited as empirical evidence and are used as vehicles for a lesson or as perspicuous examples of *something* of immediate relevance. An example from philosophy that has been widely discussed and debated, not only in philosophy, but also in STS, is what Goldfarb (2012, p. 173) dubbed the 'Parable of the Wayward Child' in his reading of Wittgenstein's (2009, §185) example of a recalcitrant child asked to continue the cardinal number series 2, 4, 6, 8 … as part of an elementary instruction in counting. In this imaginary example, the student obstinately devises a series of non-standard continuations: (e.g., 8, 6, 4, 2, 2, 4, 6, 8 …). This parable was deployed by Bloor (1973) and Collins (1985) to demonstrate the flexibility of even the most fundamental rules and procedures of mathematics and experimental physics. They used the parable for building the grounding for a 'relativistic' sociology of scientific knowledge. Bloor, Collins, and other progenitors of what became STS did not stick with 'imagined' examples, as they and many others went on to describe contemporaneous and historical cases. However, as we suggest in the following sections, the turn to empirical cases has not diminished the salience of proverbial slogans, parables, and other members of the motley family that includes them. Indeed, some of the most successful cases themselves acquired the status of parables.

Moses's bridges and the compounding of ironies

Our first case pairs a proverbial dictum with an exemplary parable. It is drawn from an article, 'Do artefacts have politics?' by Winner (1980), originally published in *Daedalus*, and later reprinted in Winner's (1986) *The Whale and the Reactor*. The article turned out to be a major success, as indicated by its bibliometric 'impact' and the extent to which it has been reproduced, discussed, and criticized as an STS classic. Much of the discussion it provoked focused on one of the several cases Winner used to show different ways in which technologies 'have' politics. Phrased as an assertion, the titular question became aphoristic: *artefacts have politics*.[13] Early in the article, Winner (1980) asserts that 'nothing could be more provocative than the notion that technical things have political qualities' (p. 121).

Winner provided several examples of technologies that, in one way or another, 'have' politics or are 'inherently political', but one case became far more memorable than the others. This case was drawn from *The Power Broker*, a critical biography of Robert Moses by Pulitzer Prize-winning journalist Robert Caro (1974). Moses was a powerful New York City official who held positions with major responsibility for designing and expanding the infrastructure in the greater metropolitan area during the 1950s and 1960s.[14] This included roads and bridges, as well as public parks and beaches, which

catered to a population of mostly White, middle-class, car-owning, suburban-dwelling commuters. Among the roads was a system of motorways called 'parkways' that excluded larger vehicles and connected the metropolitan areas to public beaches on Long Island. Aside from regulatory prohibitions, overpasses along the parkways were 'extraordinarily low', too low for buses to go under. Winner adds that Moses vetoed an extension of the Long Island Railroad to the beach. Drawing on Caro's biography, Winner attributed to Moses an intention to use the low bridges and lack of public transportation to prevent the large number of inner-city (mostly poor and Black) residents, who depended on public transport, from reaching the beaches.

Nearly twenty years after the initial publication of Winner's essay, his ironic story of the parkway bridges was subjected to a double-ironic treatment when Joerges (1999) published a critical re-examination of the Moses' bridges example. By then, Winner's parkway overpass story had become a fixture of the STS literature. Joerges dubbed it 'the bridge parable' (p. 413) and gave Winner a backhanded compliment for having translated 'a highly detailed historical episode into a highly successful parable: a pious tale in which analogies are drawn between specific instances and human behaviour at large' (p. 416). The problem, as Joerges' elaborated, was that the proverbial lesson from the bridge parable – *technology has politics* – was conceptually unclear and had dubious historical support.

With its heavy dose of irony, Joerges' refutation of the bridge parable itself partakes in the proverbial economy. He praises Winner's achievement while undermining his example and chiding the 'generations of students' who embraced the example, simplified it, and distorted it. In addition to identifying the bridges example as a parable ('a symbolic caricature' [p. 419]), Joerges likens the way it was recited over the years to 'Chinese whispers' (p. 414). To compound the ironic entanglements associated with 'Langdon Winner's motto' (p. 414), Joerges invokes another 'paradigmatic story' (p. 414): Latour's automatic door closer example (published under a pseudonym, 'Jim Johnson' [1988]) to pluralize the modes of discrimination associated with Winner's bridges. By analogy, Moses's bridges discriminate against 'luxury buses' as well as the city buses taken by inner-city residents.

The extent to which Joerges partakes of the proverbial economy becomes especially clear when he sets out a series of questions:

> What is it with parables like Winner's version of the Moses story? Why has the low-bridges example been taken up by so many authors? Why did it become such a splendid piece of ready-discourse—a 'discoursette', as it were? Why was it so wonderfully suited for further use in many other (in themselves quite different) texts in the social study of technology and of the city? (p. 420)

Part of his answer to these questions is supported by an 'adage' attributed to Victor Hugo: 'Greater than the tread of mighty armies is an idea whose time has come' (quoted in note 51, pp. 429–430). In an editor's note, David Edge observes that the quotation 'had a "career" similar to the parable of Moses' low bridges!' (p. 430). Joerges revises the adage to say, 'Greater than the mightiest idea is a story well told', and lists qualities in praise of Winner's 'well-constructed artefact': 'it leaves room for multiple interpretations, yet it

preserves concrete, ostensibly historical reference'; 'it offers in a nutshell a far-reaching, causally formulated theory … well in tune with healthy common sense'; 'all that coupled with an urgent political-moral message'; and 'it combines all major rhetorical tropes: metaphor, metonymy, synecdoche—except for irony' (pp. 420–421).

In his critique of Winner, Joerges' highlights how the Moses bridge example provides thin documentation of *intentional* design features reflecting explicit or implicit classist and racist biases. (Winner otherwise downplays explicit intentions and motives as necessary conditions for endowing technologies with political effects.) Joerges argues further that the parkway overpasses were neither a barrier (there were other public transport routes to the Long Island beaches) nor a singular cause for the uncontested fact that mainly middle-class White bathers frequented those beaches.

In an article in the same issue of *Social Studies of Science*, Woolgar and Cooper (1999) compounded the ironic entanglements by attributing realist assumptions to Joerges's critique as well as to Winner's parable. Woolgar and Cooper preferred the term 'urban legend' for characterizing Winner's example as an unsubstantiated, viral account of a purported episode. Their choice of terminology perhaps also was a pun on the urban geography featured in the story. Woolgar and Cooper did not simply debunk Winner's 'urban legend' by citing counterevidence of possible public transport routes from inner-city New York to public beaches on the north shore of Long Island, although they did register such evidence while arguing that it is always possible to extend the chain of ironies to question a rebuttal. They did not defend Winner's example, and instead compounded the irony by showing that Winner's ironic account of Moses' bridges and Joerges' ironic debunking of Winner's 'bridge parable' *both* could be argued to be otherwise. The point of attack for Woolgar and Cooper was the 'is in reality' clause. Although their suggestion that the bridge example is an urban legend might imply that the story 'is in reality' a fiction or myth, their preference was to deny all parties (including themselves) the conclusive finality of 'is in reality'.

Winner did not, to our knowledge, respond directly to Joerges' critique, but in a 1993 article he responded as follows to an earlier discussion of the bridge example by Woolgar (1991):

> I agree that all structures, including Moses' bridges, can be interpreted in a variety of different ways; in fact, my analysis presupposes exactly that. What makes the conclusion that Moses' bridges are inegalitarian political artifacts a strongly defensible proposition is not difficult to grasp. It can be seen in the role that the bridges play in the social and political history of a particular community at a particular time, as well as in the personal history of a power broker notorious in his willingness to use all possible means, including public works projects, to shape social patterns to match with his vision of what was desirable. To avoid this conclusion through the use of postmodernist interpretive irony is, in my view, politically naïve. In situations in which there are admittedly a variety of points of view that matter in making choices about technology, … one must … offer coherent arguments about which ends, principles, and conditions deserve not only our attention but also our commitment. (Winner, 1993, p. 374)

Whether or not one agrees that such moral-political commitments should stand fast in the face of the crumbling bridge example that indexed them, it should be clear that Winner's argument places his bridge parable on the same abutments as other parables and legends

that have stood the test of time. An interesting and uncanny thing about the bridge parable is that it remains such a memorable instance. Aside from any rhetorical qualities, it is simple and utterly familiar, despite the lack of concrete support it provides for Winner's generalization that artefacts 'have' politics. While Winner could, and did, call upon other cases to support and elaborate his generalization, for better and worse the bridge example remains his most memorable case.

A parable, a model, and an acronym: SCOT

From Winner's (1980) story on the politics of bridges, we move to parable that Pinch and Bijker (1984) used to frame their approach to the social construction of technology (SCOT). Their programmatic contribution extended the relativist/constructivist idiom in the sociology of scientific knowledge (SSK; Bloor, 1976; Collins, 1981) to studies of technology. The SCOT approach formulated three core concepts for studying technological developments: (1) *relevant social groups*, or groups that share a specific interest in a technological artifact; (2) *interpretative flexibility*, differences in the meaning of a technological artifact for members of relevant social groups, which in turn, feed back into designs and uses of the artifact[15]; and (3) *closure and stabilization mechanisms* that build consensus over shared meanings of technological artifacts among different relevant social groups. Pinch and Bijker (1984) dubbed this conjunction of concepts a 'model' but insisted that they were not presenting a 'cookbook recipe' (p. 438) and advocated an open-ended applicability to other cases.[16]

Viewed retrospectively, and judging from later citations, reviews, and discussions of SCOT, the example of the safety bicycle became at least as memorable as the abstract 'model' it illustrated. Like Wittgenstein's 'Parable of the Wayward Child' that Bloor and Collins used effectively to illustrate interpretative flexibility in science and mathematics, the bicycle provided a simple, familiar example to exhibit the relevance of such flexibility to the social construction of technology. When Wittgenstein opted to use elementary operations with cardinal numbers to address philosophical questions, he noted that they are no less a part of mathematics than more esoteric proofs and debates, and they have the advantage of being demonstrable to readers with limited mathematical training. The bicycle also offered a familiar technology, with relatively simple mechanisms, that served to illustrate how designs in the 19th and early 20th centuries were radically variable. Like elementary counting and addition, the bicycle is one of the earliest vehicles a child learns to operate. As Bijker put it, when reflecting on the success of the example:

> I think if the bicycle case had not been the first, but another one of our case studies, then roughly SCOT would have been the same, but I also think that the bicycle really helped. Because it turned out to be an example that worked so well with so many audiences that it just helped in the dissemination. … There are these elementary associations, a Dutchman talking about bicycles. … It turned out to be so effective in presenting the basic tenets of SCOT and has stayed a kind of iconic example, ever since.[17]

Latour (1990) followed a similar strategy when using simple and familiar technologies such as automatic seat belts, door closers, hotel keys, speed bumps ('sleeping

policemen'), and other 'mundane artefacts' to exemplify properties and tensions associated with technological 'agency'.

A potential barrier to launching the SCOT program was the impression that demonstrating that technology is 'socially constructed' did not seem much of a challenge. What else could technology be, other than 'constructed'? Proponents of SSK had argued that mathematics and the 'hard sciences' made up the 'hard cases' for the sociology of knowledge, since mathematical proofs seemed indisputable, and physical theories were reputed to be subject to crucial tests. After initial drafts of the SCOT 'bicycle' paper were submitted to *Social Studies of Science*, some of the anonymous peer reviews questioned the provocativeness of the arguments about technology.[18] David Edge, Editor of the journal at the time, also took advice on whether to expand the coverage of a science studies journal to encompass technology. Bijker and Pinch helped forge that link by presenting constructionist arguments adapted from those previously used in reference to science and mathematics. They also argued that technology was far from a facile case, because many engineers, and not a few social scientists and historians, assumed that technological change followed impersonal laws of material efficiency, and that newer designs eliminated 'bugs' and reduced sources of friction that stood in the way of progress.

Bijker later argued that the bicycle actually was a 'hard case' for sociological explanation. 'The choice for the artefact as unit of analysis was a choice for the "hardest possible case". To show that even the working of a bicycle or a lamp was socially constructed seemed a harder task, and thus—when successful—more convincing than to argue that technology at a higher level of aggregation was socially shaped' (Bijker, 2010, p. 66).

Pinch and Bijker narrated the story of the safety bicycle's development by focusing on a conjunction of material features and social circumstances: *tire composition* (inflatable tubing versus solid material) and *relevant social groups*.[19] They assigned a central role to two relevant social groups: (1) young men (sporting cyclists) who considered the high-wheeler (a particular design of the bicycle with a large front wheel) as a machine designed more for competitive racing than practical transport; and (2) women and elderly users (a much larger category of potential customers than the first group) for whom the bicycle was primarily a vehicle for transport. For the latter group, the high-wheeler was unsafe (with a tendency to throw the rider over the handlebars). A plethora of bicycle designs emerged within the *interpretative flexibility* of the contextual uses (safety, sport, speed, etc.) associated with the bicycle. When the air tire was first introduced, it was designed to make bicycles safer by cushioning the jolting vibrations experienced by riders on uneven roads. However, it also became an object of derision among the sporting cyclists, for whom contending with the bumpy ride on their high-wheelers was part of the masculine experience of racing. The air tire also was reputed to be aesthetically unappealing and a source of persistent troubles because of punctures. Later, however, bicycles with air tires were introduced for racing, where it was demonstrated that they outpaced all other bicycles. The speed of the bicycle with air tires coupled with its ability to dampen vibration ultimately *stabilized* and provided *closure* to the diverse possibilities initially associated with the design of the bicycle.

Almost twenty years after the publication of the SCOT paper, Clayton (2002), a historian of technology who had studied the bicycle, pointed out that while there had been considerable discussion of the SCOT model, nobody seemed to have 'questioned whether

the original case study work was sound' (p. 351). Clayton pointed to historical inaccuracies in some of the key claims made in the bicycle story. First, women never actually rode the high wheelers and thus, by extension, the composite relevant social group of women and the elderly 'makes no sense' (Clayton, 2002, p. 357). Second, Dunlop developed the air tire not only as an anti-vibration device, but also as a speed enhancing device. The tension between these two functions of the air tire was artificially constructed and is not evident in archival materials on the history of bicycles (Clayton, 2002, p. 358). Finally, he argued that Pinch and Bijker made an arbitrary choice of time period to illustrate that the invention of safety bicycle was not a discrete event but an extended process (Clayton, 2002, p. 359). Defending their work, Bijker and Pinch (2002) conceded that Clayton was 'able to offer a more complete historical narrative' (p. 361) of bicycle design, but that 'theoretical concepts are not directly *based upon* empirical facts. Theoretical concepts are "invented" by researchers to help them to make sense of empirical data' (p. 363, emphasis in original). They did not argue that the accuracy of the story did not matter, but that, even with its inaccuracies, their narrative effectively introduced a model that, as evidenced by its uptake, helped establish the relevance of *technology* for science studies (and thus the acquisition of the 'T' in STS). Whether or not one agrees with this argument, it points to the recurrent issue that the truth of proverbs, parables, and the like, has less to do with their referential correctness in particular cases than with their consequential applicability to an open-ended *field* of cases.

This back and forth on historical inaccuracies once again raises the question: 'Is it necessary that an artifact have a well-documented narrative history before it can serve as a case study for the development of a theoretical model?' (Epperson, 2002, pp. 371–372). Reviewing this debate through the lens of historical accuracy may tend to obfuscate how SCOT adapted established tenets of SSK in studies of technology.

SCOT was an important discursive move that not only allowed Pinch and Bijker to claim legitimacy for their work by drawing upon an established lineage of scholarship on sociology of science, but also strengthened SSK by extending it into the domain of technology, especially when the bicycle paper was republished in the 1987 'school bus' book, co-edited by Bijker, Pinch, and the prominent historian of technology Thomas Hughes.[20] In the 1980s, the field of STS was coalescing, and at the time it was much smaller than it is today and many of the participants (especially in Europe) knew one another personally. Above and beyond the published arguments, Pinch and Bijker were energetic and ambitious participants in networks that were forming among scholars, linking social studies of science with historical, philosophical, and feminist studies of technology, all of which were developing a 'generally emerging interest in a new type of technology study' (Bijker et al., 1987, p. 3).

Over time, the bicycle story became emblematic of the possibility of analyzing the workings of technological artefacts in and of themselves as an *explanandum* (requiring explanation) rather than an *explanans* (explaining something else). In fact, in defending SCOT, Bijker and Pinch themselves relied on the features of proverbial knowledge:

> The test for a conceptual framework … [is] whether it helps the researcher to make sense of case studies. It should be discarded when it loses its usefulness in that sense, and when another theoretical framework becomes available to do a better job. … The scholars … who have tried

> to apply SCOT have adapted the concepts to fit their specific needs, and most of them finish their study by criticizing some aspect of the original SCOT model. … *Yes, SCOT works*. This is, however, less obvious and needs to be tried and demonstrated explicitly in each and every case. We, and many others, continue to find SCOT useful, but certainly do not consider it a panacea for every case-study (Bijker & Pinch, 2002, pp. 368–369, emphasis in original).

Pinch and Bijker placed strong emphasis on their 'model' or 'theoretical framework' but, as they also acknowledged, the bicycle story became the vehicle that traveled through an extensive network of citations that credited and criticized their contribution. This circulation of the parable of the bicycle, with the SCOT model as its rider, is grounded in its occasional *utility* rather than its referential *truth*.

A two-word theme: 'Boundary object'

The final example we explore is a two-word theme presented in one of the most cited publications the STS literature. There are, of course, numerous one-word themes[21] as well as themes expressed with three or more words, but for reasons that are not fully apparent to us, two-word themes are especially prominent in STS. For the sake of economy, we will treat them as proxies for other themes signaled by one or a few words rather than a complete sentence or proverbial phrase. In many cases the themes are included within the titles of the articles in which they feature, indicating that the authors anticipated their iconic significance.

Two-word themes are exquisitely packaged for the (name, date) form of citation that has become common currency in many academic publications. They also facilitate the various forms of keyword indexing that proliferate through the administration and assessment of contributions to academic literatures. We illustrate this economy with the case of 'boundary object' (Star & Griesemer, 1989). Anyone with at least a passing acquaintance with the STS literature will have come across the package: ['boundary object' (Star & Griesemer, 1989)]. Together with 'boundary work' (Gieryn, 1983), 'ontological gerrymandering' (Woolgar & Pawluch, 1985), 'trading zone' (Galison, 1997), and 'interactional expertise' (Collins & Evans, 2002), it is part of a small family of two-word themes concerned with imposing, reinforcing, and crossing disciplinary and other epistemic boundaries.[22] In a retrospective on the theme of 'boundary object', Star (2010) links it to another viral two-word theme, 'interpretative flexibility'.[23] The latter theme typically is attributed to Pinch and Bijker (1984), although, as they acknowledge, the 'Empirical Programme of Relativism' (Collins, 1981) was their source for it.

Both the Star and Griesemer and the Pinch and Bijker articles have a similar organization: Each advances a conceptual theme and illustrates it with a historical case. Each also presents graphic models consisting of arrangements of words, lines, and arrows. Star and Griesemer elaborate how in the early 20th century, Annie Alexander, the founder and patron, and Joseph Grinnell, the first director of the Berkeley Museum of Vertebrate Zoology, enlisted a network of allies to collect, prepare and assemble specimens and exhibits. 'Boundary objects' appear at every turn in the story. One of the most concrete instances characterizes the way fur trappers were enlisted to supply pelts to be turned into museum specimens. The trappers needed to preserve them for museum exhibition

and research, rather than for the fur trade. The specimens were 'boundary objects' in the sense that their modified material form embodied collaboration across social and technical boundaries. Crucially, the transaction did not require a common 'vision'. Although the trappers accommodated their specimen collection to the needs of the museum, there was no requirement to share, or even understand, the museum's interest in promoting conservation and gathering material for scientific research (p. 402). In addition to this humble instance, the boundary objects identified in Star and Griesemer's analysis of the case proliferated and expanded, even to include the State of California itself.

The theme of 'boundary object' turned out to describe its own success. It became a boundary object par excellence, as indicated by a tally of 13,000+ citations of the 1989 article in *Social Studies of Science*. The citations appear in the literatures of many fields, some of which are quite remote from STS. Self-exemplification can be attributed to other cases as well: 'Interpretative flexibility' has proved to be a highly flexible interpretative theme. As Doing (2008) points out, in a piece titled 'Give me a laboratory and I will raise a discipline'—a title that parasitizes Latour's (1983) already parasitic aphorism, 'Give me a laboratory and I will raise the world'—Latour's account of Pasteur's successful effort to export laboratory operations into agriculture, industry, and public hygiene is an apt description of his own successful efforts to cultivate a disciplinary nexus in the humanities and social sciences. The rhyming relationship between the surnames 'Latour' and 'Pasteur' helps to enhance the parallel.[24]

When an aphorism, story, or phrase is drawn from a literary source and disseminated widely, citations tend to leave behind the 'context' from which it is extracted. However, just what is extracted or left behind is quite variable. Unlike the bicycle case, which proved to be crucial for disseminating SCOT and its constituent models and concepts, the story of the museum tends to be left behind when the theme of 'boundary object' is cited and deployed in an expansive network of studies. Perhaps the illustrative story was too lengthy or complicated to function as a parable, but this did not detract from the viral appeal of the two-word theme. The same can be said of 'boundary work' (Gieryn, 1983), as citations of that two-word theme typically do not mention the exemplary instance of rhetoric used by 19th century Irish physicist John Tyndall to distinguish science from religion in some contexts and from practical engineering in others. The subsequent spread of the 'boundary object' and 'boundary work' themes also differed from those of the bridge and bicycle parables, in which the exemplary narratives were evaluated and criticized for historical accuracy. Unlike aphorisms and proverbs, 'boundary object' and 'boundary work', like many other two-word themes, take a nominal rather than propositional form. While they can be compared and contrasted with other conceptual themes in STS such as collaboration and diffusion, they are not subject to confirmation or refutation.

As a theme that traveled separately from its exemplary story, 'boundary object' avoided the questioning of the historical accuracy of the Moses bridge and bicycle cases, but it ran into a different order of question, which Star (2010) addressed years later: Is there anything that could *not* be said to be a boundary object? When taking up this question, Star (2010) observed that the innumerable citations and applications of the two-word theme had expanded the catalog of 'boundary objects' to include innumerable social, political, textual, human, and non-human entities, as well as

residuals that are 'not elsewhere categorized' (p. 614). Although unwilling to stipulate what should always, or should never, count as a 'boundary object', Star suggested that theme can be used more or less specifically and cogently in a given study, and that reciting it like a mantra would not be as illuminating as using it originally to delve into specific cases. Consequently, the viral spread of 'boundary object' also demonstrates the impossibility of assigning a stable meaning to the concept, as novel meanings were supplied with each application.

Conclusion: Circulation without verification

We began this paper by centering our inquiry on the deep concomitant relationship between the success of academic papers and the characteristic orders of ordinary language they employ. To pull together some features of proverbs, parables, and themes within and beyond the STS literature, we can list the following:

(a) interpretive flexibility is both an exemplary theme and apposite description of the uptake of proverbs, parables, and themes in literature.
(b) the application of such discursive items to cases is thematic and analogical, rather than categorical and hierarchical.
(c) even when the item takes the form of a proposition, its virality and vitality do not depend upon stable correspondence to 'the facts'.
(d) citations attribute such items to particular sources, but the original sources often are uncertain, contested, or arbitrary, and in some cases, there is no known source.
(e) relevance and correctness are achieved circumstantially 'for something' of immediate interest.
(f) it may seem reasonable to suppose that proverbs, parables and themes *index* empirical contents which substantiate them, but it seems that in 'viral' instances they become 'true for' a diverse, and sometimes unexpected, array of contents.

A summary formulation we can give of these properties is *circulation without verification*. To put this plainly, a story is cited or a theme adopted, not because it is an accurate depiction of an historical episode, a true proposition, or a conceptual key to a novel domain (though it may become established as any or all of these); instead, *it is cited because it is found to be relevant, readily grasped, easily remembered, and/or poetically appealing in connection with something of immediate interest*. The lessons to be drawn and the applications are open-ended. Feyerabend's (1975) facetious two-word theme for describing scientific method—'anything goes'—provides an apt working definition of the proverbial economy. We should add, however, that *not just* anything goes very far; indeed, very few summary themes and exemplary vignettes attain virality (the proverbial lesson from the Parable of the Wedding Feast (Matthew 22:14) comes to mind: 'Many are called but few are chosen'). It is tempting (and no doubt would be interesting and rewarding) to delve further into poetic, rhetorical, and communicative practices to explain the success of the few, though (to cite a familiar one-word theme) the *contingency* of uptake is crucial.

In our view, the intrinsic qualities of ideas, the deftness of phrasing, or the novelty of what is referenced do not account for viral success, either in popular culture or academic literatures. Even though, as we have suggested, the words, phrases, and stories we described do not owe their success to referential truth, theoretical novelty, or other intrinsic qualities, neither can they be written off as *mere* surface features of language-use. They key into the local history and infrastructure of a field—in the case of STS, a social field that materially coalesced, in part, through the circulation of the three instances we discussed, as well as many others that preceded and followed them.

Our treatment of the dynamics of circulation without verification, is not meant to suggest that key concepts, case studies, and interpretive principles in the field are *nothing but* slogans, stories, and rhetorical figures; or worse, urban legends, academic folk tales and conspiracy theories. We recognize that such characterizations are frequently used to denigrate case studies, principles, rules, and concepts. However, the stories and dicta in question persist despite critical efforts to debunk and expose the lack of empirical or scholarly support for them. In the case of the Winner's bridge parable, Joerges (1999, p. 420) and Woolgar and Cooper (1999, p. 444) predicted, correctly as it turned out, that it would stand fast, despite any debunking of the historical case. At times, the appeal of such stories is strong enough that they are taken up without much, if any, effort to criticize them. We are not suggesting that these widely cited items persist *because* of deficient and uncritical scholarship. On the contrary, disappointment that 'theories', 'case studies' and 'models' are mere proverbs, parables and the like arises from hankering for a 'scientific' or other source of truth that transcends the temporal and circumstantial embeddedness of ordinary language, common sense reasoning, and literary circulation. Despite the disrepute into which it has fallen in academia, the arts of casuistry—the use of cases and 'lines' of cases to ground judgments and support maxims of conduct—may still be viable in a field like STS for holding affiliations with other academic disciplines (Jonson & Toulmin, 1988).

In our view, the 'failure' to attain consistent verification is not the problem with the summary cases and proverbial themes we discussed. However, a different concern can be raised about how a relatively few items become so central, and subject to citational tribute, in academic literature.[25] As we have argued, parables and proverbs are commonplaces, constituents of shared languages and traditions, whereas academic literatures tend to valorize disciplinary identities and trajectories, and practitioner reputations. The difficulties we have described with chasing aphorisms to sources, validating parables, and stabilizing viral themes reveals a tension between the proverbial economy and the professional political economy that integrates disciplines and elevates authors who are deemed worthy of tribute.

If we are to truly diversify the 'origin stories' of ideas and the stories we listen to, cite, and share, we must embrace the multiplicities of orality in circulation of parables. A well-circulated story not only has a good storyteller, it also has a community of listeners and re-users. How such acts of listening become the grounds for re-telling stories and purposefully remixing them with other stories from other geographies and cultures of academic practice is deeply consequential for the core political project of citational justice. It does not seem to be necessary to start from singular sources of scholarship-turned-into-parables to grow an academic discipline, rather the act of laying the

foundation for a multi-vocal conception of a research topic could also mobilize a collection of stories from diverse storytellers.[26] Indeed, STS has increasingly become an affiliative academic discipline where the concerns with studying the sociocultural foundations of technoscientific practice have become a gathering point for diverse networks of practitioners who often have their own distinct set of shared parables and proverbs grounding their work. In building these affiliations, we invite critical reflection on what stories we tell, whose stories we listen to, and whose stories we pass onto others interested in knowing STS. Our answers to these questions lay the groundwork for the proverbial economy of STS. After all, a citation is not just well-told, it is also a story well-listened and shared.

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ORCID iD

Ranjit Singh https://orcid.org/0000-0001-6453-8676

Notes

1. Shapin (2001, p. 735) lists many of these and other items, such as apothegms, gnomes, precepts, sententiae and tags. The collection of them is unbounded, and it defies easy definition. Perhaps we could invoke 'family resemblances' (Wittgenstein, 2009, §67) to justify grouping them together, but whether they are one or several families remains to be determined.
2. This is not to say that efforts to find such proof are never made. See, for example, the facetious effort by Matthews (1997) to verify Murphy's Law: 'If something can go wrong, it will go wrong.'
3. Sacks draws on Havelock (1963) and Yates (1966) on the transition between the craft of oratory and the rationalization of language in logic and written symbolism. Crowley and Hawhee (2003, p. 97) refer to ancient Greek 'rhapsodes', itinerate poets and storytellers who would use stock phrases like 'the wine dark sea' as part of the mnemonics of reciting long poems. However, memorability in the cases we are discussing can in some cases (e.g., 'artifacts have

politics') be more of a consequence of frequent repetition than of an intrinsic poetic or otherwise 'catchy' quality of the combination of words repeated.

4. Like many of the literary figures we discuss here 'proverbial economy' borrows from a more familiar academic idiom, Thompson's (1971) two-word theme 'moral economy'.
5. Such 'knowledge' does not fare well in public arguments when held up to an ideal of 'scientific' or 'mathematical' knowledge. For our purposes, however, there is no ultimate need to invoke such ideals to justify many parables and proverbs.
6. Thomas and Thomas (1928) is the commonly acknowledged source. The current Wikipedia entry gives equal credit to both authors, although it preserves the now-archaic generic use of 'men' in the quotation and points out the that 'theorem' is 'not a theorem in the mathematical sense'. See Merton (1995) on the tendency to ascribe the eponymous dictum to W.I. and not also to Dorothy, a slight for which Merton himself had been criticized (we thank Arie Rip for calling this article to our attention). Merton delves into the ambiguous, possibly anonymous, origins of the 'theorem' and of the companion phrase 'definition of the situation'. He also addresses criticisms of his own initial discussion of 'The Matthew Effect', an adaptation of the 'parable of the talents of minas' (Matthew 25: 14-30), which Merton interpreted to describe the tendency for citations to flow disproportionally to scientists (and scholars) who were famous already. The criticisms point ironically to an earlier article in which Merton (1968) acknowledged his former student and subsequent partner Harriet Zuckerman but did not list her as co-author (though in later articles on the subject he did so). To add to the epicycles of irony, his 1995 article does not mention Rossiter's (1993) ironic roasting of Merton.
7. W.I. Thomas also is credited with 'definition of the situation', along with Florian Znaniecki, though there remains some doubt about the originality of their use of the phrase.
8. Woolgar (1983, p. 248) points out that irony is a figure of speech that is notable for its many different uses and definitions. He observes that 'its blandest meaning' is produced by intending the opposite of what one says. In the social sciences, a common form of irony pertains to analytical efforts to undermine common beliefs and official doctrines and to expose them as urban legends, myths, ideologies, superstitions and the like. Double irony, as we use it here, is a professional effort to expose the fallibility of other professionals' ironic treatment of popular ideologies, myths, and so forth.
9. Gieryn (1983, p. 781) mentions in an acknowledgement note that his 'development of the concept of "boundary work" benefitted from conversations with Steve Woolgar'. Consistent with the general trend that citations trace literary pathways without exploring possible oral sources, citations of 'boundary work' credit Gieryn's publication without citing his prior conversations with Woolgar.
10. Mackenzie's (1990) 'certainty trough' is another example of a two-word theme that is illustrated with a case study (in this case of missile accuracy) and a diagram that enables readers to recognize strong similarities and some subtle differences between his and Collins's accounts. Both describe the relationship between social/epistemic distance from direct involvement with technical activity and the tendency to contest or accept face-value accounts of the products of such activity. Often such scholarly comparisons couch the discussion in terms of concepts and models, rather than commonplaces.
11. Acronyms might be viewed as members of the family we are discussing here. 'STS' itself is an acronym that does double duty in reference to Science & Technology Studies and Science, Technology & Society. Various lines of work within the field also deploy acronyms, such as SSK (Sociology of Scientific Knowledge), and ANT (Actor-Network Theory). In the case of SCOT, the acronym is a pun that enhances its memorability by reference to being Scottish. Although neither Bijker nor Pinch hailed from Scotland, their conceptual treatment

of technology owed much to the Edinburgh School's programmatic treatment of science and mathematics.

12. In scholarly discourse, a proverb can become subject to disputes about its meaning and truth. A fitting example is 'an exception proves the rule', which has been disputed not only for its source, but also for its meaning—especially the meaning of 'proves' (Shapin, 2001, p. 764, n. 35). Another case is the ancient proverb: 'You can never step in the same river twice', usually attributed to Heraclitus some 2,500 years ago. As the proverb itself suggests, how it is to be understood is subject to considerable flux, and it is a rare example of a proverb that has been subject to more than two millennia of philosophical dispute. Stern (1991, p. 582) points out that the specific phrasing of the saying and its attribution to Heraclitus is subject to doubt among scholars—not an unusual situation for such dicta. For a review of criticisms, see Egan (2019). Like Socrates before him, though for different reasons, Wittgenstein took issue with the proverb in favor of a more ordinary understanding of the expression: 'The man who said that one cannot step twice in the same river twice was wrong; one can step twice into the same river twice' (Wittgenstein, 2005, p. 304e; quoted with slightly different wording from an earlier translation in Stern [1991, p. 590]).
13. Latour (1988) later presented a similar, more explicit, aphorism when he substituted 'science' for 'war' in von Clausewitz's famous aphorism.
14. While writing an earlier draft of this article, we came across a New York Times opinion piece with the apt title 'Why are we still obsessed with Robert Moses?' (Bellafante, 2022), which discusses a play ('Straight Line Crazy') that rekindled public attention to 'the influence of modern urbanism's titanic autocrat', referring to Moses. Consistent with Caro's The Power Broker, which her article cites, Bellafante mentions that Moses orchestrated urban planning to favor the automobile-driving middle classes.
15. Addressing the criticism that SCOT focused solely on the design stage of technology (Mackay & Gillespie 1992) and did not account for the power dynamics of gender relations, Kline and Pinch (1996) went on to expand the approach to uses of technological artifacts while also discussing how gender relations between social groups mutually shaped the stabilization of technological artifacts.
16. Bijker and Pinch subsequently argued that SCOT is specific in ways that differentiate it from other approaches to technology such as Actor-Network Theory (ANT): 'We frequently warn over-enthusiastic students who often want to combine elements from the different approaches into one common theoretical framework to be careful. Merging, for example, actor networks with relevant social groups and technological frames while forgetting about distinctly different backgrounds in semiotics (ANT) and sociology (SCOT) will quite likely produce either an inconsistent or a trivial and vacuous set of concepts' (Bijker & Pinch 2012, p. xviii).
17. Wiebe Bijker, interviewed by Singh, 24 May 2012.
18. We were able to review drafts of the paper, referees' comments on them, and other correspondence with the Editor (David Edge). The files are in storage at Cornell University. To preserve anonymity, we cannot discuss the reviews in any detail. We also held discussions with Bijker and Pinch about the early drafts and submissions.
19. The capsule history of the bicycle in Pinch and Bijker's (1984) article was reprinted in their influential volume with Hughes (Bijker et al., 1987). See also Pinch's (1996) retrospective on the SCOT approach.
20. The paperback edition of the Bijker, Hughes, & Pinch (1987) volume was colloquially referred to as the 'school bus' book because the ground color of the cover was similar to that of a school bus in the United States. It is one of the best-selling books in MIT Press's STS collection.
21. Some one-word themes, such as 'technoscience' are combinations of two words, others are produced through grammatical shifts, such as from adjective to noun, verb to noun, or noun to verb.

22. The popularity of 'boundary' themes was parodied by Sokal's (1996) infamous 'hoax' article, which included 'transgressing the boundaries' in its title.
23. Explicit reference to 'interpretative flexibility' does not appear in the Star and Griesemer article, although it certainly would have fit.
24. A striking case of a poetic connection is with the proverbial verb phrase 'blooming, buzzing confusion', extracted from James's (1893) Principles of Psychology. In a weblog, Hawks (2023) traces James's viral phrase back to the passage from which it was extracted and reformats the passage in the 'rhythm of blank verse'.
25. This concern is central to ongoing efforts to promote and secure citational justice (Citational Justice Collective et al., 2022; see also CLEAR, 2022).
26. See, for example, the parables of AI in/from the majority world featured in Singh et al. (2022).

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Author biographies

Ranjit Singh is a senior researcher at Data & Society Research Institute. His current work is focused on developing robust methods to evaluate and regulate how algorithmic systems impact everyday life. His research sits at the intersection of AI infrastructures, majority world scholarship, and public policy for data-driven systems, and broadly examines the ordinary ethics of how people exercise their agency in their everyday experiences with data-driven practices.

Michael Lynch is Emeritus Professor of Science & Technology Studies at Cornell University. He has investigated practical action, visual representation, and discursive interaction in scientific and legal settings, and has written extensively about conceptual and analytical issues in the social sciences. He was Editor of *Social Studies of Science* from 2002 until 2012.