The juxtaposition of Buddhism and modern technology tends to induce surprise and even humour: visitors to Buddhist countries, for example, often photograph monks in the act of using cell phones or computers, as such images defy preconceived notions. But Buddhism and technology actually share a long, cooperative history.

Early adopters:
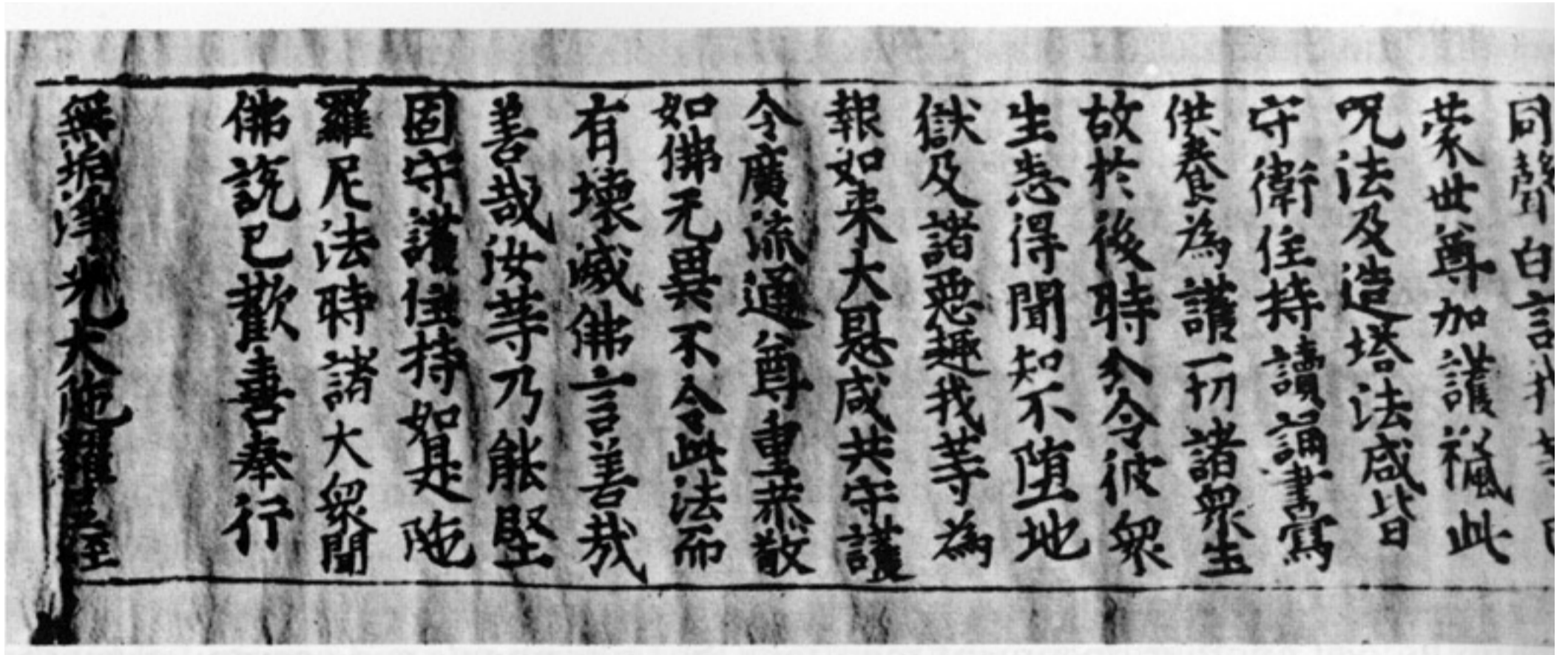## debunking stereotypes of Buddhist attitudes toward technology

Fig.1 The world's oldest extant specimen of a printed text is a Buddhist charm scroll or dharani from Korea. Image from Tsien, T. 1985. Paper and Printing, Cambridge University Press.

ANDREW GLASS

Stereotypes cloud the perception of Buddhism's relationship to technology. John Dwyer, on the Urban Dharma website, writes, 'In strict monastic societies, almost all forms of technology are considered useless since they do not further one's spiritual journey'. Peter Herschock writes in his book on Buddhism in the information age, 'Buddhist technologies...have been predominantly social technologies rooted in the training of awareness, the perfecting of attention' (Herschock 1999: 111). These views are not wrong, per se, but refer to idealised notions of Buddhism. In general, the Buddhist tradition has been keen to adopt new technology that serves the Buddhist mission, including dramatic innovations such as the introduction of writing and printing, the digital revolution, and examples from art and architecture.

A means to posterity: writing

Writing was introduced to India some time between the Buddha's death and the reign of Aśoka (273-232 BCE), who famously carved his edicts at sites around India. The earliest known Buddhist inscriptions are on stone at Bhārhut, in central India, dating from the mid-3rd to mid-2nd century BCE, and record the names of new building construction sponsors including monastics. It's unknown whether monastics at Bhārhut also wrote on ephemeral materials. The earliest mention of writing down the Buddhist canon comes from the chronicles of Sri Lanka, which report that in the 1st century BCE, during the reign of

King Vattagāmaṇī Abhaya, the three Piṭakas and the Commentary upon them, 'in order to ensure the long life of the Law', were 'recorded in books' (Mhv. 33.100-1, Lamotte 1988: 369). Recently discovered Buddhist manuscripts in Kharoṣṭhī script, from Gandhāra (ancient north-west India), have been radiocarbon-dated to a range from the 2nd century BCE to the 3rd century CE. The first to come to light are believed to date to the Common Era's first 50 years. Comprising 29 manuscript fragments written by many different scribes, this collection probably represents a deposit of old, worn out manuscripts. Some show signs of being copies: mistakes, such as haplography – the inadvertent omission of a repeated letter or letters – are best explained as copying errors. Additional factors suggest the manuscripts originate from the written tradition's inception in Gandhāra: each scribe's handwriting is unique, while in later periods it's difficult to impossible to tell one scribe's handwriting from another's; the earliest manuscripts are written on birch bark scrolls, a crude, easily damaged material relative to the 2nd-3rd century palm leaf manuscripts from Bamiyan and the paper introduced via Central Asia as early as the 3rd century; and lines of writing often stray diagonally, while in later periods scribes drew guidelines to neaten manuscript appearance.

Thus these Gandhāra manuscripts appear to represent immature writing technology. Gandhāran Buddhists likely began using manuscripts simultaneous to the first writing in Sri Lanka, in the 1st century BCE,

mentioned in the Pāli chronicles, making Buddhism the first Indian religion to do so, perhaps by 800 or more years. The oldest surviving Vedic manuscript is less than 1,000 years old (Witzel 1997: 259). The earliest known writing of Jain and Zoroastrian texts is from the 8th or 9th century (Kellens 2006: 23). Evidence from Sri Lanka indicates the canon was written down to ensure the posterity of the Buddha's teaching. Manuscripts could also be used to spread the teaching, and were imported to China and Tibet in great numbers. Dào'ān, a pivotal figure in early Chinese Buddhism, encouraged Chinese monks to visit India in search of manuscripts. Fǎxiǎn , possibly Dào'ān's disciple, visited India between 399 and 413 and copied many manuscripts, as did Xuánzàng between 629 and 643. Much later Marpa and others took manuscripts from India to Tibet.

Imparting authority, increasing efficiency: printing

Used throughout the ancient world to mark authority, seals and sealings were an important precursor to printing. Several ancient monastery seals prove Buddhist institutions used them. By the 8th century, making heavily text-laden seals was combined with stamping designs on silk and decorative paper, leading to printing. The earliest examples, driven by the 'enthusiasm of the Buddhist devotees for producing a great multitude of sacred texts' (Tsien 1985), are Chinese and associated with Buddhism, as the scripture itself encouraged copying and distributing the texts.

For example, the Lotus Sūtra, translated into Chinese by Kumārajīva in 406, reads, 'If there is anyone who preserves, recites, explains, or copies even a single verse of the Lotus Sutra, or who respects this Sutra as if it were a Buddha...know, O Bhaiṣajyarāja, that this person has already paid homage to tens of myriads of [crores] of Buddhas of the Past!' (Kubo and Yuyama 1993: 169; T no. 262). An extension of the written word's power, copying a single verse, is equated with the merit of worshipping countless past Buddhas. Printing innumerable copies created even greater stores of merit.

Dated to 704-751, the world's oldest extant specimen of a printed text is a Buddhist charm scroll, or dhāraṇī, found inside a stone stūpa at Kyongju, South Korea. The most famous example of early printing is a copy of the Diamond Sūtra found in Dūnhuáng 敦煌 by Aurel Stein in 1907, the earliest complete printed book bearing a date: it ends with the 868 CE benediction, 'On the fifteenth day of the fourth moon of the ninth year of Xiántōng 咸通, Wang Jie reverently made this for blessings to his parents, for universal distribution'. The entire Chinese Buddhist canon was first printed in Chéngdū 成都 between 971 and 983, the Kāibǎo 開寶 edition, requiring more than 100,000 printing blocks. Only a few volumes survive. At least six other complete printed editions were produced in mainland China and Korea over the next three centuries.

Printing spread to Buddhists in Japan, where Empress Shōtoku 称德天皇 (718-

769) ordered a million printed dhāraṇī scrolls between 764 and 770, and via the Silk Road to Central Asia, where from around 1300 Buddhist texts were printed in Sanskrit, Uighur, Tangut and Mongolian (Tsien 1985: 305). The Tibetan canon's first woodblock edition, the Yongle bka' 'gyur, was produced in Beijing in 1410, based on the first bka' 'gyur: the Tshal pa manuscript written 60 years earlier (Harrison 1996: 78-81). Many subsequent Tibetan bka' 'gyur and bstan 'gyur editions were produced on woodblocks until the 19th century. But printing didn't entirely replace writing: in Tibet, complete canon manuscript editions were produced alongside printed versions.

East and Central Asian Buddhist printing zeal wasn't matched in South and Southeast Asia, where printing was barely known until the 16th century European arrival. Even then, it wasn't used for Buddhist texts. Siam's King Chulalongkorn ordered the Pāli canon's first printed edition only in 1893 (Bechert and Gombrich 1984: 78), perhaps inspired by the European edition in roman script, initiated in 1881. The Sri Lankan, Cambodian and Burmese editions followed in the 20th century.

This contrast in the acceptance of printing between these two Asian regions mirrors the traditional fault line between northern Mahāyāna Buddhism and southern Theravāda Buddhism. Cultural attitudes towards books and writing esteemed in China were generally debased in India, in deference to oral tradition. Also, though written in the 1st century BCE, the Pāli canon remained

an essentially oral tradition up to modern times. Its limited scale and homogeneous nature were easier to memorise and recall, and since only educated monks could access texts – through their memories – they were protected against miscopying and apocrypha, and group recitations prevented errors. As Theravāda Buddhism spread throughout Southeast Asia, Pāli rema

ined the canonical language, in contrast to China and Tibet, where the texts were translated. Monks, who had learned the teachings in Pāli, provided explanations in the vernacular to convey particular teachings, safeguarding the canon's purity. In modern times it has been translated and printed in Sinhalese and Southeast Asia's major languages.

Moveable type was invented in the mid-11th century by Bì Shēng 畢昇 and perfected in Korea almost 200 years later, but it didn't eclipse block-printing among China's Buddhists. Movable type was popular for commercial printing, but temples avoided it, perhaps because it offered few advantages and conversion would have introduced many errors. The traditional method of making new xylograph editions usually involved pasting printing copies upside-down onto boards and carving the latter, maintaining accuracy over centuries. In Japan, however, a complete copy of the Chinese canon, the Tenkai 天海 edition, was produced with moveable type between 1637 and 1648 (Mizuno 1982: 180). Since one purpose of moveable type was to eliminate storing thousands of printing blocks, there was only enough type to set a few pages at a time. Once a page had been printed, the forme containing the type was dismantled to produce the next page. Thus only one set of copies could be made. By contrast, the second Koryŏ canon's blocks, carved in the 13th century, were used to print a new edition between 1957 and 1976.

Going digital: ancient utterances captured by the modern world

In the early 1990s Theravāda Buddhism was the first Buddhist tradition to digitise its canon. Remarkable for being instigated by Buddhist temples and organisations rather than scholars, four independent projects in Thailand, India and Sri Lanka digitised their respective versions of the Pāli texts. Today's most widely used Pāli canon version was produced by the Vippassana Research Institute (VRI), a largely decentralised organisation of meditation centres, which in 1990 began printing a new edition in the Devanāgarī script in order to reintroduce it to India. Typeset using computers, it was released electronically in 1997 on CD-ROM free of charge. CD search features benefit scholars, while a dozen different writing systems allow access to adherents throughout South and Southeast Asia.

Two American-led projects are digitising the Tibetan canons and religious literature: Geshe Michael Roach's Asian Classics Input Project started in 1987, and Gene Smith's Tibetan Buddhist Resource Center began in 1999. Each has a different focus but shares the goal of preserving Tibetan culture primarily for Tibetans, though much of their work is available to scholars as well.

In Japan, digitising the Chinese canon began in 1996, when Tokyo University Professor Yasunori Ejima 江島惠教, funded by the Japanese Ministry for Education, commenced input of the standard Taishō edition. Two years later the Chinese Buddhist Electronic Text Association (CBETA) began digitising the same Taishō edition at Taiwan National University's Buddhist Research Center. The two projects agreed to cooperate, completing the project in 2003. The Tuệ Quang Wisdom Light Foundation hopes to produce the Buddhist canon's first Vietnamese translation by transliterating the CBETA data into Vietnamese script (http://tinyurl.com/24g4ej).

Serving the faith

Why has Buddhism adopted new technology? It begins with the Buddhist message of the four noble truths: suffering, the origin of suffering, the cessation of suffering and the path leading to the cessation of suffering. To reach an audience, a message must be communicated in a way its audience understands. Since Buddhism doesn't target a particular group, it is in principle open to anyone. In the Vinaya, the Buddhist monastic code, the Buddha instructs his disciples, 'I command that the word of the Buddha be learned by each one in his own mode of expression (*sakāya niruttiyā pariyāpuṇitum*)', as opposed to Vedic Sanskrit (*chandas*) [Vin II.139], which was the domain of Brahmanism. Loosely interpreted, preserving old ways simply for the sake of tradition is not important; communicating the message in a way that people understand is. Therefore, a new means of perpetuating the transmission, whether a new language or medium, is encouraged.

Second, throughout history Buddhists have been concerned about the disappearance of Dharma, the record of the Buddha's teachings. This basic fear may also underlie instructions to copy texts and drive the adoption of new ways to preserve and distribute them. Third, as technology changed, new practices and rituals developed which incorporated it. Writing and printing became empowered with the capacity to protect, for instance via amulets made from texts, and the power to transfer merit, as in dedications connected with an act of donation.

Finally, as Buddhism became institutionalised, monasteries needed financial and material support for monks and nuns. Adopting technology which could attract support benefited the institution and helped fulfil its primary function of spreading the Buddha's teaching. Human nature respects power, including the increased power that comes with learning new technology. Technology was and remains a powerful way of inspiring generosity.

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Beyond literature
What other technologies have Buddhist communities embraced?

In the last year, researchers from the Japan Center for International Cooperation in Conservation reported that tests conducted on 7th century Buddhist murals in the caves of Bamiyan, Afghanistan, revealed oil-based pigments, making them the world's oldest oil paintings, predating European and Mediterranean examples by more than 100 years (*National Geographic*, 6 February 2008).
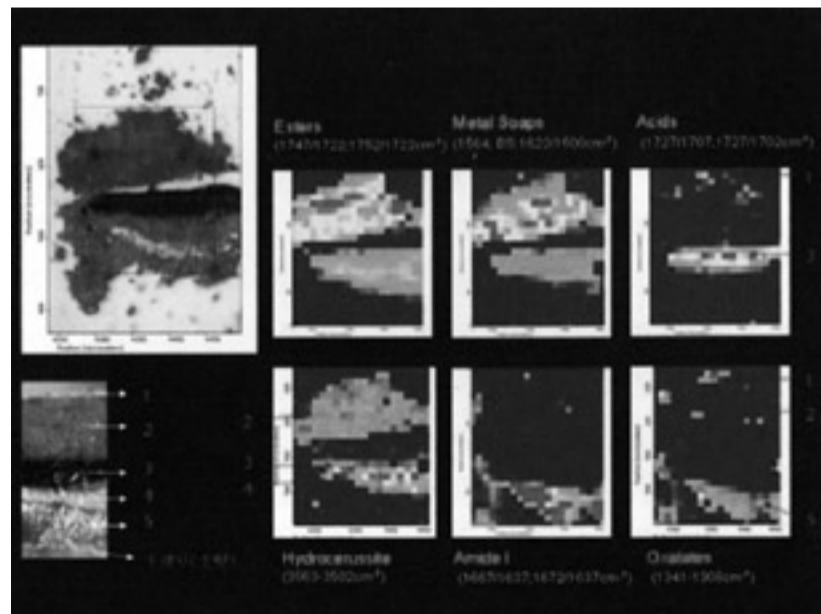
In Gandhara, suspending large stone umbrellas on pillars above their sttpas required monastic authorities to use the latest technology.

Ghandara's Buddhist art is well known for incorporating Greco-Roman techniques and models. The Buddha's image itself may have been developed in Gandhara under foreign influence. Photograph courtesy of www.lgpn.ox.ac.uk