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Science meets Comics

Proceedings of the Symposium on Communicating and Designing the Future of Food in the Anthropocene

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Manga meets Science: Going beyond the Education-Entertainment Divide

How readers perceive science comics is swayed by the general notion of comics they hold, in particular with regards to the question "... why call such works comics at all?" (Duffy 2015: 5). For most regular readers, comics are anything but a context-transcending medium of representation that interrelates image and text, simultaneity and sequentiality, page and panel. "Comics can name a means of communication and/or an aesthetic visual style and/or particular narrative tropes and/or a subculture and/or an industry." (ibid.). Conventions, connotations, and cross-references shared by specific readerships are not to be dismissed when weighing the odds of a comics' educational impact.[1] It is the 'culturally qualifying aspects' rather than the technological, material, and semiotic properties that warrant 'comicness' (Wilde 2015). In other words, the perception of comics is shaped as much by textual features and paratextual elements which may invite, for example, educational readings, as by readers' experience within a specific mediascape which may defer narrow educational intentions.

In Japan, most contemporary readers expect comics, or manga[2], to be entertaining fiction (*story manga*), magazine-based, and targeted at age- and gender-specific demographics. These narratives eventually reappear in bound book editions (*tankōbon*), after they have proven to be popular to an extent that would warrant print runs of more than 5,000 copies. Due to the central role of magazines as first site of publication since the 1960s, genre specificity has been essential – for editors, readers, and artists alike. While manga's traditional genres have been gender- and age-specific, thematic genres such as SF, horror and comedy, or recently also blog-like *essay manga*, come to the fore whenever the otherwise prevalent categories forfeit efficacy. But there is one genre which does not comply with these categories, i.e. *gakushū manga*, educational or instructional comics (lit. *manga to learn something from*). Difficult to determine with regard to both its formal particularities and market share, and more or less unheeded by manga critics, this genre provides one site for science to meet comics. As issues of global concern such as the Anthropocene Kitchen did not surface in Japanese news media let alone manga, this article

1 In line with recent English-language comics studies, this article deliberately uses *comics* for both the singular and plural.

2 In line with Japanese and Japanological custom, this article uses Japanese nouns in the plural without 's'

focuses on science comics in a more general sense with an emphasis on comics rather than science, trusting in the agency of the comics media[3], i.e. that comics is more than a mere 'container' of assumingly stable knowledge.

1. *Gakushū Manga*, an Inconspicuous Genre

Science comics (*kagaku manga*) began to aid school education with a more or less patronizing attitude in the late 1930s (Itō 2013: 206), and they gained momentum from the mid-1950s onwards, concurrently with the Japanese equivalent to *Classics Illustrated*, i.e. editions of *Famous Literary Works as Manga*. In contradistinction to purely entertaining material, both types have traditionally been positioned as educational comics (*gakushū manga*). Within the educational domain, literature, history, and practical skills have featured more prominently than science, especially since the 1980s when adult readers started to reach out for initially child-oriented publications such as *Hello, Personal Computer!* (*Konnichi wa maikon,* 1982) by Sugaya Mitsuru[4] (b. 1950). In an investigation conducted in 2008, Sugaya listed also law, nursing care, statistics, and so-called qualifying examinations among the thematic genres of educational comics popular with adult readers. Promoting manga to these readers as a tool of efficient learning – an entry point to acquiring basic knowledge as prerequisite for handling more specialized publications – Motoyama Katsuhiro (2012) foregrounds accounting, business administration, and national economy. Subjects like these were pioneered by renowned manga artist Ishinomori Shōtarō (1938-98) and his production studio.[5] Their *Japan, Inc.: Introduction to Japanese Economics* (*Nihon keizai nyūmon,* 1986-88) (Fig. 1) became a bestseller with salarymen in Japan and one of the very first manga to be translated into Western languages.[6] While presenting facts in form of an engaging narrative, its publication did not take the form of manga-magazine serialization, and precisely this positioned it as a *gakushū manga* within the Japanese mediascape.

Readers beyond the age of elementary school children encounter *gakushū manga* usually in book form, although not necessarily that of the manga *tankōbon* released by a publisher specialized in manga.[7] Mostly drawn by artists without reknown in the field of manga entertainment[8], *gakushū manga* books have traditionally been hiding behind non-spectacular cover designs, which at times even indicate the name and affiliation of an academic supervisor. This packaging has facilitated

3 For the notion of *media* (as a collective singular), as distinct from *medium* or *mediums*, encompassing not only technical, or technological, but also aesthetic and societal aspects, see Mitchell/Hansen (2010).

4 Japanese names are given in the domestic order, surname preceding first name without separation by comma except in the Works Cited list. Sugaya's volume received one of publisher Kodansha's Children Manga Awards in 1983, together with a second one titled *Game Center Arashi*.

5 Volume 1 was not yet drawn by Ishinomori himself but his staff.

6 Eng. trans. 1988, Ger. trans. 1989.

7 Another popular format are series of booklets (consisting of 34 pages and sized bigger than A4).

8 See for example the adaptations of literary works within the *Manga de Dokuha* (lit. *reading through with manga*) imprint created by an anonymous collective and published by East Press (since 2007).

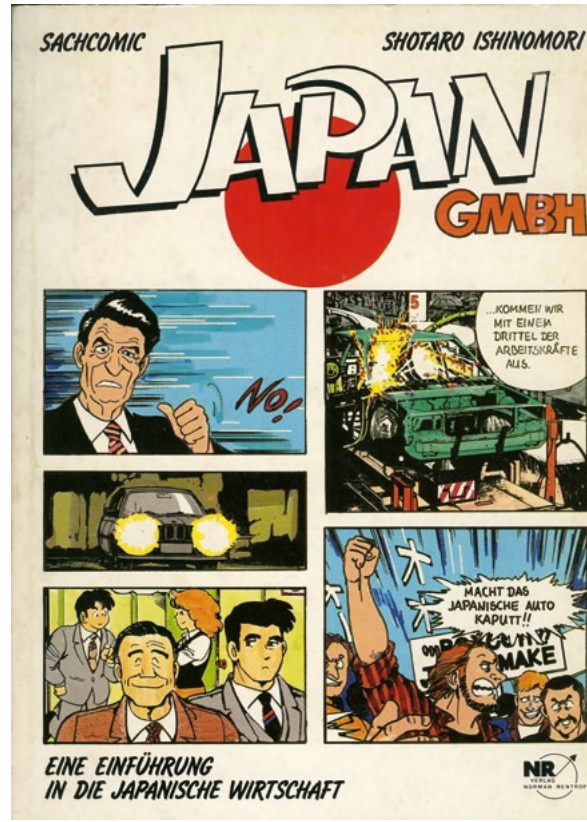

Fig. 1: Ishinomori Shōtarō (1989): *Japan GmbH: Eine Einführung in die japanische Wirtschaft.* Bonn: Rentrop. Cover illustration.

parents' acceptance (and expenditure), but also a certain wariness on part of regular consumers with regards to treating such comics as manga proper. The "distant relationship between educational comics and the cultural institution of comics" (Duffy 2015: 4) is nothing particular to a specific country, although the extent to which educational comics are "produced outside the editorial regimes, print production and distribution methods, fan and artist communities, and entertainment industry tie-ins so often associated with comics as popular cultural production" (ibid.) differs, due to the size of the domestic Japanese manga market and its genre-specific bifurcations as well as the increasing degree of blending fact and fiction, educational earnestness and mangaesque fun.

As is well known, manga is divided into gendered genres, but without the tie to a specific magazine, educational manga exhibit less gendering, which means in turn that they resort, by tendency, to male genres (i.e. manga for boys and men) as the most widely sharable styles while eschewing fan-cultural fashion to not detract from the primary, educational purpose.[9] Although not a comics, the revised edition of the English textbook for junior high school students *New Horizon* by publisher Tokyo

9 This is the reason why they have been "largely found in shōnen and sēnen [sic!] manga", as Murakami/Bryce observe (2009: 50).

Shoseki is a telling example in that regard. Within a few days after the beginning of the school year in April 2016, a newly introduced character – the cute blond teacher Ellen Baker (Fig. 2) – went viral on fan sites and social networking services. Denchūbō, the male artist who created her, "said he was incredibly happy to see Baker getting so much attention, [but] if the character starts getting too much notoriety for things other than her academic contributions, parents and guardians might not take kindly to it" (Baseel 2016: n.p.). In other words, the kind of mangaesque character design which incites fannish appropriation may appeal to students and publishing houses, but not necessarily educators. This falls into line with Duffy's observation that "the educational institutional context uses comics and animation to draw attention, but also to temper narrative engagement by redirecting reader focus on didactic learning" (2015: 9) – although the engagement triggered by the Ellen Baker character is not exactly a narrative, but a post-narrative one, driven by a strong affection towards cute characters and their appropriation in fan fiction and fan art rather than a primary interest in narrative and author.[10] Against the backdrop of recent database-oriented approaches to popular media texts and fans' game-like imagination[11], Itō Yū, researcher at the Kyoto International Manga Museum, calls for analyzing *gakushū manga* not only from the perspective of the imparted knowledge, but also character design, as familiar mangaesque character types invest, for example, the representation of historic personae with a specific contemporary media-induced actuality (2013: 217-218). For publications to get accepted by educators, however, it is vital to cater to pedagogic rather than comics-specific concerns, including fan-cultural ones.

Fig. 2: Denchūbō: Ellen Baker character, April 2016

While character design operates as a powerful visual attractor of attention, educators are inclined to focus on the verbal component of comics as the primary conveyer of knowledge. But the dialogue, too, may take a mangaesque, i.e. an affect rather than cognition-oriented, form. In this regard, the case of the high school mathematics textbook published by Keirinkan in their *Olé!* series in early

10 Cf. Itō Gō 2005, Galbraith 2009.
11 Cf. Azuma 2009, Kacsuk 2016.

2007 is worth mentioning. When submitted to the MEXT[12] Textbook Screening Committee it got approved only after revisions: The amount of pages that presented mathematical issues in the form of colloquial dialogues between mangaesque characters – initially 70 out of 183 – had to be reduced to 20, and the casual short form, common among teenagers, was to be changed to standard Japanese. While the Committee objected to the lack of a necessary link between mangaesque parts and learning content – in particular with the argument that "it is hard to understand the [pedagogic] intention behind certain remarks by the teacher character" (Nagai 2007: n.p.) – it overlooked the primal issue: the growing need to pique students' interest in science. Any attempt to stimulate that interest by affective means – whether verbal or visual – meets with resistance on the part of educators to whom those means appear merely 'decorative'.

In contradistinction to textbooks, educational comics do not have to pass the ministry's screening. Consequently, they have been free to unfold manga-typical properties, namely humorous exaggeration, appealing narratives, and anthropomorphization, or – more advanced and media-specific – 'characterization'.[13] This inclination surfaced already in the 1950s, for example, in *Manga Biology* (*Manga seibutsugaku*) by Tezuka Osamu (Fig. 3, 4, see next page). Five years after the launch of *Astro Boy* (*Tetsuwan Atomu*, 1952-1968), Tezuka, the trailblazer of Japanese graphic narratives, serialized his later award-winning science comics on biology in an educational journal for junior high school students (May 1956 - March 1957). It is composed of lectures by the recurrent character Dr. Anything and Everything (*Nandemokandemo hakase*) and independent episodes, which sometimes feature anthropomorphized animals, sometimes a Science Fiction setting. Noteworthily enough, Tezuka himself was aware of the necessity to aim for an equilibrium: "If we exaggerate too much, it becomes a mere manga, loosing its characteristic as science comics, and if we represent things in a real way, then it gets bookish and looses its mangaesque character." (op. cit. Itō 2013: 212).

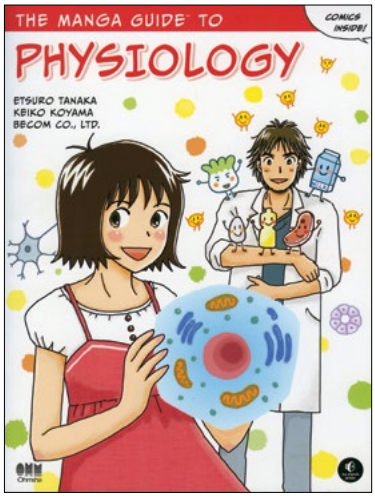

Fig. 5: Etsuro Tanaka/ Keiko Koyama/ Becom Co., Ltd. (2016): *The Guide to Physiology*. San Francisco: No Starch Press/ Ohmsha. Cover.

Sixty years later, Japan's science comics have become vast in number, but they rarely exceed the domestic market, one of the few examples being the *Manga Guide* (*Manga de wakaru*) series by publisher Ohmsha, which was launched in 2004 and has since seen translated editions released in collaboration with American and Brazilian publishers, among others (Fig. 5). The

12 Japan's Ministry of Education, Culture, Sports, Science and Technology.
13 Cf. Nozawa 2013.

Fig. 3: Tezuka Osamu (2009 [1957]): *Manga Seibutsugaku* (Tezuka Osamu Manga Zenshū, vol. 279). Tokyo: Kodansha. Cover.

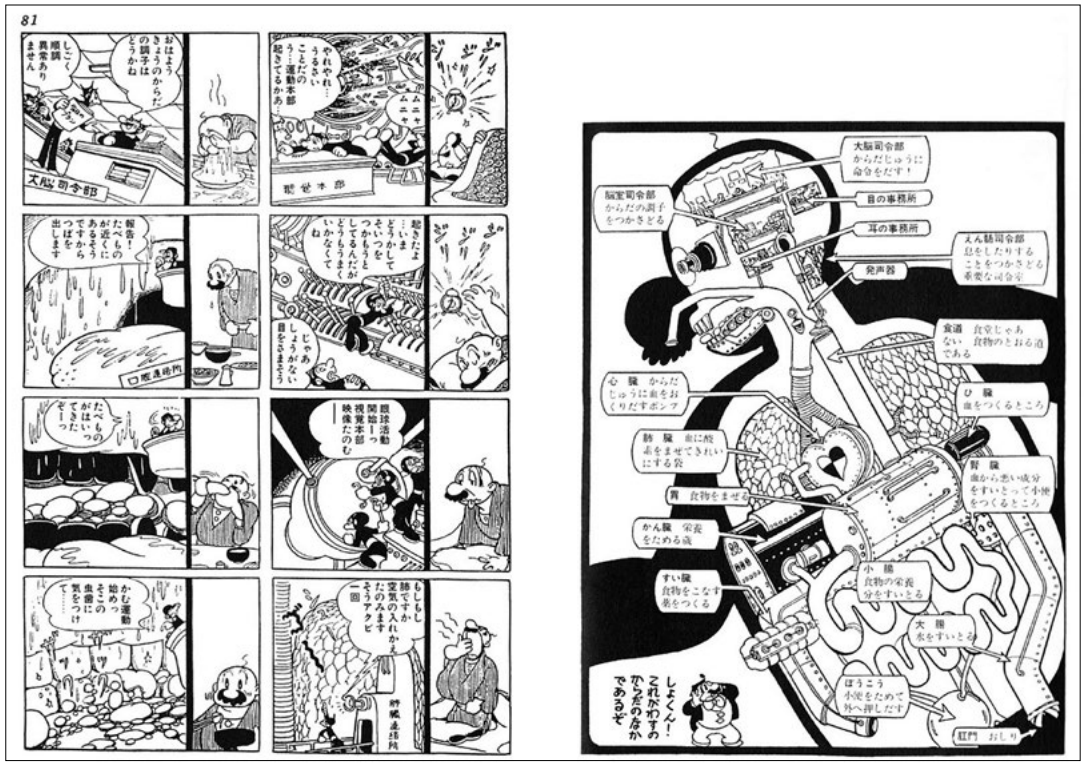

Fig. 4: Tezuka Osamu (2009 [1957]): *Manga Seibutsugaku* (Tezuka Osamu Manga Zenshū, vol. 279). Tokyo: Kodansha. pp. 80-81 [reading direction from right to left].

biggest player with regards to educational comics in Asia is South Korea. Appearing in books with sturdy bindings and good-quality paper, educational manhwa hold a 50% share of the domestic comics market (Lim 2011: 44), and they have been gaining ground in the People's Republic of China, Taiwan, Thailand, Indonesia, and Malaysia as well. Characterized by a ratio of 65% education and 35% entertainment, as critics have ascertained, their most representative series are the science comics *Why?* by publisher Yea Rim-Dang (since 1989/2001[14], 50 vols. in total; Fig. 6) and the 18-volume aid to learning Chinese ideograms *Magical Thousand Characters* (*Mabeop Cheonjamun*) by publisher Owl Book, started in 2003. Leaning on the Chinese novel *Journey to the West* as well as Toriyama Akira's manga *Dragon Ball*, the latter employs Sun Wukong (Son Gokū), the monkey king, as its protagonist who now has the gift of spelling magic words (Fig. 7, see next page). While this series is also available in English (addressed to Korean learners of the language, Fig. 8, see next page), a Japanese version has not been released as distinct from the *Survival* series by Korean publisher Mirae N Culture[15]. One volume of this series, scripted by Hong Jae-Cheol and illustrated by Mun Jeong-hoo (2004), addresses *Earthquake Survival* (*Jishin no survival*). The preface points to the Kobe earthquake of 1995 and states that Korea is not necessarily safe of such danger. The all-color manhwa itself relates the story of a Korean father and his two kids who go to Japan for a hot-spring trip but get eventually caught in an earthquake and tsunami (Fig. 9).

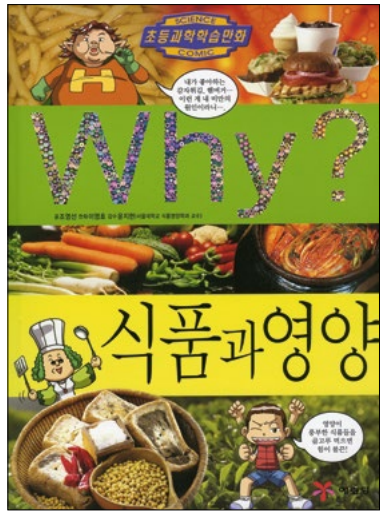

Fig. 6: Na Seunghoon (2008): *Sikpoom gwa yeongyang* (*Why? Food and Nutrition*). Seoul: Yea Rim-Dang. Cover.

Fig. 9: Hong Jae-Cheol (script) & Mun Jeong-hoo (art): Jishin no survival, Kagaku manga series (Earthquake Survival). Tokyo: Asahi Shinbunsha 2008. Cover.

14 With an eye to foreign markets, the series name was changed to the English *Why?* in 2001.
15 Japanese edition under the name of *Science Comics (kagaku manga)* by the publisher of one of Japan's biggest newspaper, Asahi Shinbunsha.

Fig. 7: Studio Cereal (2009): *Mabeop Cheonjamuni* (*The Magical Thousand Characters*), vol.1: Bureora Baram Pung. Seoul: Owl Book. Cover.

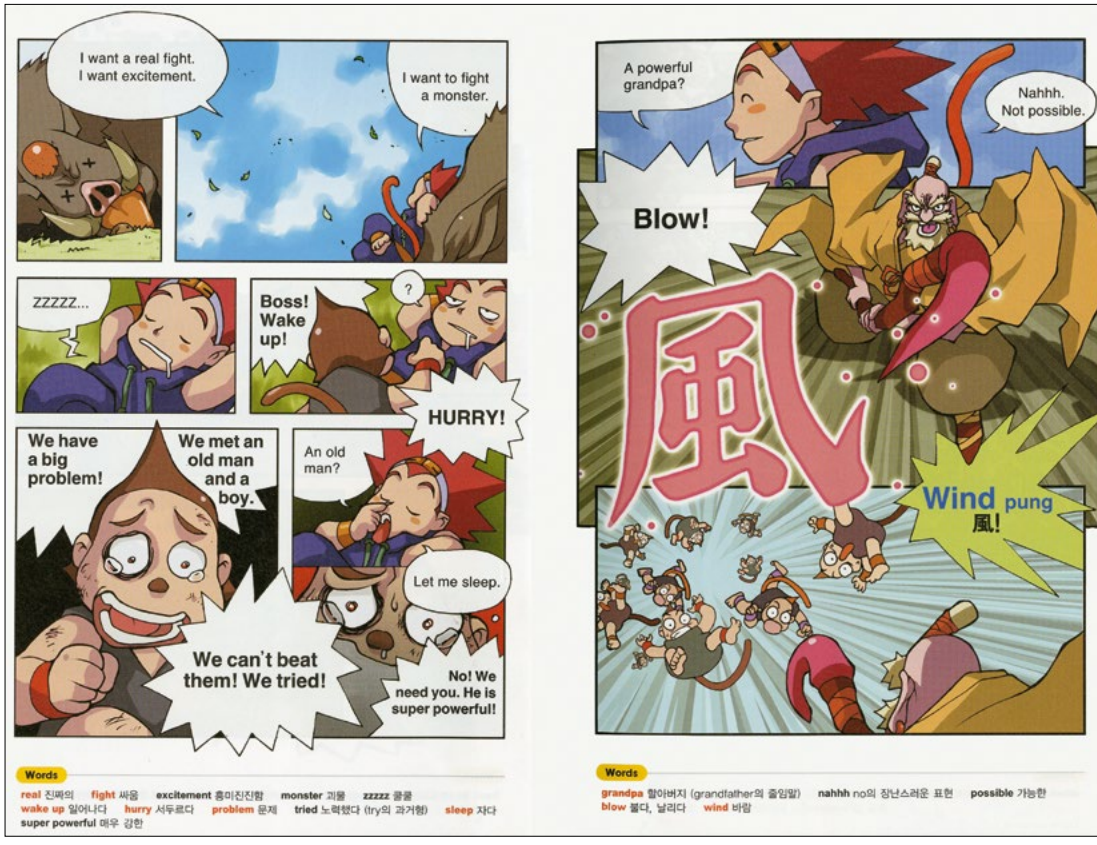

Fig. 8: Studio Cereal (2010): *Yeong-eo ro igneun mabeop cheonjamuni* (*The Magical Thousand Characters: English Textbook*), Seoul: Owl Book, pp. 18-19 [reading direction from left to right].

2. Beyond the Education-Entertainment Divide

"Prioritizing communication over aesthetics and information delivery over narrative engagement" (Duffy 2015: 4) and the implied downplaying of aesthetic and affective aspects in favor of a performed neutrality are reminiscent of the documentary mode of address as discussed by Nina Mickwitz (2016: 24), but they are not necessarily characteristic of educational comics in South Korea and Japan, and neither is the assumed distance from commercialism. In other words, the Western notion of *non-fiction comics* (Ger. Sachcomics) which rests on the assumed opposition between fact and fiction, education and entertainment, culture and commerce, does not necessarily apply, and this is due not only to cultural differences but also the age of digitalization in which such segregations are becoming obsolete all over the world.

By now, educational manga appear in a vast variety of forms, stretching from entirely fictionalized accounts to talking-heads, occasionally including hybrids of purely textual passages and a few paneled pages in-between. Sugaya (2008) differentiates five types, the least comics-like ones being text-centered explanations accompanied by one-page illustrations with mangaesque characters (Fig. 10) and the *For Beginners* series, which, due to its graphic-design appearance, i.e. the small amount of paneled pages, makes it reportedly hard to read for Japanese consumers[16]. A third type identified by Sugaya are educational books with an introductory part rendered in

Fig. 10: Futahiro Tokihiko/Sideranch Co. (2011): *Manga de wakaru: Enerugī no shikumi* (*Understanding through manga: The way energy works*), supervisor Iida Tetsuya. Tokyo: Ikeda Shoten, pp. 36-37

16 Started in Mexico in 1966, the first translated Japanese edition (*Freud*) was published in 1980 by publisher Gendai Shokan, the first original Japanese volume in 1982. In the 2000s, an originally Japanese *For Beginners Science* series was also released (13 vols in total), dedicated mainly to ecological and health issues including cosmetics and food safety.

the form of a graphic narrative. *Manga de wakaru: Enerugī no shikumi* (*Understanding through manga: The way energy works*) by Futahiro/Sideranch Co. (2011), for example, opens with six paneled – and colored – pages: College student Yōta has an assignment to write an essay about Japan's energy issue, but is not interested at all until the female alien Hikari arrives who needs a significant amount of electric power to return to the future where she comes from. This sequence is followed by short sections each beginning with a title in the form of an interrogative clause and providing answers by means of written text and illustrations in a restrained mode. But 52 out of the 248 pages present a graphic narrative and extend it to the point where solar energy is finally used to help the cute alien, clearly referencing the media experience of young readers but as distinct from educational manhwa still clinging to monochrome printed comics rather than glossy all-color surfaces reminiscent of anime, video games, or webtoons (Fig. 11).

Fig. 11: Futahiro, Tokihiko/ Sideranch Co. (2011): *Manga de wakaru: Enerugī no shikumi* (*Understanding through manga: The way energy works*), supervisor Iida Tetsuya.
Tokyo: Ikeda Shoten, pp. 244-245 [reading direction from right to left].

The two prevalent types of educational manga, however, employ paneled pages throughout. While the more classic variant conveys the learning content via a more or less funny teacher-pupil relationship drawn in a rather cartoony style, the bulk of educational manga today are actually graphic narratives, entertaining fiction which allows to focus on both the knowledge and the human interest story (or either one). The prevalence of the latter started in the mid-1980s when artists and editors began to include specialized expertise in the hope that it would work like a souvenir, i.e. stick in readers' memory together with the artist's name. By now, this strategy has become mainstream, suffice to mention the ninja-related information in Kishimoto Masashi's *NARUTO* (1999-2014), the reference to the traditional board game in *Hikaru no Gō* by Obata Takeshi/Hotta Yumi (1998-2003), or the central role of traditional Japanese playing cards in female artist Suetsugu Yuki's *Chihayafuru* (since 2007). But there is also an explicit focus on science in some recent graphic narratives serialized in representative manga magazines. Hebi-zou[17], a female artist who had first gained renown with the series *Nihonjin no shiranai nihongo* (*The Japanese the Japanese Don't Know*)[18], has been successfully running the series *Kesshite mane shinaide kudasai* (*Please, do not attempt, never*, Fig. 12) in the manga monthly *Morning* since 2014. In ironic contrast to the series title's warning, every chapter features a risky experiment conducted by a group of physics students under the supervision of their handsome professor, who brings into play the basic scientific knowledge as well as the historic scientists who discovered it. One day the students explore, for example, why stuntmen do not get burned when their bodies are covered with flames (Fig. 13).

Fig. 12: Hebi-zou (2014): *Kesshite mane shinaide kudasai* (*Please, do not attempt, never*), vol. 1. Tokyo: Kodansha. Cover.

17 Her penname translates literally as 'storehouse of snakes'.
18 Scripted by Umino Nagiko. Gentōsha 2009-2013, 4 vols.

Fig. 13: Hebi-zou (2014): *Kesshite mane shinaide kudasai* (*Please, do not attempt, never*), vol. 1. Tokyo: Kodansha, pp. 14-15 [reading direction from right to left].

Another manga by a female artist, Shimizu Akane's debut work *Hataraku saibō* (*Cells at Work*), which has been appearing in the boys manga weekly *Shūkan Shōnen Sirius* since 2015 and filled three tankōbon volumes so far, presents stories from the inside of the human body, namely about the cells which warrant its immunity. These cells appear as anthropomorphic characters. In the very beginning, the female lead – the red blood cell AE3803 – trieds to ward off an attack by the monster-like Streptococcus pneumoniae, but to win she needs support by the handsome guy called White Blood Cell (Fig. 14, 15). The fact that the medical terms as such serve as character names – the reader meets, among others, Macrophage, Myelocyte, and T-lymphocyte – is highly unusual but extremely effective and justifies the genre categorization of this series as science manga.

What Shimizu carries to extremes, i.e. the entwining of character-driven entertainment and education, is acknowledged not only by manga readers but also the Nippon Foundation's Manga Edutainment project (*Kore mo gakushū manga da!*),

Fig. 14, 15: Shimizu Akane (2015): *Hataraku saibō,* vol. 1.
Tokyo: Kodansha (Sirius KC), Fig. 14: Cover, Fig. 15: pp. 8-9 [reading direction from right to left].

launched in 2015.[19] Under the auspices of veteran artist Satonaka Machiko, one hundred titles have been selected. Remarkably enough, the list does not include any *gakushū manga* in the strict sense. It consists solely of story-manga series such as Ikeda Riyoko's narrative *Berusaiyu no bara* (*The Rose of Versailles*, 1972-1973) about the French revolution, Nakazawa Keiji's Hiroshima tale *Hadashi no Gen* (*Barefoot Gen*, 1973-1985)[20], Takemiya Keiko's pioneering Boys Love narrative *Kaze to Ki no Uta* (*Poem of Wind and Trees*, 1976-1984), which aimed at sexual education, and – in category No. 9 called *Science/Learning* (*kagaku/gakushū*) – Ishikawa Masayuki's *Moyashimon* (*Tales of Agriculture*, 2004-2014).[21]

With a special focus on fermentation, *Moyashimon* approaches the world of microorganisms, and it introduces them in a 'characterized', but not necessarily anthropomorphized way (Fig. 16). The germs utter *"Kamosu zo!"* (*We will brew!*) and sometimes even *"Kamoshite korosu zo!"* (*We will brew and kill you!*) as in the case of Escherichia coli 0157:H7, the pathogenic bacteria invading the campus festival of the Tokyo University of Agriculture. Freshman Sawaki Tadayasu, the 'blond' guy in the black suit in Fig. 17 who warns everyone to not eat anything, can hear and see the microbial beings[22] – and the manga reader with him. Just as Sawaki bridges two species, the narrative employs a twofold way of storytelling. Volume 8 of the series is representative in that regard. It begins with seven 'educational' pages exhibiting

19 Only the outline is available in English so far (last access: 20 June 2016). http://www.nippon-foundation.or.jp/en/news/articles/2015/17.html
20 Called a 'documentary manga' by Kinsella (2000: 79) in disregard of the fact that its mode of address is neither documentary nor educational.
21 Serialized in the youth manga magazine *Evening*, 2004-2013, and subsequently in *Morning Two*, 2013-2014, republished in 13 tankōbon volumes, only two of which were officially published in English translation.
22 Whose made-up name provides the manga's title, a portmanteau of the words *moyashi* (lit. seed malt, rice malt; used also in the production of soy sauce, fermented soybean paste, and rice wine) + *mon* (abbr. *mono*: things, beings). Best understood as the plural form, which the Japanese language does not clearly indicate.

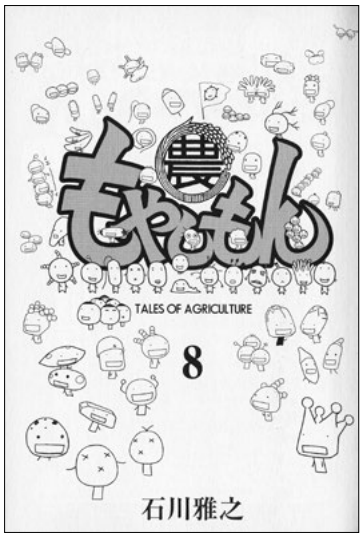

Fig. 16: Ishikawa Masayuki (2009): *Moyashimon* (*Tales of Agriculture*), vol. 8. Tokyo: Kodansha. Frontispiece.

a low-key paneling and no central character to identify with. Here, the moyashimons assume the role of narrator to explain what beer is. They introduce different sorts (such as Pilsner, Ale, Lager etc.) and their ingredients, and they even touch upon the German, or more precisely Bavarian, purity law (annotated in the upper left margin of Fig. 18). Then the narrative mode changes to direct action, which also passes on knowledge but intradiegetically and through dialogue. While this may easily incur displeasure if the educational intent becomes all too obvious, *Moyashimon* averts the detriment by its often humorous focus on character interaction and the affects involved.[23]

The main issue in volume 8 of *Moyashimon* is Japanese in comparison to European beer and, above all, Japanese craft beer in contrast to established Japanese brands. Graduate student Mutō Aoi, also known as 'Miss Agri U' among the students, stands in for the ordinary Japanese reader with her initial scepticism of microbreweries. After about 100 manga pages, in the course of which she meets a young female farmer who brews her own beer, Mutō reverses her judgment and organizes a craft-beer festival on campus, Agri U's own Oktoberfest. Having caught the influenza

Fig. 17: Ishikawa Masayuki (2005): *Moyashimon* (*Tales of Agriculture*), vol. 1. Tokyo: Kodansha, pp. 192-193. [reading direction from right to left]

23 Murakami/ Bryce (2009: 51-54) emphasize the similarity of *Moyashimon's* two narrative modes with *rakugo*, a traditional art of humorous storytelling, in which the performer on stage plays the roles of both narrator and interacting characters.

Fig. 18: Ishikawa Masayuki (2009): *Moyashimon* (*Tales of Agriculture*), vol. 8. Tokyo: Kodansha, pp. 4-5. [reading direction from right to left]

virus (which one moyashimon cautions the reader against at the very bottom of the page in Fig. 19), she cannot participate in the festival herself, but from her sickbed she tells Sawaki and the others that she has finally realized what beer is, namely "a beverage that goes best with a smile" (Ishikawa 2009: 174). Thus, the narrative comes full circle: What has begun as a concentration on impersonal knowledge culminates in an acknowledgement of the importance of interpersonal relations, or situated knowledge. Exemplary of how typical manga meets science, *Moyashimon* entwines what scientific education tends to neatly separate, first of all, the probable and the improbable: Speaking germs do not really comply with scientific standards; nevertheless, the *Moyashimon* manga has been endorsed as scientifically accurate. The inclination to join what fashion has strictly divided manifests itself most clearly on the level of representational content. In addition to the human and non-human species it surfaces in the character of Sawaki's male friend and fellow student Yūki Kei, who turns out to be a cross-dresser (the long-haired 'girl' in the bottom-left panel of Fig. 19). But the inclination applies equally to the very mode of representation, ranging from the two ways of storytelling to the structural interplay between cognition and affect, to 'manga as method', so to speak.[24]

24 Cf. Takeuchi 2005 (1960).

Fig. 19: Ishikawa Masayuki (2009): *Moyashimon* (*Tales of Agriculture*), vol. 8. Tokyo: Kodansha., p. 173.

3. Comics as Method

With respect to knowledge and education, comics tend to be treated as a 'container', i.e. a medium without agency, expected to serve the higher purpose. This tendency manifests itself in privileging representational content and verbalized, or verbalizable, meaning, even with regard to the pictorial side, for example, when critics praise manga for "spelling out the thematic focuses in the illustrations" (Murakami/ Bryce 2009: 50). As outlined above, the field of comics is anything but homogenous. Rather than discussing cultural differences – related to the receptiveness for consumer-related indetermination, flippancy, and conventionalization – this article has highlighted educational manga putting emphasis on entertaining serialized graphic narratives. The high-grade linkage of enjoyment and education which they perform has its limits. Their prevalence may, for example, go at the expense of documentary comics or comics journalism, genres not as prominent in Japan as in Europe and North America. In terms of quantifiable knowledge, Sugaya (2008) reports on an investigation which revealed that the story-manga type suits the cognition of nexuses rather than retrievable data and long-term rather than short-term memory. While the potential to attract readers via the power of affect is widely acknowledged, a distinct, comics-specific contribution to education is usually not expected or sought. But if it is true that "narratives of objective knowledge, universal truths, and the possibility of neutral representational practices have become subject to critical scrutiny, theoretical scepticism, and political pressure" (Mickwitz 2016: 20), then comics should be able to do more than support scientific monologizing, authenticity, and strictness. It seems time to conceptualize 'comics as method'. As distinct from the traditional assumption that educational comics just package and convey prefabricated educational content without affecting the content itself, 'comics as method' would mean to acknowledge comics' own potential for the formation of knowledge, for example, through the interrelation of affect and cognition, or imagination and rationalization. Educational manga are an interesting case to start with.

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